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O ČASOPISU

Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/ Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business, stalna je znanstvena publikacija Fakulteta. Izlazi od 1971. godine. U razdoblju od 1988. do 1993. izlazi u kontinuitetu jednom godišnje, a od 1993. u dva broja godišnje (proljeće i jesen). Koncepcija časopisa jest orijentacija na objavljivanje tekstova iz ekonomske teorije i ekonomske politike. Primarno je usmjeren na objavljivanje tekstova znanstvenog sadržaja, a samo iznimno i kvalitetnih stručnih radova. Drugi dio sadrži prikaze i ocjene knjiga, pregled nekih važnijih najnovijih izdanja znanstvenih djela u području ekonomskih i njima srodnih znanosti, te obavijesti o međunarodnim konferencijama, javnim pozivima i drugim važnim informacijama. Koncepciju, ciljeve i strategiju časopisa usmjerava Međunarodni savjetodavni odbor. Urednički odbor svojom politikom uređivanja časopisa provodi utvrđene odrednice Međunarodnog savjetodavnog odbora. Časopis je referiran u JEL-u (*Journal of Economic Literature*)/EconLit (*American Economic Association's Electronic Database*), Pittsburgh, Pennsylvania, USA od 1993. godine, a od 2007. i u bazama IBSS (*International Bibliography of the Social Sciences*), ProQuest, Cambridge, UK i DOAJ (*Directory of Open Access Journals*), Lund University, Sweden. Od lipnja 2008. referira se u bazi CAB Abstracts, UK, a od 31. srpnja 2008. godine do 31. prosinca 2018. godine i u bazama SSCI (*Social Sciences Citation Index*), *Social Scisearch* i JCR (*Journal Citation Reports/Social Sciences Edition*), Thomson Reuters, Philadelphia, USA. Thomson Reuters baze referiraju članke objavljene u svesku 1/2007. Časopisa i nadalje, a baza Proquest – ABI/INFORM, Ann Arbor, Michigan, USA referira Časopis od sveska 1/2006. Baza SCOPUS, Elsevier, B.V., Amsterdam, The Netherlands referira sve radove objavljene od 2008. godine. Časopis referira i EBSCO, Ipswich, MA, USA u svojim bazama EconLit with Full Text i SocINDEX u Abstracts&Indexing s referencama kao i baza ERIH PLUS od 2016. godine. Od 1. siječnja 2019. Časopis se referira u ESCI – Emerging Sources Citation Index (Clarivate Analytics).

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Policies for managing sudden stops[*]

Chokri Zehri[1]

Abstract

Managing capital flows needs an appropriate association of foreign exchange reserves, foreign borrowing, and capital control. These policies are considered as a tool to predict sudden stops (SS). Consequently, this analysis identifies the occurrences of SS for a sample of 200 countries within the period 1985 - 2019. The probability of SS is determined through a logit model. Results suggest that effective management reduces the probability of sudden stops. A spillover risk influence analysis was conducted on the gross domestic product, consumption, investment, and unemployment. The results show harmful impacts on these macroeconomic variables. The findings demonstrate that countries with a satisfactory level of exchange foreign reserves, small foreign borrowing, and initiating capital controls before the occurrence of SS, are less touched by the spillover risk than emergent economies which are more vulnerable than rich economies.

Key words: *sudden stops, policies, capital flows, debts, reserves, controls*

JEL classification: *F32, F36, F37*

1. Introduction

The countries that have received large capital flows can be exposed to diverse risks, specifically when these capitals are badly managed (Eichengreen and Gupta, 2016). One of the most common risks is capital flow sudden stops, reflecting an abrupt stop in inflows. The expected consequence is often exhaustion of exchange reserves and high currency depreciation. To enjoy the advantages of these inflows, developing countries must well manage the accompanying risks (Jeanne and Korinek, 2019).

With the increase in global capital flows, these countries are being faced with a major economic challenge that requires an in-depth study and to be openly

resolved. Numerous analyses look for an ideal approach to accumulate reserves, raise foreign borrowing, and resort to restriction policies using capital controls (Aizenman and Lee, 2007; Hawkins and Turner, 2000 and Zehri and Abdelkarim, 2020). The practice of capital controls is mainly seen after the Asian financial crisis of 1997. This restrictive policy instrument has made it possible to better understand the devastating effects of SS (Ostry, 2012). The interest in the use of capital controls has been resurfaced with more intensity, especially after the recent financial crises of 2008, as a necessary instrument to reduce the risks resulting from financial weakness. Ostry et al. (2010) suggest, dealing with the various macroeconomic risks, that a set of controls on capital movements must be used. These controls are above all effective in conjunction with the holding of a certain level of international reserves. Evidence shows that several economies that have liberalized their financial systems are keen to accumulate foreign exchange reserves. The ideal practice of these three procedures (controls, reserves, and debts) is composed of many studies dealing with administrating capital movements. Simultaneously, these policies are utilized to cope with the main risk of capital inflows, the sudden stops. In the 1990 decade, the reversal flows affecting developing economies were seen as warning signs of a larger crisis, that of 2008. Throughout these reversal flows, economies have less access to the credit market, which caused serious distortions of the current account and which led to heavy recessions.

The study contributed to previous studies by proposing an analytical framework that helps policymakers towards better management of capital flows and ensuring more macro-financial stability. Firstly, we identify periods of sudden stops using a panel of 200 developing and developed countries over the period 1985-2019. Several empirical studies use an analysis of events by monitoring the abrupt evolution of current account and trade balance to detect these periods of sudden stops.

Secondly, the study followed the evolution of macroeconomic aggregates about their values for a period considered normal, to determine some features of sudden stops events. Referring to previous studies, the paper suggests rules that help to determine these SS events (Hutchison and Noy, 2006; Guidotti et al., 2004; Agosin et al., 2019). Regarding sudden stops periods, there are two major policy matters: First, which factors determine the manifestation of this downtime? And second, what impact will these sudden stops have on a country's macroeconomic aggregates? The study targets to give adequate responses to these questions.

The study has contributed to earlier studies by concentrating on the three policies already debated. Foreign exchange reserves, foreign borrowing, and capital controls are the three basic aspects of adequate governance of capital flows, which have an important role in solving this spillover risk. The analysis uses a logit model to determine sudden stops likelihood.

Thirdly, once we have determined these SS periods as well as their role in increasing the probability of reversal flows, the study will try to determine their impact on the welfare of the economy. These periods were often accompanied by persistent recessions and major macro-financial vulnerabilities, leading to weaker consumption and investment and consequently to significantly lower growth rates (Calvo, Izquierdo and Mejia, 2004). Two major characteristics are specified from the 2008 crisis: a reversal in capital flow and a drop in production (Calvo, 1998). Some studies have analyzed the economic crisis features of countries, which have experienced sudden stops; especially, there has been a decline in the gross domestic product, consumption, and investment, as well as an increase in unemployment (Chari, Kehoe, and McGrattan, 2005; Calvo and Talvi, 2005; Cardarelli, Elekdag, and Kose, 2010). For a larger sample in comparison to previous studies, we try to analyses the adverse evolution of these aggregates. The study targets to prove, in events of SS, the degradation of these aggregates in comparison to the "calm" period. On the other hand, we try to prove that emergent economies are more influenced by SS than developed economies (Calvo, Izquierdo, and Talvi, 2006).

The *research hypotheses* arising from the previous debate are summarized as follow:

H1: Dates of SS can be determined with exactitude.

H2: Our model can determine the probability of SS

H3: The SS have adverse effects on the macroeconomic aggregate.

This study is organized as follows: The next section reviews the empirical literature concerning the prediction of sudden stops and the consequence of sudden stops on economic fundamentals. The third section shows the models' variables and regressions methods. The fourth section displays empirical study in reliance on three goals. Primarily, the analysis identifies the sudden stops periods. Secondary, the analysis investigates the factors of sudden stops probability and highlights the adequate management of capital flows in lowering this probability. Finally, the study highlights the changes in macroeconomic fundamentals through a comparison before and after SS periods. The last two sections (five and six), discusses the consequence of study results and the approaches needed to prevent sudden stop.

2. Literature review

Considering the research hypotheses of the study, this section develops the literature review around three components. First, theories discussing the occurrence of SS, second, empirical studies to predict SS and third, the impacts of SS on macroeconomic aggregates.

2.1. Theory of sudden stops

Many theories discussed the occurrence of SS (Calvo, 1988, 1998; Kaminsky and Reinhart, 1999; Cole and Kehoe, 2000; Mendoza, 2006). Models have been built to clarify policymakers' decision to fail on its credit repayment or an external lender's agreement to borrow, generally, the impacts of default are exogenous. Contrary, another row of studies has concentrated on the impacts of sudden stops, taking the SS as provided. Chari et al. (2005), Cook and Devereux (2006), and Meza and Quintin (2007) suppose that sudden stop is exogenous and they analyze their impacts on macroeconomic fundamentals. To hold reserves is an exterior balance sheet action monitoring by the central bank where foreign borrowing is usually provided to the public sector for many economies (Alberola, Erce and Serena, 2016). The cost of borrowing debt is higher than the return of holding reserves which makes their accumulation an unprofitable decision (Bussiere et al., 2013). The common guarantee of borrowing and the holding of reserves would be examined as a puzzle in traditional preventative saving models (Kawai and Lamberte, 2010).

The interest of empirical studies on sudden stop-events is mainly addressed to macroeconomic variables. Calvo and Talvi (2005), Guidotti et al. (2004), Chari et al. (2005), and Meza and Quintin (2007) are mainly interested in the fall in the global output caused by the SS. Similarly, these studies are interested in monitoring the role of international reserves in stabilizing the economy. Foreign exchange reserves in the literature, are mostly accumulated, to avoid the negative effects of capital inflows (Alfaro and Kanczuk, 2009; Bianchi et al., 2012; Caballero and Panageas, 2005; Jeanne and Rancière, 2011). When the occurrence of crises is less compared to the vulnerability of recent years, huge volumes of international reserves are collected and saved. The inability to rationalize the level of reserves accumulated by emerging countries has led Obstfeld, Shambaugh, and Taylor, (2010) to declare the predictive failure of existing SS theories.

2.2. Anticipating sudden stops

Studies on sudden stops mainly focus on the use of event analytic approaches. These methods try to determine the periods of SS through careful selections on the data of the current account and trade balance. The empirical literature has studied rigorously the factors intervening to determine the probability that a SS appears. Among the studies, Guidotti et al. (2004) defined empirically the appearance of a SS event when global capital flow falls by more than one standard deviation from their average over the analysis period.

A SS is defined as a large fall in capital flows, as measured by a year-over-year increase in the current account/gross domestic product ratio by more than two standard deviations above the average change in this ratio (Calvo et al. 2006;

Milesi-Ferretti and Razin, 2000). These authors also give a second definition of SS, they consider it to be systemic when the fluctuation of the J.P. Morgan Emerging Markets Bond Index (EMBI) exceeds its mean by twice its standard deviation. A third determinant to isolate the SS is given by Calvo et al. (2005), an enormous and abnormally fall in global output.

Many studies suggest that sudden stops events arise from the properties of some domestic variables (Edwards, 2007; Calvo 2002; Cavallo and Frankel, 2004). Several macroeconomic aggregates are affected by massive inflows of foreign capital. for example, there will be an increase in the current account deficit, a depreciation of the local currency, a total relaxation of bank credit to the private sector or distortions in the balance sheets of banks and domestic firms which have funds borrowed in foreign currency (Alfaro et al., 2014).

The empirical literature on the balance of payment crises is also rich in the drivers of SS periods. The current account deficit constitutes the key variable and which knew the most agreement to test the possible appearance of SS in the countries using a fixed exchange rate regime compared to those using a flexible regime (Levy-Yeyati and Sturzenegger, 2005).

There are also other explanatory variables of SS which were also used in empirical studies. A high ratio of foreign borrowing/net exports is likely to increase the likelihood of SS. Besides, the dollarization of the liabilities measured by the ratio liabilities in the foreign currency of the financial sector / M2. Contrary to the variety of predictors of sudden stops, there was no agreement, among the empirical studies, about the optimal policy both to manage the capital flows to predict these SS and to limit their negative impacts on the economy. Although the deficiency noted in empirical studies, a large theoretical literature has focused on the predictive role of the three policies for managing capital flows: exchange reserves, foreign borrowing, and capital control. Korinek and Mendoza (2014) demonstrate that an internal decision for holding reserves diminishes the probability of sudden stops. During major macroeconomic imbalances, policymakers cannot be solvent for their loans without proceeding with liquidations. This process causes sudden stops especially if lenders refuse to give more relaxation in repayment of these loans. Reserves can, in this case, help to reduce the probability of sudden stops by offering repayment guarantees to lenders.

The vision about the advantages of capital account openness, established in 1973, has been modified over the last few years/the last five decades???resulting in finding out all the weak spots /he shortcomings of this practice. Even international financial organizations recommend a comeback to restrictive policies on capital movements (Alfaro et al., 2004). These recommendations have been followed, in several emerging countries, by the introduction of constraints, especially on the short-term capital inflows, which are seen as an essential source of financial

instability. Likewise, Taxes on foreign currency loans, which are a source of sudden stop events, are broadly part of capital control policies (Korinek, 2011).

Does financial liberalization rise the probability of the occurence of SS? To what extent do capital controls reduce the likelihood of the occurrence of SS event? The role of capital control in predicting SS is still unclear. Evidence shows that these controls reduce capital flow reversal and thus reduce the probability of sudden stops. The facts show that restrictive policy on capital movements reduces the reversible shifts of capital flows and therefore the probability of an SS. Unfortunately, empirical studies have not been able to validate this theoretical proof. The majority of empirical results founded show that even with capital controls the probability of a SS event is not reduced (Edwards, 2004).

Despite that several studies have used international reserves and foreign borrowing as two instruments of macroeconomic policy, their precautionary function for the SS has been less reported and, generally, includes only one variable in the empirical regressions. Here we use quite a number of variables reflecting both reserves and borrowing. For capital control, the analysis uses recent indexes of restrictions on capital movements, four indexes established by the studies of Chinn and Ito, (2006), and Fernandez et al. (2016).

2.3. Sudden stops and macroeconomic aggregates

The junction between the economic sphere and financial sphere is the central focus of the debate on sudden stops, and more precisely, on the link between financial vulnerability and macroeconomic imbalances. Calvo and Talvi (2005) are interested in the case of Latin America and the severe macroeconomic conditions following periods of sudden stops which drastically reduced the growth rate of these countries. The case of Chile attracted particular interest from these authors. Despite a highly robust macroeconomic situation and heavy restrictive policies applied to capital inflows, the country was not spared from a crisis in capital flows and devastating macroeconomic consequences in the wake of the Russian crisis. Following loans previously contracted from outside, the SS can reduce an adverse shock to global income, like a decline in the terms of trade. A similar shock can be accompanied by degradation in the current account and a rise in the inflows.

The occurrence of sudden stops and lowering the external debt had its consequence in a high current account adaptation and exchange rate depreciation. In contrast, the debt alleviation and the adjustment of the current account can greatly reduce the level of investment. This reduction in investment has made it possible to meet the stricter conditions of external financing. A drop in the investment of around 20% was seen just after the Russian crisis. Calvo, Izquierdo, and Talvi (2006) find that no credit restoration from either abroad or inside and a very limited investment restoration are detected during the reversal situation of capital flows.

Some studies use a standard equilibrium model to demonstrate that high constraints on external debt can generate a SS (Chari, Kehoe and McGrattan, 2005). The authors find that these SS are not the main cause of the decline in production, on the contrary, they help to increase the output. Consequently, such models need to integer other factors, which have unfavorable impacts on production. These factors are so influential to submerge the favorable impact of the SS.

Other studies have investigated the effects on the global well-being of a country and not paying attention to a separate macroeconomic aggregate. These effects can come from income inequality and other social indicators. Among these studies, Bilan et al. (2020) were more interested in the effects of income distribution on overall social well-being, find that fair income distribution and low-income inequality lead to economic progress and social well-being. Fazaalloh, A. M. (2019) also studied the impacts of foreign direct investment on the overall welfare. The author uses the income inequality for the case of Indonesia as a proxy to the overall social well-being and finds that a trade-off between economic growth and income inequality, particularly in developing countries, frequently occurs. FDI has indirect and negative effects on income inequality, via economic growth. Consequently, SS of foreign direct investment can affect the global well-being of the state. Considered as part of flows generating SS, FDI is also focused by Vasa and Angeloska (2020). The authors have analyzed the correlation between FDI and economic growth. Vasa and Angeloska (2020) emphasis on the variables that are considerably influencing changes and impact on FDI in Serbia. The authors suggest a very weak correlation between FDI inflows and increased GDP growth. The GDP growth has strong correlations with industry growth, FDI inflow, and FDI outflow. Other studies have concentrated on the factors inherent to the firms which create these sudden investment outflows. Among these studies, Abidi et al. (2018) have studied the importance of FDI in the MENA region. Their study examines the extent to which Gulf Cooperation Council firms' decisions to conduct investments in MENA region are explained by their characteristics (size, age, performance, state ownership, and debt structure). The findings reveal that while the firm's size and performance exert a positive effect on a firm's decision to expand within MENA region, state ownership has a negative influence.

Given that the idea of SS generates a grievous macroeconomic unbalances is not accordant, our study analyzes its effects on the main macroeconomic fundamentals (gross domestic product, investment, consumption, and unemployment). According to Calvo and Reinhart (1999) that generally, the SS does not happen in developed countries, leads to the conclusion that SS is a central feature of emergent crises spreading over the other countries around the world. This is why the SS effect analysis is applied to the total sample of 200 countries, including developed and emerging economies. These impacts may be expected to be clearer among developing countries than among the developed ones.

3. Methodology

3.1. Identifying SS events

A country that receives a large volume of foreign capital is suddenly and unexpectedly deprived of these inflows, such is the general context of a sudden stop. In particular, this event occurs when there is a drop of at least 5% in gross domestic product per year (Edwards 2004). According to Guidotti et al. (2004), Agosin and Huaita (2012) and Agosin, Díaz, Karnani (2019), this event occurs if the annual decline in the financial account is at least equal to one standard deviation from its average and also greater than 5% of gross domestic product. Specifically, a SS occurs when $SS_{it} = 1$ and defined as:

$$SS_{it} = \begin{cases} 1 & if\ \Delta FA_{i,t} < \overline{\Delta FA_t} - \sigma_{\Delta F_i}\ and\ \left|\frac{\Delta FA_{i,t}}{GDP_{i,t}}\right| \geq 5\%, whenever\ FA_{i,t-1} > 0\ and\ FA_{i,t} = 0 \\ 0 & otherwise \end{cases} \quad (1)$$

where $\Delta FA_{i,t} = FA_{i,t} - FA_{i,t-1}$ is the annual variation in the financial account.

3.2. Predict sudden stops

The paper has contributed to the past analysis on the probability of SS by the employ of a set of explicative variables:

– Broad money of GDP,

– Current account balance,

– Liabilities dollarization (net incurrence of liabilities),

– Exports of goods and services,

– Terms of trade,

– Real effective exchange rate,

– Real interest rate.

The three policies for managing capital flows are defined by the following dimensions:

– For international reserves, we use four variables: reserves and related items, total reserves, net foreign assets, and bank liquid reserves to bank assets ratio.

– For external debt, we use two variables: debt service on external debt, total and external debt stocks.

– Capital controls indexes are defined in Table 1 and consist of four indexes: ka, Kai, Kao, and KAOPEN.

Table 1: Capital control indexes

Index	Definition	Source
ka	Overall restrictions index (all asset categories)	Fernández, Klein, Rebucci, Schindler, and Uribe (2016) "Capital Control Measures: A New Dataset"
kai	Overall inflow restrictions index (all asset categories)	
kao	Overall outflow restrictions index (all asset categories)	
kaopen	The extent of openness in capital account transactions	Chinn, M. D., and H. Ito, The Chinn-Ito Index, http://web.pdx.edu/~ito/Chinn-Ito_website.htm, last updated July 2017.

Source: Fernández, Klein, Rebucci, Schindler, and Uribe (2016) "Capital Control Measures: A New Dataset"; Chinn, M. D., and H. Ito, The Chinn-Ito Index, http://web.pdx.edu/~ito/Chinn-Ito_website.htm, last updated July 2017.

According to Gourinchas and Jeanne (2012) and Hur, Kondo (2016) a panel logit model with country fixed effects was applied to regress the following equation:

$$\Pr\left(SS_t^i = 1 \middle| X_i\right) = \frac{\exp\left(\alpha_i + \beta X_i\right)}{1 + \exp\left(x_i + \beta X_i\right)} \tag{2}$$

where SS_t^i define if an economy country 'i' is in a sudden stop period in the next 't' years, and X_i denotes, classical determinants previously defined in this section. As a hypothesis for the study, SS probability becomes low with:

– High foreign exchange reserves,

– Low foreign borrowing,

– Rigid capital controls.

We empirically follow the evolution of some macroeconomic fundamentals before and after the periods of sudden stops. As assumed in this study, there will be deterioration in the macroeconomic situation after the SS. The study except that this degradation will be more remarkable in developing economies than in developed (Benigno and Fornaro, 2012).

4. Empirical data and analysis

4.1. Data

The study is applied for a sample of 200 developed and developing countries, over the period 1995-2019. These are annual data collected from various sources, mainly statistics from the International Monetary Fund (IFS) and the World Bank database (WDI).

For capital control, we use the Chinn-Ito financial openness index (KAOPEN) to designate the extent of restrictions applied by a country (Chinn and Ito, 2006). And also we use three indexes defined by Fernandez et al. (2016).

4.2. Sudden stops periods

Total capital flows are determined using various types of liabilities on FDI, PI, and all other investments. It was majorly calculated by the sum of net portfolio investment, net foreign direct investment, and net flows on external debts. The study follows the definition of Guidotti et al. (2004), Agosin and Huaita (2012) and Agosin, Díaz, Karnani (2019) for SS periods. Events of brusque reversals are determined when capital inflows decline exceed the standard deviation of their mean fluctuation within the analysis period, additionally, when that drop is at a minimum of 5% of GDP. If the two previous conditions are satisfied we judge that the period is "intense", if not, "normal".

Table 2 displays annual periods of "normal" and "intense" sudden stops for developing and developed economies. The results show that the mean for developing economies is generally shorter in comparison to developed economies.

Table 2: SS Periods for developing and developed economies

Years	Normal		Intense	
	Developing Economies	Developed Economies	Developing Economies	Developed Economies
1985	2.84	8.46	4.72	5.56
1986	2.75	6.77	4.14	5.26
1987	4.75	6.48	7.53	2.79
1988	3.49	7.53	5.65	5.63
1989	6.11	4.94	5.04	8.06
1990	6.71	5.31	5.34	8.22
1991	2.93	4.91	6.01	7.42
1992	2.91	4.12	5.23	5.16
1993	3.34	2.87	6.00	3.69
1994	1.93	2.12	7.92	4.25
1995	6.38	2.60	8.57	6.35
1996	818	1.14	8.65	6.48
1997	5.21	5.11	7.54	7.07
1998	9.70	3.47	6.56	4.91
1999	7.65	3.68	5.76	5.10
2000	8.83	6.80	5.48	5.14
2001	9.60	2.42	4.92	5.07
2002	6.45	2.29	4.87	5.25
2003	7.06	2.71	5.75	5.75
2004	5.33	5.39	2.20	5.18

Years	Normal		Intense	
	Developing Economies	Developed Economies	Developing Economies	Developed Economies
2005	5.08	4.87	2.53	5.59
2006	6.48	3.04	4.58	5.79
2007	7.43	3.17	3.05	5.51
2008	4.41	4.44	2.31	4.91
2009	5.99	2.19	3.79	5.10
2010	5.39	3.14	2.24	3.06
2011	5.64	2.88	3.83	3.57
2012	6.82	1.99	2.14	3.39
2013	5.56	6.74	3.71	12.51
2014	3.84	6.56	3.68	4.29
2015	4.28	8.37	2.20	3.56
2016	3.94	7.27	3.91	3.93
2017	4.68	3.54	2.68	4.43
2018	3.18	2.78	2.28	3.89
2019	3.85	4.54	1.55	5.56
Mean	4.39	5.15	4.83	5.21

Source: author's calculations

4.3. Forecast sudden stops

To detect a sudden stop event with countries' fixed effects, we used a discrete choice panel model. This type of model is often used in the early warning literature of financial crisis prevention. We have chosen the logit models instead of the probit models based on the results of Hausman's specification test. This test confirms the rejection of the hypothesis that the profit estimator is consistent and efficient.

Similarly, the choice of fixed effects instead of random effects is motivated by the fact that traditional probit models with a random effect require independence of unobservable country effects on the independent variables. Whereas with a fixed effect logit panel model, we can have robust coefficient estimates without the unobservable country effects be associated with the independent variables.

Regressions are executed with the totality of 200 countries included in the panel. Respectively the results of the regressions for the explanatory variables of sudden stops concerning the three dimensions of our study, foreign exchange reserves, foreign borrowing, and capital control are presented in Tables 3-5.

The results demonstrated a statistical significance of major factors affecting the probability of sudden stops and have the expected sign. The probability of sudden stops is greater when there is a slowdown in economic growth and there is more risk aversion among the agents operating on the financial markets. Contrarily, the overall liquidity rates and the long-term interest rate are insignificant.

Concerning the combination of policies for managing capital flow, the results show a significant relationship between foreign borrowing and foreign exchange reserves. A high ratio of reserves to debts is associated with a low probability of sudden stops. Countries with a considerable stock of foreign exchange reserves relative to their external debt are less vulnerable to a sudden stop.

Table 3: Fixed effects model for foreign exchange reserves

Independent variables	Foreign Exchange Reserves			
	Bank Liquid Reserves	Total Reserves	Net Foreign Assets	Reserves and Related Items
Broad money of GDP	-0.130*** (0.020)	0.516 (0.326)	0.120*** (0.016)	-0.022 (0.232)
Current account balance	0.459*** (0.031)	1.920*** (0.047)	0.003*** (0.000)	0.471*** (0.017)
Exports of goods and services	0.010** (0.075)	0.247** (0.094)	0.279** (0.080)	0.032*** (0.003)
Final consumption expenditure	-0.182** (0.068)	0.036 (0.375)	-0.002** (0.035)	-0.191** (0.051)
GDP	0.306*** (0.026)	0.518 (0.378)	-0.016*** (0.007)	0.014 (0.950)
GDP Growth Annual	-0.065 (0.001)	0.192 (0.224)	-0.613** (0.076)	0.994** (0.085)
GDP per capita	0.001*** (0.000)	0.058** (0.081)	0.003*** (0.000)	-0.427 (0.249)
Net acquisition of finance	0.360 (0.276)	-0.001*** (0.000)	-0.002** (0.048)	-0.151 (0.740)
Net financial account behavior	0.368** (0.076)	0.081** (0.088)	0.473 (0.180)	0.054*** (0.008)
Net incurrence of liabilities	0.508** (0.096)	-0.711 (0.179)	0.004 (0.310)	0.281** (0.083)
Real effective exchange rate	0.103*** (0.030)	0.254 (0.152)	0.004** (0.098)	0.507** (0.078)
Real interest rate	0.213** (0.085)	0.154*** (0.027)	0.001 (0.322)	0.555*** (0.031)
Terms of trade adjustment	0.286** (0.081)	0.456*** (0.037)	0.131 (0.634)	0.161** (0.076)
Trade of GDP	0.041*** (0.012)	0.029 (0.116)	0.000*** (0.013)	0.018** (0.089)
Unemployment	-0.072** (0.071)	0.031*** (0.049)	0.021 (0.130)	0.761*** (0.087)

*** Significant at the 5% confidence level; ** Significant at the 10% confidence level; Standard errors in parenthesis.

Source: author's calculations

Table 3 shows that the current account balance, exports of goods and services, terms of trade, and Trade (% of GDP) are the most significant variables to explain the different independent variables of foreign exchange reserves. The coefficients

of these explanatory variables are positive, reflecting their favorable impacts on the accumulation of international reserves. Monetary and foreign exchange policies, across the sample country, also seem to favor the accumulation of foreign exchange reserves. The coefficients of variables real effective exchange rate and real interest rate are positive and significant, defining a favorable influence on the four dependent variables of foreign exchange reserves. The control variables which consider the macroeconomic conditions (GDP growth, employment, and consumption), determine a good framework favoring the attraction of foreign currencies.

Table 4: Fixed effects model for foreign borrowing

Independent variables	Foreign Borrowing	
	Debt Service on Foreign Borrowing	Foreign Borrowing Stocks
Broad money of GDP	0.126** (0.074)	0.002** (0.052)
Current account balance	0.153*** (0.037)	0.561*** (0.014)
Exports of goods and services	0.086** (0.056)	0.158** (0.030)
Final consumption expenditure	0.965 (0.219)	0.727*** (0.015)
GDP current US%	0.692 (0.253)	-0.138 (0.753)
GDP Growth Annual	0.018*** (0.001)	-0.215** (0.067)
GDP per capita	0.360** (0.077)	0.097** (0.064)
Net acquisition of finance	-0.547 (0.144)	-0.905 (0.184)
Net financial account behavior	-0.009** (0.081)	-0.235 (0.496)
Net incurrence of liabilities	0.054** (0.085)	0.694** (0.067)
Real effective exchange rate	-0.022** (0.075)	0.185*** (0.020)
Real interest rate	-0.264** (0.052)	0.037** (0.076)
Terms of trade adjustment	0.284** (0.095)	0.032 (0.280)
Trade of GDP	-0.002*** (0.023)	-0.748** (0.074)
Unemployment	-0.014** (0.096)	- 0.045** (0.035)

*** Significant at the 5% confidence level; ** Significant at the 10% confidence level; Standard errors in parenthesis.

Source: author's calculations

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Table 4 displays results for two dependent variables proxies of foreign borrowing: debt services on foreign borrowing, and foreign borrowing stocks. The findings show that international trade variables such as trade, terms of trade, current account balance, and exports have positive effects on both the accumulation of external debt and the cost of this debt. Monetary and exchange rate policies also seem to support the accumulation of external debts but, on the contrary, reduce the burden of these debts. The coefficients of the real effective exchange rate and real interest rate are negative and significant to explain Debt service on foreign borrowing and are positive and significant to explain foreign borrowing stocks. Macroeconomic conditions, through GDP, consumption, and employment, support the recourse to foreign borrowing and therefore the debt burden.

Table 5: Fixed effects model for capital controls

Independent variables	Capital Controls			
	Ka	Kai	Kao	KAOPEN
Broad money of GDP	-0.070*** (0.011)	-0.513*** (0.026)	-0.555** (0.081)	0.560** (0.076)
Current account balance	-0.555*** (0.028)	-0.318** (0.067)	-0.191** (0.031)	0.163*** (0.028)
Exports of goods and services	-0.093** (0.066)	-0.052** (0.063)	-0.045** (0.061)	0.025 (0.102)
Final consumption expenditure	0.341** (0.065)	0.031** (0.079)	0.011*** (0.031)	-0.820 (0.331)
GDP current US%	-0.414 (0.626)	0.435*** (0.046)	0.141*** (0.031)	-0.444 (0.366)
GDP Growth Annual	-0.156 (0.149)	-0.196** (0.089)	-0.124*** (0.049)	-0.012*** (0.000)
GDP per capita	-4.37*** (0.423)	-1.165*** (0.010)	-0.541*** (0.069)	-0.972** (0.075)
Net acquisition of finance	-0.230** (1.073)	-0.001*** (0.000)	-0.370** (0.083)	0.538*** (0.245)
Net financial account behavior	-0.391** (0.071)	-0.297*** (0.009)	-0.223** (0.084)	0.936 (0.724)
Net incurrence of liabilities	0.871*** (0.041)	0.137*** (0.037)	0.369 (0.219)	0.013** (0.082)
Real effective exchange rate	0.181*** (0.023)	0.259*** (0.042)	439.9** (0.081)	-0.065** (0.087)
Real interest rate	0.001*** (0.021)	0.162** (0.085)	4.870 (1.751)	-0.268*** (0.003)
Terms of trade adjustment	-0.056** (0.070)	-0.454** (0.077)	-0.056*** (0.040)	0.016** (0.078)
Trade of GDP	-0.871** (0.071)	-0.780** (0.058)	-3.871 (1.601)	-0.705 (0.330)
Unemployment	0.014*** (0.010)	0.324*** (0.014)	-0.411 (8.311)	0.069 (0.040)

*** Significant at the 5% confidence level; ** Significant at the 10% confidence level; Standard errors in parenthesis.

Source: author's calculations

The findings of Table 5 highlight the importance of capital controls to stabilize the economy. The main variables sources of foreign reserves holdings display negative coefficients for Fernández et al. (2016) indexes (ka, kai, and kao) and a positive coefficient for Chinn and Ito (2006) index (kaopen). We must be careful when interpreting these results because these indexes reflect an opposite appearance. High values of ka, kai, and kao mean tighter controls, while for kaopen, the high value reflects fewer controls. For all these indexes, it seems that the variables generating foreign exchange reserves are hampered by capital controls, evidence that has been established in the literature review. Among these variables were particularly cited, current account balance, net acquisition of finance, net financial account, and net incurrence of liabilities. Broad money of GDP (M2 / GDP) is often used in the literature of financial crises as an indicator of financial system instability. This variable shows a positive association with kaopen, and negative with ka, kai, and, kao, indicating that increased capital account liberalization may cause more financial deepening but also generate financial instability. Monetary and exchange rate policies are consistent with restrictive capital flow policies. The coefficients of the real effective exchange rate and real interest rate are positive with ka, kai, and kaopen and negative with kaopen, suggesting accordance with the restrictions applied through capital controls.

4.4. Impacts of SS on economic fundamentals

The impact analysis conducted on the consequences of these events of SS on the gross domestic product, consumption, investment, and unemployment, shows disastrous effects. Before periods of sudden stops (Tables 6 and 7), economies with a satisfactory stock of international reserves, low external debt, and tight restriction policy on capital movement are the lowest touched by the spillover risk. We also observe that developing economies are more influenced than developed economies.

Table 6: Panel logit regressions (prior sudden stop)

	GDP	Consumption	Investment	Unemployment
Foreign Exchange Reserves				
Reserves and related items	0.294** (0.076)	0.014** (0.094)	0.019*** (0.257)	−4.415 (0.955)
Total reserves (% of total external debt)	3.469*** (0.007)	0.061** (0.068)	0.027 (0.177)	−0.093 (0.184)
Net foreign assets (current LCU)	0.015** (0.74)	−0.282** (0.097)	−0.019*** (0.000)	-0.643 (2.071)
Foreign Borrowing				
Debt service on external debt, total (TDS, current US$)	0.060*** (0.008)	−4130 (0.368)	0.014** (0.056)	-0.049 (0.121)
External debt stocks, total (DOD, current US$)	−0.050 (0.269)	0.077 (0.197)	−1.591 (0.266)	−0.001 (0.271)
Capital Controls				
Ka	−0.729 (0.529)	0.057** (0.078)	−0.280 (0.718)	−1.393*** (0.055)
Kai	0.327 (0.464)	−0.240** (0.067)	−0.000 (0.091)	−0.081 (0.748)
Kao	- 0.142*** (0.037)	−0.827 (0.107)	-0.016*** (0.008)	−1.466*** (0.042)
KAOPEN	−0.093 (0.228)	0.052*** (0.018)	−0.048 (0.744)	0.016** (0.079)

*** Significant at the 5% confidence level; ** Significant at the 10% confidence level; Standard errors in parenthesis.

Source: author's calculations

The results in Table 6 show that, before sudden stops, there are positive impacts of foreign exchange reserves variables on the macroeconomic aggregates. This is the result of periods of massive capital inflows, among other things, in the form of exchange reserves. There has been empirical literature evidence that these inflows have to lead to high economic growth rates, particularly, for emerging countries. Debts have often been seen as a means of promoting the economic activity of a country if they are well allocated and are particularly investment-oriented. This is observed through positive and significant coefficients for GDP and Investment. Unfortunately, for other variables, consumption, and employment, there are no external debt impacts, the coefficients are non-significant. Considering capital control indexes, the effects are diverse on GDP, consumption, investment, and employment, which do not allow giving a clear interpretation. We admit that these capital controls were weak for the periods before SS, their impact was thus reduced.

Table 7: Panel logit regressions (after a sudden stop)

	GDP	Consumption	Investment	Unemployment
Foreign Exchange Reserves				
Reserves and related items	- 0.242** (0.067)	- 0.184** (0.095)	- 0.237*** (0.027)	0.251*** (0.048)
Total reserves (% of total external debt)	- 0.198** (0.068)	- 0.076** (0.090)	- 0.868 (0.932)	0.681** (0.087)
Net foreign assets	- 0.453** (0.099)	- 0.071** (0.075)	- 0.021*** (0.033)	0.481** (0.097)
Foreign Borrowing				
Debt service on external debt, total	- 0.024** (0.053)	- 0.047** (0.084)	- 0.014 (0.152)	0.056*** (0.011)
External debt stocks, total	- 0.081*** (0.015)	- 0.056*** (0.021)	- 0.032*** (0.011)	0.053** (0.081)
Capital Controls				
Ka	0.342** (0.072)	0.217 (0.100)	0.325** (0.073)	- 0.319** (0.072)
Kai	0.324** (0.071)	0.016 (0.150)***	0.057 (0.082)	- 0.014*** (0.030)
Kao	0.016 (0.150)	0.019 (0.251)	0.065*** (0.041)	- 3.683*** (0.037)
KAOPEN	0.047*** (0.011)	0.170** (0.059)	7.539 (0.437)	-0.013*** (0.017)

*** Significant at the 5% confidence level; ** Significant at the 10% confidence level; Standard errors in parenthesis.

Source: author's calculations

The results of Table 7 show that after SS periods, there are positive coefficients of the variables of foreign exchange reserves and external debts on the variables, GDP, investment, and consumption and also a positive impact on unemployment. Consequently, the SS periods will lead to deterioration in macroeconomic conditions. This degradation is clearer by comparing these results with those of Table 6, before SS. These results are similar to the empirical literature about the impact of SS on the economy, and consequently, highlight the adverse effects of SS.

For the impact of the capital control indexes, there are positive and significant coefficients for a majority of these indexes (and negative for unemployment). These results show that the restrictive measures, applied after, SS support the macroeconomic aggregates. These controls have often been seen as a measure of financial stability and to hedge the economy against the unwanted effects of speculative capital flows.

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5. Results and discussion

The paper has specified and recognized periods of sudden stops for developing and developed economies to establish indexes of foreign exchange reserves, foreign borrowing, and capital inflows. The financial account of each country's balance of payments was used to collect data on gross capital inflow. These results show that the developing economies are the most resilient and show shorter sudden stops periods than those of the developed countries. Our results join those of Forbes and Warnock (2012) about the behavior of capital flows and the reaction of emerging countries to the reversal capital flow.

Contrarily, some coefficients of explanatory variables were not significant, this was the case for rates on global liquidity and long-term interest. This insignificance is not astonishing since historically the majority of capital inflow in developing economies has been in the form of FDI, which tends to be less sensitive to circumstances of the international finance and other types of investment notably portfolio investment (Espinoza, 2014).

The regression results show that countries with satisfactory foreign exchange reserves and also a low external debt burden are less faced by events of sudden stops. This finding is consistent with the results found in previous studies. Durdu et al (2009) find that the risk of a sudden stop is closely linked to the level of reserves accumulated by a country. Gourinchas and Obstfeld (2013) indicate that foreign exchange reserves play an important role to prevent financial crises, while Hur and Kondo (2016) suggest that the level of reserves is an indicator of predicting financial vulnerability.

The results of the study show that the spillover risk before the occurrence of a sudden stop is negligible for economies with correct policies for managing capital inflows, in particular with sufficient foreign exchange reserves, low foreign borrowing, and early capital controls. Fornaro (2019) confirms these observations, he shows that above all the application of capital controls is one of the essential factors to counter spillover risk. Overall, in an international context full of uncertainty, the monitoring of macroeconomic aggregates provides robust evidence on the importance of foreign exchange reserves to ease tensions on the financial markets of emerging countries.

An interesting role played by the foreign exchange reservesgives a kind of confidence to the resident investors and constitutes a kind of guarantee which prevents a fall or a stop in capital inflow (Mendoza, 2005). The economic impact of sudden stops is very significant. A decline in economic growth could reach 5% for an average economy following these international capital movements and/or a drop in capital inflows. These unfavorable movements of capital will cause a shortage in sources of financing, emerging countries will suffer following this shortage throughout periods of financial stress.

The results of the study can also be interpreted under the impossible trinity concept (also known as the trilemma). For the past few decades, international macroeconomics has postulated the "Trilemma": with free capital mobility (absence of capital controls), independent monetary policies are feasible if and only if exchange rates are floating. Certainly, our study group these policies but consider the use of capital controls, that's why we don't examine the impacts of the three policies in a Trilemma framework. The results can also be interpreted in a broader or a limited Trilemma framework noted Quadrilemma and Dilemma. Firstly, the original Trilemma has morphed into a Quadrilemma, wherein financial stability has been added to the Trilemma's original policy goals (Aizenman, 2019). Our results highlight financial instability through the broad money of GDP variable (measured by M2 / GDP). The theoretical literature on financial crises usually uses this variable as a proxy for financial instability. Thus, our results can be also examined in the Quadrilemma. Secondly, the findings can be interpreted in a more reduced framework, the Dilemma. The global financial cycle transforms the trilemma into a "Dilemma" or an "irreconcilable duo": independent monetary policies are possible if and only if the capital account is managed (Rey, 2015). The main problem is to find an optimal policy for managing capital flows. The exchange rate policy (fixed or floating), as well as the liberalization of capital flows, have been grouped under an optimal policy for managing capital flows. The study results can be debated regarding the definition of an optimal policy for managing capital flows that will avoid sudden stops.

6. Conclusions

The models used in this study made it possible to draw some conclusions. The study highlights the great role of foreign exchange reserves which could serve as a shock absorber during crises, although it remains responsive to the scaling variable. The explanatory power of international reserves and its predictive role for sudden stops is interesting and the reserve / foreign borrowing ratio constitutes an adequate indicator of the international reserve.

The study results answered our three research hypotheses, by determining the periods of SS (H1) and highlighting the role of foreign exchange reserves and external debts to increase SS probability and also the role of inhibition of capital controls for this probability (H2). The study joins those who find negative impacts of SS on the macroeconomic aggregates (H3).

The paper emphasizes that countries accumulating foreign exchange reserves before the sudden stop have vigorously utilized them moreover for protecting the local currency from devaluation, to provide confidence in the country's ability to honor its financial commitments; and to provide funding assistance to local

companies that have experienced severe constraints in obtaining credits (Mendoza, 2010). The empirical analysis has provided panel data proof where other elements were administrated to assess the strength of this result. The regressions estimations highlight the pro-cyclical character of capital flows and the fact that international variables are more interesting than endogenous-country factors to explain the capital outflows movements. The panel results have given proof that foreign exchange reserves are associated with a decline in inflows and with an increased willingness of resident investors to minimize the risks involved in repatriating investments during periods of global financial instability.

It is concluded that restrictive policies using capital control are not a lasting solution to cope with reversal capital and the recurrent manifestation of sudden stops. However, external debts show considerable dependence on controls so as not to resort to floating. If the sudden stop issue is not removed using dollarization, it would appear to have the advantage as a further market-oriented alternative for excellence. To have a total liberalization of capital account often requires independent management of exchange rate and monetary policy, as suggested by the impossible trinity or the incompatibility triangle.

Finally, the study gives a definition and a calculation of the events of SS as employed by previous studies. It will be interesting for a new study to conduct further research into sudden stops periods and to compare its results with those of previous studies. Likewise, total capital flows can include several types of flows other than those of this study. A new study may modify the calculation of total capital flows and consequently can obtain new results. Besides, our study chose to examine the consequences of SS on macroeconomic aggregates, a novel study can analyze the consequences of SS on the overall social well-being or income inequality.

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Politike upravljanja naglim zastojima

Chokri Zehri[1]

Sažetak

Upravljanje financijskim tokovima iziskuje odgovarajuću povezanost deviznih rezervi, inozemnog zaduživanja i kontrole kapitala. Ove politike smatraju se alatom za predviđanje naglih zastoja (SS). Stoga se u ovoj analizi utvrđuje pojavljivanje naglih zastoja / prekida financijskih tokova na uzorku od 200 zemalja u periodu od 1985. - 2019. godine. Vjerojatnost SS-a određuje se pomoću logit modela. Rezultati ukazuju na činjenicu da učinkovito upravljanje smanjuje vjerojatnost naglih zastoja. Provedena je analiza utjecaja rizika prelijevanja na bruto domaći proizvod, potrošnju, investicije i nezaposlenost. Rezultati pokazuju štetne utjecaje na ove makroekonomske varijable. Nalazi potvrđuju da zemlje sa zadovoljavajućom razinom deviznih rezervi, malim inozemnim zaduživanjem i koje započinju s kontrolom kapitala prije pojave naglih zastoja financijskih tokova manje pogađa rizik prelijevanja nego li gospodarstva u nastajanju koja su ranjivija od bogatih gospodarstava.

Ključne riječi: *nagli zastoji, politike, tokovi kapitala, dugovi, rezerve, kontrole*

JEL klasifikacija: *F32, F36, F37*

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Working women and per capita household consumption expenditures; an untouched reality[*]

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Abstract

Working women have more compulsive buying tendencies which can lead to a significant increase in their household consumption expenditures. This study investigates the effects of changes in the number of working women on household per capita consumption. We test the hypothesis that changes in the number of working women have a discernible impact on household final per capita consumption expenditures, due to their differing consumption propensities, by doing an empirical analysis based on panel data set of 36 OECD economies within the period 2000-2016. The results indicate that changes in the number of working women increase the household per capita consumption expenditures. The result

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also implies that age plays a significant role in working women consumption decision making and may lead to significant differences in aggregate consumption expenditure. These findings suggest the importance of understanding changes in the number of working women in planning for aggregate consumption mobilization and in the formulation of aggregate growth policies.

Key words: *working women buying behavior, household per capita consumption expenditures, GDP growth, empirical study, OECD countries*

JEL classification: *D12, D91, J16*

1. Introduction

Consumption is considered to be an essential element for the most part of macroeconomic models since it takes from about 50% to 70% of gross domestic product in most economies.[7] It is important to explore all the critical factors which influence consumption expenditures.[8] Compulsive behavior of women with respect to buying decision is of significant importance and need to be examined thoroughly/ in detail. Women's spending behavior is quite different from men's be. Their marginal propensity to consume is relatively higher making them strong consumers (Kornrich and Roberts, 2017). Specifically working women, due to their high purchasing power, are considered as more imprudent to consumption decisions[9]. Thus we investigated the phenomena in respect of working women. To learn about household final per capita consumption expenditures through working women spending behavior is crucial for the macroeconomic perspective of the economy.

Over the last half-century, the percentage of working women has increased enormously almost everywhere in the world[10]. The consequences for family performance and lifestyle patterns once the woman's main working hours are removed from home are vast in magnitude (Anderson and Eswaran 2009; Lancaster, Maitra and Ray, 2008). Despite the implication of this social trend, inadequate consideration appears to have been paid to investigating its implications for encouragement policies. Relatively little interest seems, such as, to have been publicized in assessing whether working women families have exact needs and interests which provide opportunities for mounting new products and services,

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[7] For example, in 2017, USA personal consumption expenditures were $12.6 trillion, contributing 70 percent of total United States <u>real GDP</u>.

[8] In this research for examining gross domestic product as a means to comprehend what is holding back country's economic situation, we will examine consumption expenditures through an important channel of working women expenditure behavior.

[9] Detailed explanation is given on the next pages.

[10] According to global professional services firm estimates, worldwide aggregate incomes of women are calculated to reach an astounding $18 trillion by 2018. Women impel 70-80% of the entire consumer buying, through a amalgamation of their own buying power and influence on others. (Forbes estimates)

or for emphasizing definite benefits and appeals. When we question the relation between number of working women on per capita consumption expenditure, the first answer directly comes up is income effect, which explains the changes in their consumption pattern. However, except for the income effect there are many other factors explaining the different consumption propensities of working women.

Despite the fact that working women's compulsive buying behavior[11] makes them spend relatively more than men[12] and the income effect, there are other reasons making working women particularly spend larger proportions of their income. The following reasons show that this neglect of the working women consumption expenditure pattern is unjustifiable. Firstly, the time constraints on the routine of household tasks such as cooking, grocery, cleaning, and in particular on the time when these household tasks are performed in working women's families, propose that different strategies are probably to be developed to deal with these problems. One supposition is that working women will show more interest in time-saving products and services such as take-out meals, instant dusting sprays, laundry, and cleaning service. Secondly, working women's lifestyle is comparatively different to non-working ones. They spend more on their personal grooming, clothing and other things. Thirdly, dissimilarities in attitudes among working and non-working women in the direction of female roles are likely to influence their consumption behavior. The double roles of a woman in her employment and in the home entail that the degree of involvement in different "homemaker" responsibilities such as "Chief Cook", "Housekeeper", "Mother", will differ from a non-working woman for whom such functions are the focal point of her continuation (Shotick, 2015). This does not essentially mean rejection of homemaker functions by working women, but rather that the search for other chances for self-fulfillment in activities outside the home (Keng and Lin, 2005). Therefore, the time and effort dedicated to homemaker roles, as well as concepts of opposite behavior in these functions, may differ from those of the non-working women (Killewald 2011). Based on all these phenomena we build the first hypothesis that the number of working women has significant effect on consumption expenditures.

With the raise in number of working women in past decades, economic activity amplified extensively (Albanesi, 2017). Their participation leads higher growth in different economic indicators. Working women spending behavior is one of the aspects which is helping economic doings and improving the living standards. Women participate in 70-80 percent of the overall consumer spending[13]. Therefore,

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[11] Compulsive buying behavior is the psychiatric nomenclature which is characterized by excessive or poorly controlled urges or behaviors related to buying and spending.

[12] For example, in the research it is estimated that compulsive buying behavior affected between 2 to 16 percent of the United States population and that 90 percent of sufferers were women.

[13] In Bridget Brennan's article published in Forbes news on May 20, 2019, she quoted women as the world's most powerful consumers.

supposedly higher women spending leading more household expenditures ultimately affect to the aggregate consumption expenditures. To understand the concept on extensive level, a macro level analysis had better be done as to investigate the connection between number of working and aggregate consumption expenditures. Thus the second hypothesis is that the a positive change in numbers of working women increases per capita household consumption expenditures.

Likewise, if we imply the above reasons for different age groups of working women, there are significant differences between the buying behaviors of different age groups (Addessi, 2018). Generally, young women have relatively more compulsive buying behavior than middle-aged and elderly women. However, middle-aged working women spend more on family expenditures. It is empirically proven that working wives increase their expenditures on family necessities such as children education, clothing, non-durable etc. (DeWeese and Norton, 1991). Limited attention has been paid to investigating the impact of the women's employment status on buying behavior and on their consumption expenditures. A few comparisons of purchase behavior in working and non-working women's families have been made.. For instance, it has been found that working women tend to be more efficient in organizing household tasks; they make fewer shopping trips and are more likely to be accompanied by their husbands than non-working women (Lee, Lee and Chang, 2014). On the other hand, there appears to be little support to indicate that working women are more interested in convenience products than non-working women (Bhupal and Sam, 2014). Such studies are not based on complete information and barely scratch the surface of the working women phenomenon. Thus the third hypothesis is that the age of working women does matter on their spending decision and eventually to overall consumption expenditures.

The main purpose of the study is to investigate the effect of changes in the number of working women on household final per capita consumption expenditure[14]. The key research purpose is to find whether changes in working women appear to have a substantially significant effect on household consumption expenditure, which likely to give an adequate basis for measuring household final per capita consumption expenditure. In addition, to investigate whether there are significant attitudinal differences within different age groups of working women which show the way to different spending behavior patterns, and suggest that a finer level of study based on sub-segments within each group is possible to be more appropriate for decision-making purposes.

The rest of this study is organized as follows. Section 2 is the literature review on studies and theories that are related to Consumption expenditures and working

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[14] Whereas while estimating through income approach, aggregate consumption is the first part of gross domestic Product. Hence we ultimately are looking for working women participation in economic growth through consumption channel.

women consumption behavior. Section 3 presents a brief introduction of the variables and data employed here. Section 4 establishment of the econometric model and section 5 provides the basic empirical results. Section 6 summarizes the Conclusion. Discussion and policy implications are presented in the final section.

2. Literature review

The most part of the economic literature on consumer spending views all households as compound decision-making entities with common preferences and pooled incomes. Such as, studies done by Apps and Rees (1997), Chen and Woolley (2001), Browning (2010) and d'Aspremont et al. (2019) view in favor of broadening the collective model of household spending behavior. Whereas, also number of studies rejecting this 'income-pooling' predicting the household utility framework is available in the literature[15] (see, e.g. Schultz, 1990; Bourguignon et al., 1993; Hoddinott and Haddad, 1995; Lee, 2007; Browning et al., 2013; Watson et al., 2013; Beblo& Beninger, 2016).

Women show compulsiveness in shopping as they look for corroboration of a sense of worth through shopping and spending (Dittmar, Beattie & Friese, 2004). The working women have attained high on irrational buying scale as their pressure to match the manifestation requirement in terms of buying and spending are more as they are exposed to relatively wider social pressure. The other cause could be that the working women are more strained due to anxiety and high work pressure. They do shopping to do away with stress. Shopping plays a psychosomatic function in their lives (Dittmar, 2000; Dittmar, 2001). It will be not erroneous to say that shopping is a leisure activity for them. Taking this aspect into consideration, it can be concluded that it is not only the working women's economic dominion that makes them open to irrational buying tendencies but also socialization. Credit card availability is also supposed to be one of the causes for overspending (Joji & Raveendran, 2008; Joireman, Kees & Sprott, 2010) working women, being the earning entity can get the facility of credit cards that provide them access to more purchasing power. The current growth in retail malls and other amenities of online buying work as a fuel in the fire for the rising tendency to buy. Shopping which conventionally was considered as a trail of moral and mystical decay (Hirschman, 1992) is now regarded as a symbol of social vanity.

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[15] However, there is not any single study analyzing proposed questions in this study empirically. Previous studies basically mostly presenting related theoretical concepts and those with empirical analysis are basically examining some other similar ideas using micro-level survey data for particular region. This study examines widely the whole concept using macro-level data with accurate econometric techniques and concluding general results.

Phipps and Burton (1998) concluded that Male and female earnings do not always exert the same influences on household consumption expenditures. They found that husbands and wives are each more possible to use their own earnings for the things of private consumption (taking clothing, for example, is a private household consumption category) and that expenditures on household public goods reflect gendered spheres of responsibility (assuming children education expenses, for example, is a public household consumption category). Manchanda (2010) found that there is a major dissimilarity in the compulsive buying tendencies of working and non-working women. The study indicated that nonworking women are less compulsive buyers than working women while the level of socialization might be one of the factors for the equivalent. In another study (Manchanda 2015) the author talk about the question of whether the young generation is actually moving towards covetousness and compulsive buying inclinations?

Svaleryd (2009) did an empirical analysis on women representation and public spending and found the gender as a significant determinant of public spending. According to the results women's representation affects spending on childcare, education and elderly care. Schmeer (2005) investigated how married women use their access to and manage over economic resources to raise household spending on food. The study, using data from Cebu, Philippines, found that the household with more women earning spends more on food. The study also indicated that the women's control over their income is mainly important for expanding food expenses in the poorest households. While in richer households, women who make little of their own earnings also use husband income transfers to expend food expenditures.

Foster and Mammen (1992) indicated that wife's employment status was significantly explained expenditure on food away from home, on child care and on total services only. Conversely, to what may be expected, only families of part-time working wives increased expenses on food away from home comparative to families of full-time homemakers. Hopkins, Levin, and Haddada (1994) used a gender-disaggregated cyclic consumption model to explore whether the flow of income or the gender of an income earner or both, manipulates household spending patterns at a given level of household income? The study found that for the total household expenditures, the gender of the income earner matters, given that the annual income is not pooled and together the flow of overall income and the flow of gender-specific income are significant determinants of household consumption expenditures.

Household production variables have a significant impact on service expenses (Soberon and Dardis, 1991). The study examined the factors influencing household spending for services in the United States and found a significant difference between the families with full-time and part-time working wives in expenses on child care, on food away from home, and on total services. Fisher (2010) empirically estimated

that women are less possible to save in the short term if they are in poor health, whereas poor health does not significantly change the short term saving of men. Ganita and Abdoul (2014) estimated the effect of female income on children expenditures after an increase in income through the National Rural Employment Guarantee Scheme (NREGS) program. The study indicated that female income has a significant increase in the expenditure share of children's clothing and footwear consumption, and this positive urge happens on account of a major increase in the expense share for boys. Male income, from the program, on the other hand, has no impact on children expenditure for the considered categories. Zamora (2011) checked the Causal effect of female labor contribution on household consumption expenditures and found that female labor contribution causes an increase in the consumption expenditure of several commodities based on visible household characteristics. Female labor contribution also causes changes in consumption expenditures that are unobservable for us but are pragmatic and considered by the household at the time when it decides whether the women participate.

The above-mentioned literature has investigated a number of direct and indirect effects of the working women spending behavior on household consumption expenditures and has found a lot of positive impacts in this regard. This paper adds to the aforementioned literature by exploring another effect of working women buying behavior on per capita consumption expenditure. Specifically, we analyze different age group buying attitude and their effects on expenditure. This study, as a result, fills some gaps in our understanding of the relation between working women and consumption expenditures.

3. Methodology

On the basis of previous literature and following the life cycle/ permanent income hypothesis, we employ the permanent consumption model. The model says that consumption is a function of Permanent Income[16] is

$$C = f(I, Z) \tag{1}$$

Here 'C' represents real per capita Aggregate consumption, 'I' is the real per capita Income and 'Z' is the vector of other factors affecting Aggregate consumption. However, as in this research we are interested to find how women work participation affect aggregate consumption, our interest variable that is working women is a binding factor in consumption decision. Thus to take in factor into account, we used the following regression

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[16] Though many other factors affect consumption, income is the most important by far.

$$C = a_0 + \beta_i\,I + \beta_{ww}\,WW + \beta_z\,Z + \mu \qquad (2)$$

where '*WW*' represents the total number of working women. To measure the effect of change in total number of working women on consumption, we formulate a model using difference of the main variables as if we include them in level form, the results will only show their relationship in level. So, it is necessary to include difference of each real variable (real per capita consumption, real per capita income and total number of working women). We will include log difference of the variables to allow the direct estimation of consumption elasticities. Moreover, we also include the other determinents of aggregate consumption[17]. Therefore, the full regression specification will be:

$$\Delta\ln C_{it} = a_0 + \beta_i\,\Delta\ln I_{it} + \beta_{ww}\,\Delta\ln WW_{it} + \beta_{fr}\,\Delta FR_{it} + \beta_{cpi}\,\Delta CPI_{it} +$$
$$+ \beta_{ppp}\,\Delta PPP_{it} + \mu \qquad (3)$$

Now further we can also include alienated categories of young, middle and old working women in equation.

$$\Delta\ln C_{it} = a_0 + \beta_i\,\Delta\ln I_{it} + \beta_{ww}\,\Delta\ln WW_{it} + \beta_{fr}\,\Delta FR_{it} + \beta_{cpi}\,\Delta CPI_{it} +$$
$$+ \beta_{ppp}\,\Delta PPP_{it} + \beta_{yww}\,\Delta\ln YWW_{it} + \beta_{mww}\,\Delta\ln MWW_{it} + \beta_{oww}\,\Delta\ln OWW_{it} + \mu \qquad (4)$$

where C_{it} is the real annual aggregate consumption of country i at time t; I_{it} is the real annual income of country i at time t; WW_{it} is the total number of working women of country i at time t; FR_{it} is the fertility rate of country i at time t;CPI_{it} is the annual consumer price index of country i at time t; PPP_{it} is the purchasing power parity from country i at time t; YWW_{it} is the total number of young working women of country i at time t; MWW_{it} is the total number of middle working women of country i at time t; OWW_{it} is the total number of old working women of country i at time. Now the impact of a one unit change in number of working women is calculated as:

$$dC\frac{1}{C} = dWW\left[\beta_{ww}\frac{1}{WW}\right]$$

By re-arranging the equation

$$\Rightarrow \frac{dC}{dWW} = \frac{\bar{C}}{\overline{WW}}[\beta_{ww}]$$

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[17] On basis of literature, we include only those variables which may cause change in per capita consumption. These include income, population (measuring through fertility rate), inflation (measuring by consumer price index) and purchasing power parity. Although there is large number of literature considered wealth as a necessary determinant of consumption. Due to unavailability of data we skip this variable in our model.

where bar on a variable indicates its sample mean. As the change in consumption due to change in number of working women is referred working women effect so this analogous derivative will be the working women effect (WWE) is $\frac{dC}{dWW}$, therefore working women effect can be estimated by:

$$\text{WWE} = \frac{\bar{C}}{\overline{WW}} [\beta_{ww}]$$

Now to estimate the consumption elasticity of working women above equation becomes:

$$\varepsilon_{ww} = \frac{dC}{dWW} \div \frac{\overline{WW}}{\bar{C}} = \beta_{ww} \qquad (5)$$

So by estimating the value of β_{ww} in above equation (4), we will calculate the consumption elasticity of working women. Similarly, the coefficient of young working women, middle working women and old working women variable represent their consumption elasticities.

$$\varepsilon_{yww} = \frac{dC}{dYWW} \div \frac{\overline{YWW}}{\bar{C}} = \beta_{yww} \qquad (6)$$

$$\varepsilon_{mww} = \frac{dC}{dMWW} \div \frac{\overline{MWW}}{\bar{C}} = \beta_{mww} \qquad (7)$$

$$\varepsilon_{oww} = \frac{dC}{dMWW} \div \frac{\overline{MWW}}{\bar{C}} = \beta_{oww} \qquad (8)$$

Cross-sectional dependence is an important issue in panel data econometrics. It will be wide of the mark to assume in order to errors are cross-sectionally not dependent and slopes are homogeneous. Due to the appearance of micro panel data in which both the cross-section (N) and the time series (T) dimensions are large, it is necessary to test for cross-sectional dependence. Cross-correlated errors may be grounded by numerous issues, for instance omitted frequent effects, connections contained by socioeconomic systems, and spatial possessions (Chudik and Pesaran 2013).

Ignoring cross-sectional dependence can cause inadvertent outcomes. Firstly, conventional unit root tests have considerable size deformations if the errors are cross-sectionally dependent (O'Connell 1998). Secondly, overlooking cross-sectional dependence by using fixed or random effect methodologies is likely to create incompatible and biased predictors (Sarafidis and Robertson 2009). The cross-sectional dependence of errors is tested by using the CD test given by Pesaran (2004)[18]. The CD test is used at the time when cross-sectional aspect is larger

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[18] Pesaran (2004) has proposed two approaches to test for cross section dependence by using the pair-wise correlation coefficients of residuals in the regression equations. In Monte Carlo experiments it

than the time characteristic in the panel (N > T). This check is robust to structural breaks, as well as non-normality of the errors. But, it might be inconsistent if the cross-sectional dimension is lesser than the time characteristic in the panel (N < T). The bias-adjusted LM test given by Pesaran and Yamagata (2008) explains the inconsistency problem. In this revision, though panel data is used with more number of cross-sections than years (T > N), we formulate use of both tests to make sure whether cross-sectional dependence presents in our data. The CD test statistic is intended as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}} F \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \rho_{ij} \right) \sim N(0,1), i, j = 1, 2, 3, \ldots, N \qquad (9)$$

the bias-adjusted description of the CD test is

$$LM = \sqrt{\frac{2T}{N(N-1)}} F \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \rho_{ij} \right) \frac{(T-k)\rho_{ij}^2 - E(T-k)\rho_{ij}^2}{Var(T-k)\rho_{ij}^2} \qquad (10)$$

in which $\hat{r}_{ij}$ is the model estimation of the pair wise correlation of residuals taken by ordinary least square (Hernández-Salmarón and Romero-Ávila 2015).

As the results on above test indicated cross-sectional dependence in the series, subsequently we employed the CIPS panel unit root test (Pesaran 2007)[19], which is robust toward cross-sectional dependence. The CIPS panel unit root test uses the subsequent augmented Dickey–Fuller regression to compute the cross-sectionally augmented ADF statistic (CADF).

$$\Delta y_{i,t} = a_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + \varepsilon_{it} \qquad (11)$$

where $\bar{y}_{t-1} = \frac{1}{N} \sum_{i=1}^{N} y_i$, $\Delta y_t = \frac{1}{N} \sum_{i=1}^{N} \Delta y_{i,t}$ and ε_{it} is the error term. Then, using the CADF statistic computed above, the CIPS statistic is resulting as shown in Equation

$$CIPS = \frac{1}{N} \sum_{i=1}^{N} CADF_i \qquad (12)$$

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comes out that the CD test has the right size for any combinations of N and T while the LM test goes with T large relative to N.

[19] Pesaran (2007) proposed an alternative unit root test where the ordinary augmented Dickey–Fuller regressions are improved with the cross-section averages of the lagged levels and first-differences of individual series.

Furthermore, the Dumitrescu–Hurlin test is used to check the existence of panel causality. The test entails the following model:

$$y_{i,t} = \alpha_i + \sum_{i=k}^{K} \beta_i \, y_{i,t-k} + \sum_{i=k}^{K} \gamma_i \, x_{i,t-k} + \varepsilon_{i,t} \qquad (13)$$

in which $y_{i,t}$ and $x_{i,t}$ are the interest variables, k is the lag order, α_i is the constant, and $\varepsilon_{i,t}$ is the error term. The Dumitrescu–Hurlin panel causality test supposes the nonexistence of causality for all the individual variable in the panel and describes the null hypothesis as follows:

$$H_0 = \gamma_{i1} = \gamma_{i2} = ... = \gamma_{ik} = 0, \ \forall_i = 1, 2, ..., N \qquad (14)$$

The other hypothesis states that there is as a minimum one Granger causal relationship in the panel:

$$H_0 = \gamma_{i1} = \gamma_{i2} = ... = \gamma_{ik} = 0, \ \forall_i = 1, 2, ..., N_1 \qquad (15)$$

$$\gamma_{i1} \neq 0 \text{ or } \gamma_{i2} \neq 0 \text{ or } \gamma_{ik} = 0, \ \forall_i = N_1 + 1, 2, ..., N$$

in which $N_1 \in [0, N{-}1]$. The Dumitrescu–Hurlin test creates the Wald statistic (W) to test the null hypothesis and then calculates the W statistic by taking the average of N individual Wald statistics.

$$\overline{W} = \frac{1}{N} \sum_{1}^{N} W_i \qquad (16)$$

And assuming that the Wald statistics are independently and identically distributed by crosswise individuals, the consistent Z and $\widetilde{Z}$ Wald statistics can be computed as follows:

$$\overline{Z} = \sqrt{\frac{N}{2K}} (\overline{W} - K) \qquad (17)$$

$$\widetilde{Z} = \sqrt{\frac{N}{2K} \left(\frac{T-3K-5}{T-2K-3}\right) \left(\frac{T-3K-3}{T-3K-1}\right)} (\overline{W} - K) \qquad (18)$$

in which T is the number of times, N is the number of cross sections, and K is the number of lags. If the computed $\overline{Z}$ and $\widetilde{Z}$ Wald statistics are larger than the critical values, then the null hypothesis is rejected, representing causality between series.

In next section the above equations are estimated using different econometric techniques. And results are shown at the end.

4. Empirical data and analysis

The selected variables for the study are household actual per capita final consumption expenditures (as consumption), total number of employed women (as a proxy working women), net actual per capita national disposable income (as income), consumer price index (as an alternative for inflation), per capita gross domestic product, purchasing power parity, men unemployment rate, and fertility rate. Below, we give an explanation of our measures for variable assortment and also source/ explanation/structure of the data by evaluating our construction and that of analogous studies.

4.1. Data and variables

We choose countries on basis of some criteria, be going to pick up the variety of the data all the way through the size, arrangement, and regional dissimilarity of the countries as in the existing similar literature (i.e., see Slacalek, 2009). On basis of data availability and modeling constraints, it is decided to use the annual panel data of 36 advanced countries including moderately small advanced economies, such as New Zealand, Finland, Czech Republic, New Zealand, and Sweden as well as large countries, such as Italy, Australia, France, the UK, Japan, Canada, and the US, from the year 2000 to 2016[20]. Also, the research focuses on the number of working women which in a way presenting female labor force participation. That is relatively higher in OECD's countries than the other developing and non-developed nations. Therefore, it was evenhanded to go with the given sample for this research. The precise descriptions of all variables are given below.

4.1.1. Dependent variable

Household final per capita consumption expenditure

Studied like Mccarthy and Kilic (2015) and Hossain et al (2015) used household per capita final consumption, collect by world bank indicators, as consumption expenditures. Household per capita final consumption expenditure (per capita private consumption) is calculated by using private consumption in constant 2010 prices and World Bank population approximates.

Household per capita final consumption spending is the market value of all goods and services, together with durable products (such as home appliances, cars, and home computers), purchased by family units. It excludes purchases of private housing but includes imputed rent for the owner has taken dwellings.

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[20] All the data for 36 OECD countries from the year 2000 to 2016 is obtained from OECD Statistics and World Bank Indicators.

It also includes payments and fees to governments to attain permits and licenses. Moreover, household consumption expenditure includes the spending of nonprofit institutions helping households, even while reported independently by the country. Data are at constant 2010 U.S. dollars.

4.1.2. Independent variable

Number of working women

The labor force data on employment by sex and by standard age groups (15-34, 35-54, 55+, total) is used as a number of working women.[21] The data is collected for full-time employed women. While the women in part-time employment, involuntary part-time employment or economic short-time works are not classified as fully employed workers. On average the persons whose usual working hours for all jobs are totally less than 35 to 40 hours per week are considered as part-time workers. Whereas, unpaid family workers who are working less than 15 hours per week, are not classified as employed. Population figures reported in labor force statistics (LFS) employment data by sex are Census-based, while the data tables are taken from labor force surveys.

Based on previous literature (i.e. Dreger and Reimers 2012; Desta 2014 and Biyun 2014) we used other explanatory variables including Per capita income, Fertility rate, Consumer price index, Male unemployment rate and Purchasing power parity in regression analysis**.** The details are as follows.

4.1.3. Other explanatory variables

In the research we use other explanatory variables as follows: per capita income, fertility rate, consumer price index, men unemployment rate, and purchasing power parity. More detailed explanation is presented below:

Per capita income

Net national income is calculated by GNI minus consumption of fixed capital. It also excludes natural resources depletion. Datta and Meerman (1980) using U.S. data in comparison to Malaysian distribution found per capita income as a better measure of welfare analysis than household income. Thus, we used per capita income data estimated at constant 2010 U.S. dollars and World Bank population approximates.

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[21] Total employed women are considered here as total number of working women. Including total number of employed women, data is also separately collected for three categories based on age groups such as young, middle, and old those are divided as in ages 15-34, 35-54, and 55+ respectively.

Fertility rate

Asumadu-Sarkodie, Owusu, and Zhang (2016) found bidirectional causality between household per capita final consumption expenditure and fertility rate. Total fertility rate stands for the number of children that born to a woman if she were to live to the end of her childbearing years and put up with children in respect to age-specific fertility rates of the specified year. Data is taken from OECD statistics.

Consumer price index (Inflation)

Inflation is measured by the consumer price index, which gives an idea about the annual percentage change in the charge of acquiring a container of goods and services (that perhaps predetermined or distorted at specified periods) to the standard consumer.

Inoue, Kilian and Kiraz (2009) explain that the reaction to inflation news cause an increase in households' education level, dependable with the continuation of constraints on household's capability to route this information. Thus leads a change in consumer decision making. Whereas, when the expected inflation rate could not be observed, the real consumption would be only affected by the judgment error of unobservable price increase (Han and Hung 2006).

Male unemployment rate

Unemployment considerably affects short term consumer spending decisions. Koç (2015) explains how these short term changes make a considerable impact on aggregate consumption expenditures. Unemployment refers to the share of the labor force that is devoid of work but available for and looking for employment. Definitions of labor force and unemployment differ by country. The data on unemployment of OECD countries is collected from Labor Force Statistics (LFS).

Purchasing power parity

According to Asian Development Bank report (2015), the PPPs are collected by major economic aggregates which measure the real per capita actual final consumption expenditure. PPPs are the rates of currency exchange that make equal the purchasing power of different currencies by eliminating the disparities in price levels between countries. In their simplest form, PPPs are basically price relatives that show the proportion of the prices in national currencies of the identical good or service in different countries. PPPs are also calculated for manufactured goods groups and for each of the different levels of aggregation up to and counting GDP.

Once dividing the household aggregate consumption and income data by the interpolated total population data, we obtain the data for consumption and income

per capita variables, respectively. We deflated all nominal data apart from interest rates by the CPI and take the natural logarithm of all variables to build a log-log model, which let us to compute elasticities. Table 1 gives you an idea about the descriptive statistics.

Table 1: Summary statistics

Variables	(1)	(2)	(3)	(4)	(5)
	N	Mean	SD	Min	Max
Consumption	612	18998.38	9302.303	4177.261	41578.88
Income	612	29103.02	16311.59	4803.995	82707.57
working women	612	6560.497	11732.26	71	70869
Young working women	612	2314.614	4102.407	28	24834
Middle working women	612	3171.031	5450.889	33	31989
Old working women	612	1074.866	2301.465	3	16082
Men unemployment rate	612	7.6	4.169989	1.3	25.6
Fertility rate	612	1.679329	0.377544	1.076	3.11
Consumer price index	612	2.754538	4.19018	-4.478103	54.91537
Purchasing power parity	612	44.70203	147.226	0.28	893.5

Note: Consumption and income are stated in real, per capita terms. Data belongs to 36 OECD countries for the year 2000-2016.

Source: OECD statistics. https://stats.oecd.org/

4.2. Diagnostic tests

The empirical estimation includes different diagnostic tests for a more accurate estimation results. After data mining, several compulsory diagnostics were done to choose the appropriate estimation technique. Among them more important tests are on hand in this section. Before starting the mathematical calculation, a brief graphical explanation is presented below.

Figure 1 shows the change in the number of working women in OECD countries from the year 2000 to 2016[22]. The graph illustrates an obvious increase in number of working women throughout all the years. There is a diminutive drop off in the year 2007-08 but then it starts increasing gradually.

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[22] Data Source; OECD statistics. https://stats.oecd.org/

Figure 1: Total number of working women

Figure 1 representing the trends in total number of working women (in thousands) in all OECD countries for the year 2000-2016.

Figure 2 represents the trends in per capita household consumption in 36 OECD countries from the year 2000 to 2016.

Figure 2: Aggregate household per capita consumption
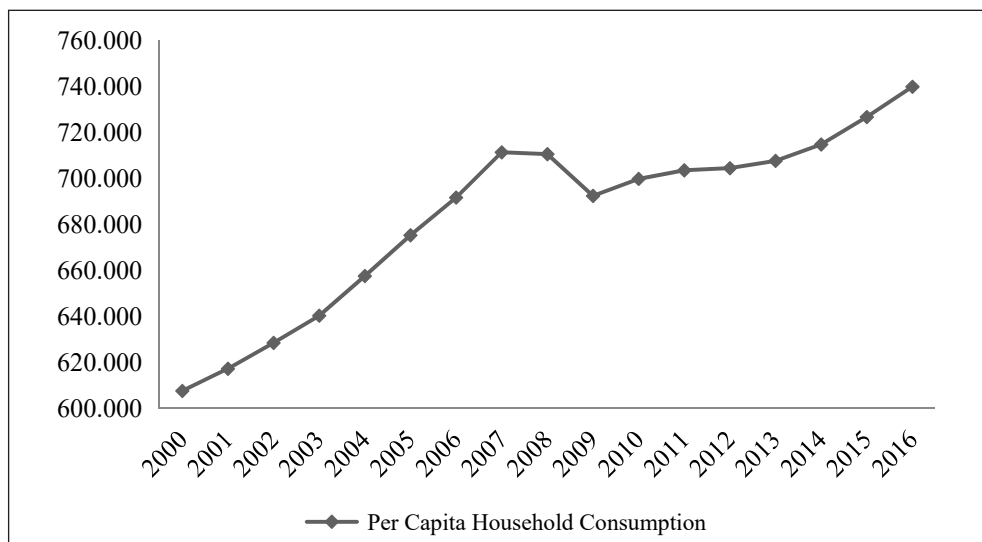
It can be seen clearly that per capita household consumption increase from the year 2000 to 2007-2008, and then after a small decrease it start increasing from the year 2009 to 2016. Overall, the series also shows an increasing trend throughout the time.

Figure 2 representing the trends in aggregate household per capita consumption (in millions) in all OECD countries for the year 2000-2016.

In OECD countries, both the number of working women and per capita household consumption expenditures (shown in the figure 1 and 2) explain the similar increasing trend in the given time period 2000-2016. Figure 3 represents the trends in per capita household consumption expenditures and the number of working women in 36 OECD countries within the period 2000-2016[23].

Figure 3: Household per capita consumption expenditures and number of working women
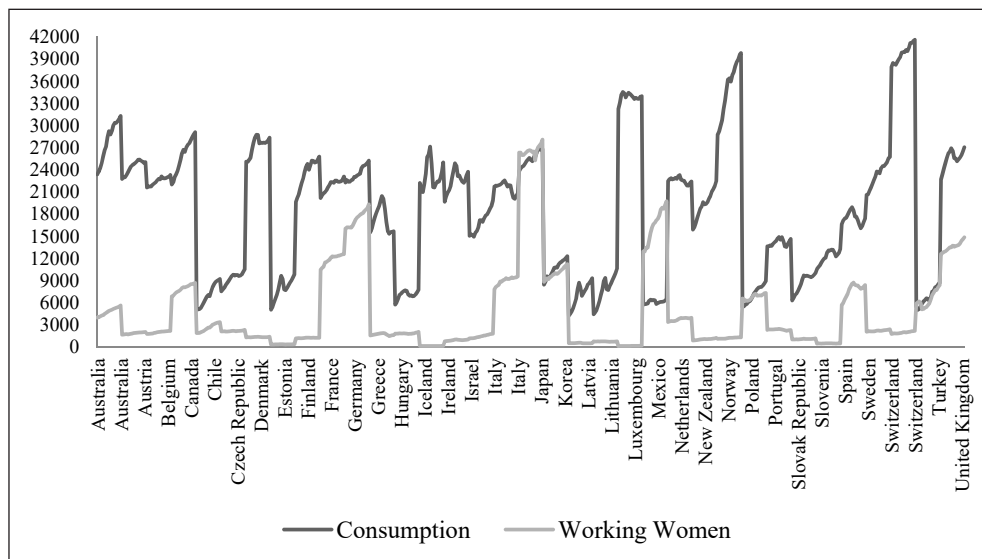
Figure 3 representing the trends in household per capita consumption expenditures (in millions) and number of working women (in thousands) in 35 OECD countries for the year 2000-2016.

It presents an increasing trend in both series across the panel of the individual country. Apparently, it can be observed that per capita consumption is moving along with the number of working women trend within the individual country for the respective 17 years. Since consumption expenditures are the most important and

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[23] Data Source; OECD statistics. https://stats.oecd.org/

effective component of economic growth and as working women buying behavior is the determining factor of consumption expenditures, it is important to investigate how this factor can influence the level of per capita consumption.

4.2.1. Cross-sectional dependence tests

Table 2 shows the outcomes of the CD test and bias-adjusted LM test. Consequently, the null hypothesis of no cross-sectional dependence is rejected[24], which points out that we ought to employ methods that are robust to cross-sectional dependence to evade inconsistent and biased outcomes.

Table 2: Cross-sectional dependence test results

	Value
CD Test	2.57 *
Bias Adjusted LM Test	0.4418

Note: *, **, *** indicate that statistics are significant at the 10%, 5%, and 1% level of significance, respectively. The null hypothesis is no cross-sectional dependence.

4.2.2. Unit Root and Cointegration Tests

Table 3 illustrates the results of the CIPS unit root test. As the null hypothesis of a unit root possibly cannot be rejected, we bring to a close that all the variables are non-stationary in levels. Alternatively all variables are of level stationary with order I (1).

Table 3: CIPS Unit Root Test Results

	CIPS	
	Intercept	Intercept Trend
Consumption	-1.926	-2.479
Income	-1.843	-2.433
Working Women	-1.462	-1.678
Fertility Rate	-1.625	-2.469
CPI	-2.905	-2.962
PPP	-1.489	-1.628

Note: *, **, *** indicate that statistics are significant at the 10%, 5%, and 1% level of significance, respectively. For the CIPS test the null hypothesis is nonstationary.

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[24] On the basis of data (used in this research) properties as CD test justifies more to our estimations, so the results of CD test are only interpreted are here.

As the all the variables are I (1), consequently we need to investigate whether the variables are cointegrated. It will enable us to use non-stationary series in levels exclusive of creating a spurious association if a linear arrangement of them is integrated in the midst of order zero (Atasoy 2017). Consequently, we make use of the second-generation Durbin–Hausman test developed by Westerlund (2008), which obtains cross-sectional dependence into account. The test creates two test statistics. The panel test (DHp) presumes that the autoregressive constraint is similar for all the sections. In results, rejection of the null hypothesis involves cointegration for all the cross-sections. The group test (DHg) allows the autoregressive parameter to be different across cross-sections. In a similar way to the DHg, if the null hypothesis is rejected, one brings to a close that cointegration exists.

Table 4: Durbin-Hausman cointegration test results

	Value
DHg	-1.74***
DHp	-4.25**

Note: *, **, *** indicate that statistics are significant at the 10%, 5%, and 1% level of significance, respectively. The null hypothesis is no cointegration.

The results of the Durbin–Hausman test are shown in Table 4. Given that both the DHg and the DHp test refuse the null hypothesis of no cointegration, we finish off with hat the variables are cointegrated. In other words, the outcomes suggest that consumption has a long-term relation with income and number of working women.

4.2.3. Causality check

In addition to our conclusion from above test, we used the Granger causality test set up by Dumitrescu and Hurlin (2012)[25], which is robust to cross-sectional dependence and constraint heterogeneity. The test entails running Granger non-causality tests for all cross-sections individually.

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[25] Dumitrescu and Hurlin (2012) proposed a simple test of Granger (1969) non-causality for panel data estimations. The test statistic is based on the individual Wald statistics of non-causality across all the cross-sections. In Monte Carlo experiments, the test statistics have very good small sample properties, and also can be used in the presence of cross-sectional dependence.

Table 9: Dumitrescu-Hurlin panel causality test results

Direction of Causality	Z_bar	Z_bar_tilde	Result
Income → Consumption Consumption → Income	9.2079*** 7.3845 ***	6.1822 *** 4.8460 ***	Bidirectional Causality
Working Women → Consumption Consumption → Working Women	5.4083 *** 9.6230 ***	3.3979 *** 6.4864 ***	Bidirectional Causality
Men Unemployment rate → Consumption Consumption → Men Unemployment rate	5.3195 *** 5.1379 ***	3.3328 *** 3.1997 ***	Bidirectional Causality
Fertility rate → Consumption Consumption → Fertility rate	12.9122 *** 24.6502 ***	8.8967 *** 17.4982***	Bidirectional Causality
CPI → Consumption Consumption → CPI	17.3294 *** 4.6614 ***	12.1336 *** 2.8506 ***	Bidirectional Causality
Working Women → Income Income → Working Women	16.4488 *** 29.3516 ***	11.4882 *** 20.9433 ***	Bidirectional Causality
Men Unemployment rate → Income Income → Men Unemployment rate	7.8613 *** 7.8137 ***	5.1954 *** 5.1605 ***	Bidirectional Causality
Fertility rate → Income Income → Fertility rate	13.2222 *** 15.4689 ***	9.1238 *** 10.7702 ***	Bidirectional Causality
CPI → Income Income → CPI	16.1136 *** 2.3986 **	11.2427 *** 1.1924	Unidirectional Causality from CPI to Income
Men Unemployment rate → Working Women Working Women → Men Unemployment rate	7.3845 *** 9.2079 ***	4.8460 ** 6.1822 ***	Bidirectional Causality
Fertility rate → Working Women Working Women → Fertility rate	7.3845 *** 9.2079 ***	4.8460 ** 6.1822 ***	Bidirectional Causality
CPI → Working Women Working Women → CPI	7.3845 *** 9.2079 ***	4.8460 ** 6.1822 ***	Bidirectional Causality
Fertility rate → Men Unemployment rate Men Unemployment rate → Fertility rate	15.7111 *** 16.7914 ***	10.9477 *** 11.7393 ***	Bidirectional Causality
CPI → Men Unemployment rate Men Unemployment rate → CPI	13.9992*** 6.5468 ***	9.6932 *** 4.2321 ***	Bidirectional Causality
PPP → Men Unemployment rate Men Unemployment rate → PPP	7.3845 *** 9.2079 ***	4.8460 ** 6.1822 ***	Bidirectional Causality
CPI → Fertility rate Fertility rate → CPI	1.0435 3.0005 **	0.1994 1.6334	Unidirectional Causality from CPI to Income

Note: ***, **, * denote the statistical significance at 99% level, 95% level, and 90% level, respectively. Lag orders have been selected according to the Akaike Information Criteria.

In view of that, table 9 suggests the existence of bidirectional causality between the pairs of consumption–income and consumption–working women. The results also show bidirectional causalities between all other variables except income-CPI and

fertility rate-CPI. The results suggest unidirectional causalities from income to CPI and from CPI to fertility rate.

4.2.4. Other diagnosis

Furthermore, heteroscedasticity has been also detected in our sample. Whereas, there is significant multicolinearity has been found in correlation matrix. In the presence of all these issues of cross-sectional dependence and heteroscedasticity, there is a need to estimate regressions with robust standard errors. Previous literature shows that consumption can be endogenous in several models (Campbell and Cocco 2007). To deal with this problem the models are then estimated using instrumental variable techniques; two-stage least-squares (2SLS) and generalized method of moments (GMM) with Driscoll and Kraay (1998) and cluster standard errors. Consumption and income are estimated through some instrument variables that affect these variables as well independent variable simultaneously. Instrumental variables include previous per capita consumption expenditures, previous per capita income, male unemployment rate, inflation, and previous per capita GDP. The use of a fixed or random effect model is then decided with Hausman test after fitting the auxiliary regression proposed by Wooldridge (2002) with cluster (IID) and Driscoll and Kraay standard errors[26]. This method is robust to the general form of cross-sectional dependence and heteroscedasticity. The insignificant test statistic for each model shows the presence of fixed effects. On the basis of these entire tests, hence it is decided that fixed effect models with two-stage least-squares (2SLS) and generalized method of moments (GMM) methodologies with Driscoll and Kraay (1998) and cluster standard errors are estimated.

4.2.5. GMM and 2SLS estimations

The results of the 2SLS and GMM estimations for the whole panel are depicted in Table 5 and Table 6. The first column in both tables exhibits the results of the baseline specification, whereas the second, third and fourth columns present the results of the different age group specifications. As expected, income is the largest component of household aggregate final consumption, with a coefficient value of around 0.53–0.60 in three specifications (Table 5). This implies that a 1 percent increase in the net real per capita national disposable income (income) causes a 0.53–0.60 percent increase in household real per capita final consumption expenditure (consumption). The number of working women has an elasticity of around 0.16 in all specifications. This outcome implies that the number of working women and consumption are positively correlated and that a 1 percent increase in

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[26] Driscoll and Kraay's methodology estimates the errors in this way that the covariance matrix estimator is consistent and independent of the cross-sectional dimension N.

the number of working women causes a 0.16 percent increase in consumption. Thus number of working women has a significant effect on consumption expendituresi.e. the higher the number of working women, the greater increase per capita household consumption expenditures.

Table 5: GMM Instrumental Variable Regression Estimation Results

	Model 1	Model 2	Model 3	Model 4
Income	0.5862*** (0.0248)	0. 6084 *** (0.0287)	0. 5697*** (0.0237)	0.5376*** (0.0127)
Fertility Rate	0.0332*** (0.0071)	0.0922 (0. 0075)	0.0106*** (0. 0119)	-0.0504*** (0.0149)
CPI	-0.0027*** (0.0005)	-0.0019*** (0.0002)	-0.0051*** (0.0011)	0.0018*** (0.0004)
PPP	-0.0006*** (0.0000)	-0.0006*** (0.0000)	-0.0006*** (0.0000)	-0.0006*** (0.0000)
Working Women	0..1632*** (0.0784)			
Young Working Women		0.1440*** (0.0703)		
Middle Working Women			0.2266*** (0.0944)	
Old Working Women				0.0726*** (0.0582)
Observations	611	611	611	611
Centered/ Uncenterd R^2	0.5699	0. 6080	0. 4270	0.6950
Residual SS	12.6169	11.5000	16.8086	8.9468

Note: Here consumption is the dependent variable which is the log difference of real annual household per capita consumption, Income variable is the log differences of real, per capita annual income, fertility rate variables is the differences of annual fertility rate , CPI is the difference of annual CPI, PPP is the difference of annual PPP, Young working women represents the working women with the ages between 15 to 34 years old, Middle working women represents the working women with the ages between 35 to 54 years old, Old working women represents the working women with the ages between 54+ years old. Standard errors are given in the parentheses below the corresponding estimates. Centered/ Uncentered R-squares are given at the end.

∗Coefficient significant at the 10% level.; ∗∗Coefficient significant at the 5% level.; ∗∗∗Coefficient significant at the 1% level.

However, the evidence for the whole panel also suggests counter-intuitive results. In this respect, Young, middle and old working women all have a positive significant relationship with consumption with the coefficient of 0.14, 0.22 and 0.07 respectively. This outcome implies that the number of young working women and consumption are positively correlated and that a 1 percent increase in the number of young working women causes a 0.14 percent increase in consumption. While for

middle and old age women a 1 percent increase in the number of young working women causes a 0.22 and 0.07 percent increase in consumption respectively. Thus the results show that age of working women does matter on their spending decision and eventually to overall consumption expenditures.

The results of 2SLS regression are presented in table 6 which are not much different the above presented GMM regression. As like the above one, the results of 2SLS regression (Table 6) estimation also show income coefficient value of around 0.53–0.60 in three specifications. This implies that a 1 percent increase in the net real per capita national disposable income (income) causes a 0.53–0.60 percent increase in household real per capita final consumption expenditures (consumption).

Table 6: 2SLS Instrumental Variable Regression Estimation Results

	Model 1	Model 2	Model 3	Model 4
Income	0.5766*** (0.0259)	0. 6025 *** (0.0291)	0. 5590*** (0.0252)	0.5314*** (0.0135)
Fertility Rate	0.0350*** (0.0072)	0.0939 (0.0076)	0.0149*** (0.0124)	-0.0470*** (0.0151)
CPI	-0.0031*** (0.0006)	-0.0021*** (0.0003)	-0.0061*** (0.0013)	0.0018*** (0.0004)
PPP	-0.0006*** (0.0000)	-0.0006*** (0.0000)	-0.0006*** (0.0000)	-0.0006*** (0.0000)
Working Women	0..1403*** (0.0804)			
Young Working Women		0.1240 *** (0.0721)		
Middle Working Women			0.2093*** (0.0954)	
Old Working Women				0.0449*** (0.0619)
Observations	611	611	611	611
Centered/ Uncenterd R^2	0.6191	0. 6494	0. 4704	0.7503
Residual SS	11.1737	10.2860	15.5364	7.3236

Note: Here consumption is the dependent variable which is the log difference of real annual household per capita consumption, Income variable is the log differences of real per capita annual income, fertility rate variables is the differences of annual fertility rate , CPI is the difference of annual CPI, PPP is the difference of annual PPP, Young working women represents the working women with the ages between 15 to 34 years old, Middle working women represents the working women with the ages between 35 to 54 years old, Old working women represents the working women with the ages between 54+ years old. Standard errors are given in the parentheses below the corresponding estimates. Centered/ Uncentered R-squares are given at the end.

* Coefficient significant at the 10% level.; ** Coefficient significant at the 5% level.; *** Coefficient significant at the 1% level.

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Income is the basic determinant of consumption expenditures. A slight change in income affects one's consumption/saving decision. While the other various factors also can contribute with income in interactive way and cause changes in consumption. The number of working women has an elasticity of around 0.14, which is almost similar to the results of table 5, impending with the same theoretically consistent results. Likewise, the other results of 2SLS estimations are nearly the same with GMM estimation. The validity and consistency of these results are later checked for robustness in section 4.2.6.

4.2.6. Robustness check

The above results are then verified through robustness check. If the signs and magnitudes of the estimated coefficients in robustness check are also credible, this can be taken as the confirmation of coefficients consistency in above estimated regression (Lu and White 2014).Hence the regression results coefficient can be reliably interpreted as accurate causal effects of the related independent variables, with all that this may bring about for policy making analysis and economic insight. Table 7 and 8 present the robust result of above GMM and 2SLS estimations. The results in Table 7 are almost similar as in table 5.

Robustness check make sure that how certain core estimated regression coefficients perform when the regression designs are modified in some way, usually by adding or removing variables. These robust command results show the validity of the coefficients in the above estimations. There is no difference in the signs of coefficient while showing a minor difference in their magnitudes. Similarly, the results of robust 2SLS regression in table 8 are similar as above in table 6.

Table 7: Robust GMM Instrumental Variable Regression Estimation Results

	Model 1	Model 2	Model 3	Model 4
Income	0.54621*	0. 6092***	0. 5886***	0.5501***
	(0.0277)	(0.0137)	(0.0237)	(0.0217)
Fertility Rate	0.0332***	0.0873	0.0210***	-0.0503***
	(0.0101)	(0. 0066)	(0. 0315)	(0.02309)
CPI	-0.0030***	-0.0028***	-0.0055***	0.0014***
	(0.0003)	(0.0002)	(0.0021)	(0.0000)
PPP	-0.0003***	-0.0007***	-0.0006***	-0.0006***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Working Women	0..1643***			
	(0.0644)			
Young Working Women		0.2014***		
		(0.621)		
Middle Working Women			0.2732***	
			(0.08401)	
Old Working Women				0.0719***
				(0.0501)
Observations	611	611	611	611
Centered/ Uncenterd R²	0.6372	0. 6550	0. 5738	0.7029
Residual SS	13.8194	11.0083	17.8843	10.5702

Note: Here consumption is the dependent variable which is the log difference of real annual household per capita consumption, Income variable is the log differences of real, per capita annual income, fertility rate variables is the differences of annual fertility rate , CPI is the difference of annual CPI, PPP is the difference of annual PPP, Young working women represents the working women with the ages between 15 to 34 years old, Middle working women represents the working women with the ages between 35 to 54 years old, Old working women represents the working women with the ages between 54+ years old. Standard errors are given in the parentheses below the corresponding estimates. Centered/ Uncentered R-squares are given at the end.

** Coefficient significant at the 10% level.; ** Coefficient significant at the 5% level.; *** Coefficient significant at the 1% level.

Thus the above results regression coefficients can be interpreted as true estimators. Furthermore, the above estimations were also estimated through ordinary least squares. While, the results of basic ordinary least regressions are not presented in the above section. The results of basic regression also show quite similar signs and magnitudes of estimated coefficient. Thus, those results also add in the validity of estimated coefficients in GMM and 2SLS regressions.

Table 8: Robust 2SLS Instrumental Variable Regression Estimation Results

	Model 1	Model 2	Model 3	Model 4
Income	0.4903*** (0.0101)	0. 6122 *** (0.0282)	0. 5352*** (0.0202)	0.5314*** (0.0029)
Fertility Rate	0.0312*** (0.0066)	0.0882 (0.0068)	0.0156*** (0.0119)	-0.0392*** (0.0122)
CPI	-0.0030*** (0.0006)	-0.0028*** (0.0008)	-0.0058*** (0.0011)	0.0017*** (0.0003)
PPP	-0.0006*** (0.0000)	-0.0006*** (0.0000)	-0.0006*** (0.0000)	-0.0006*** (0.0000)
Working Women	0..1392*** (0.0737)			
Young Working Women		0.1137 *** (0.0700)		
Middle Working Women			0.2334*** (0.0873)	
Old Working Women				0.0437*** (0.0583)
Observations	611	611	611	611
Centered/ Uncenterd R^2	0.7249	0. 7330	0. 6258	0.8128
Residual SS	13.2491	11.2979	17.3398	9.8942

Note: Here consumption is the dependent variable which is the log difference of real annual household per capita consumption, Income variable is the log differences of real per capita annual income, fertility rate variables is the differences of annual fertility rate , CPI is the difference of annual CPI, PPP is the difference of annual PPP, Young working women represents the working women with the ages between 15 to 34 years old, Middle working women represents the working women with the ages between 35 to 54 years old, Old working women represents the working women with the ages between 54+ years old. Standard errors are given in the parentheses below the corresponding estimates. Centered/ Uncentered R-squares are given at the end.

* Coefficient significant at the 10% level.; ** Coefficient significant at the 5% level.; *** Coefficient significant at the 1% level.

On the basis of above all empirical results, we further explain the implication and augmentation of the phenomenon discussed in this research in next sections.

5. Results and discussions

The results in above section demonstrate the approval of all of three null hypotheses. Firstly, the statistically significant coefficient estimates in all regressions indicates that the number of working women has a considerable effect on consumption expenditures. Secondly, the positive coefficient estimates explain that the numbers of working women increase per capita household spending and an increase in number of working women will increase per capita

household consumption expenditures. Thirdly, the results clearly show that age of working women does matter on their spending decision and eventually to overall consumption expenditures.

As explained in above sections, working women compulsive buying behavior makes them spend relatively more than men. Except from income effect, there are other reasons making working women particularly to spend larger proportions of their income. These empirical results are consistent with the theoretical framework formed by this study. High number of working women has significantly positive effect on consumption expenditures. Thus, the results can be generalized as the countries with high percentages of working women have a positive effect on their per capita household expenditures, leading a higher economic growth. These finding illustrate the importance of females in jobs, which brings a considerable difference gross domestic product through elevated consumption levels. Age is an important factor considering spending behavior of women. The coefficient obtained for different age groups illustrate better understanding of the impact of female spending on consumption expenditures. A high percentage of middle age women in jobs would boost up economy through high their high spending as compare to young and old age women. Thus, the countries with high proportion of middle age working women have edge on their better level of consumption expenditures. These results provide a very clear understanding for the policy makers of the working women spending behavior phenomenon and the observable fact related to the contribution in economic output.

As, mentioned earlier middle age working women spend more on family expenditures. Their spending may increase due to various reasons, such as increase in income, spending on children and husband, spending on housing etc. Thus, the results showing highest coefficient for middle age women are theoretically and economically significant. While, young age women following middle age women have relatively more compulsive buying behavior to old age women. Generally, women in old age have fewer things to spend on than in young age. Thus, all the results justify the above presented whole theoretical phenomenon of working women spending behavior and their effect on household per capita consumption.

Moreover, CPI and PPP have negative significant on household per capita consumption while fertility rate has significantly positive, relations in three of these specifications. These results are consistent with economic theory. As the level of inflation and purchasing power parities increases, it affects household per capita expenditures negatively. With the decrease in rate of CPI and PPP, people would be able to increase their consumption expenditures. Also, with increasing fertility rate, due to scarce resources, one would have negative effect on personal consumption expenditures. All the coefficients are showing consumption elasticities with respect to the individual variable. This means these coefficients are showing the percentage changes in consumption with respect to their individual variable.

6. Conclusion

In the light of the phenomenon that working women have more compulsive buying propensities, which can lead to a significant increase in their consumption expenditures, the important research question is: How changes in the number of working women affect their consumption pattern within the household and do they have a discernible impact on household per capita consumption expenditure? This research explores the effects of changes in the number of working women on household per capita consumption. The results from two-stage least squares (2SLS) and generalized method of moments (GMM) techniques show that the increase in the number of working women has a significantly positive effect on the household final per capita consumption expenditure. The result also implies that age plays a significant role in working women consumption decision making. As compared to young and old age, middle-aged working women are more responsive to increase in household final per capita consumption expenditure. As well the number of young age working women affect consumption expenditures more than number of old age working women. Hence, middleaged working women add more in aggregate consumption than other age groups. In real term, this result is according to long-term women spending behavior. Though young working women relatively considered as more compulsive buyers, however, due to higher income and family expenditures in middle age, we can say middle age working women are more responsive to an increase in consumption expenditures.

This research supports the alternative hypotheses as it designates that habitual working woman spending behavior leads to add in household per capita consumption expenditures. There are limited numbers of such studies measuring the effect of working women on the economy through consumption channel. The research on macro level indicates broad understanding on women's spending behavior on economy. The findings on the changes in household per capita consumption through a change in the number of working women nexus have imperative policy allegations and ought to be of interest to policymakers, market partakers, and researchers. Particularly for the countries with low women participation in economic activities, this study is constructive for future policy making.

The study gives a better understanding of female psychological spending behavior. Not only has it explained the observable fact empirically but also explained the theoretical aspects of working women purchasing behavior. Further amplification of this research should be a major apprehension at this time. As in the case of many developing economies, women's liberation movement adds much deeper and wider based support. Thus, this research can be further extended to other regions. Moreover, the questions of women spending behavior on household consumption expenditure can be deeply examine using micro level data. Mastering the implications of these key social forces is therefore likely to be crucial for understanding future improvements in consumption patterns and growth.

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Zaposlene žene i izdaci potrošnje kućanstava po glavi stanovnika: neistražena/nedodirnuta stvarnost

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Sažetak

Zaposlene žene sklonije su kompulzivnoj kupovini što može dovesti do značajnog povećanja izdataka za potrošnju kućanstava. U ovom radu istražuje se utjecaj promjene broja zaposlenih žena na potrošnju kućanstva po glavi stanovnika. Testira se hipoteza da promjena u broju zaposlenih žena ima značajan utjecaj na izdatke finalne potrošnje kućanstva per capita, zbog različitih sklonosti potrošnji, a provedena je empirijska analiza temeljena na skupu panel podataka 36 gospodarstava OECD-a u razdoblju 2000. – 2016. Rezultati pokazuju da promjena broja zaposlenih žena povećava rashode kućanstva per capita. Nadalje, rezultati impliciraju da životna dob zaposlenih žena ima vrlo značajnu ulogu u donošenju odluka o potrošnji što može dovesti do značajnih razlika u ukupnim izdacima potrošnje. Ovi rezultati ukazuju na važnost razumijevanja činjenice da promjena broja zaposlenih žena utječe i na planiranje ukupne potrošnje i formuliranje politika gospodarskog rasta.

Ključne riječi: *kupovno ponašanje zaposlenih žena, izdaci za potrošnju kućanstva po stanovniku/ per capita, rast BDP-a, empirijska studija, zemlje OECD-a*

JEL klasifikacija: *D12, D91, J16*

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Long-run price performance of local and dual class IPOs in alternative investment market[*]

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Abstract

Earlier studies document that IPOs are underpriced in the short-run and underperformed in the long-run. In almost all studies, researchers analyze the IPO performance using the dataset from highly liquid markets. However, the pricing behavior of IPOs in the Alternative Investment Market (AIM) is different. There is a reason to expect the price performance of IPOs in the AIM to be significantly different from IPO performance in traditional markets mainly because of the diminished liquidity of AIM offerings as well as the meager disclosures required in comparison to traditional markets. To test our propositions, we select 292 IPOs listed on AIM during the period between 2001 and 2016 and apply the Extreme Bound Analysis (EBA) to determine the factors that cause longer-term performance. This study reports that investors in the alternative markets earn significant positive returns if the stock is held for three years, and the price variation is dependent upon the firm size. This illustrates that investment in small-sized firms seems more profitable as compared to those of large-sized firms in the AIM. Moreover, this study examines statistical evidence bearing on the question of whether early investors in IPOs can expect abnormal excess returns in the long-run.

Key words: *IPOs, long-run price performance, extreme bounds analysis, alternative investment market*

JEL classification: *G12, G14, C1*

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1. Introduction

It is well-established evidence that IPOs are often underperformed in the long-run. Because the spread between the short-run and long-run share prices is almost large which is categorized as underperformance of new issues (Ali, 2017; Fine, Gleason, and Mullen, 2017; Mumtaz, Smith, and Ahmed, 2016). The level of underperformance varies across the nationality of the issuers and exchanges (Mudambi *et al.*, 2012). Ritter, (1991) initially started a long-lasting debate that gave birth to various propositions purporting to explain the long-run underperformance. Researchers suggested that the spread reflects the prospects and opportunities facing the issuers (Loughran & Ritter, 1995). Most of the prior literature is replete with analysis of IPO long-run pricing performance in the main markets; however, limited literature is available to evaluate the long-run pricing performance of IPOs in AIM. This study adds to the existing literature how IPOs behave on alternative markets in a wider horizon.

An important question arises as to how IPOs behave in the long-run issued in AIM as the dynamics of the market are different than the main markets. We can argue that firms don't require any specific financial record, the regulatory framework allows foreign companies to enlist their securities on AIM owing to low regulatory burden, no minimum capital requirements for the size or number of shareholding (Wahid, Mumtaz and Mantell, 2019), and only 22% new issues were listed on the main market whereas 78% of new issues were listed in an alternative market during the past two decades (Wahid, Mumtaz and Mantell, 2020). Due to higher trading activities in AIM, optimistic investors may participate in the offering, thus, the value of IPO exhibits uncertainty regarding the existence of variation for optimistic and pessimistic investors (Miguel and Francisco, 2016). The flow of information in the long-run diverges the expectations of investors and corrects the price movements. With all these justifications, the purpose of this study is to examine how local and dual IPOs behave in the long-run.

This study aims to examine the research questions: (i) how can one characterize the long-run price performance of IPOs issued in the AIM? (ii) how does the divergence of opinion influence long-run performance? (iii) do market conditions affect the pricing dynamics? (iv) are the price dynamics of IPOs influenced by the size and price of the issue? and (v) what are the robust predictors that influence the long-run performance of unseasoned issues? This study reports that investors in the alternative markets earn significant positive returns if the stock is held for three years, and the price variation is dependent upon the firm size. In long-run board independence also plays a significant role. The findings of the study have also practical value for those investors who are especially interested in earning abnormal excess returns in an alternative market.

The rest of the paper is structured as follows. Section 2 elaborates the literary review focuses on the theoretical discourse on long-run IPOs returns and operating

dynamics of AIM. Section 3 explains the econometric model. Section 4 describes the data, sample size and findings of the study. Section 5 discusses the findings and Section 6 concludes the study.

2. Literature review

This section reviews the underpinning theories that are important to describe the long-run price performance of the new issues. Long-run behavior indicates that IPOs underperform from one to three-year period. There are various reasons for the underperformance e.g. (a) window of opportunity hypothesis, (b) impresario or fads hypothesis, (c) divergence of opinion hypothesis, and (d) entrenchment theory. Moreover, this section focuses on the operating framework and the regulatory environment in the AIM.

2.1. Theoretical framework on IPO underperformance

In the literature of IPO performance, the third anomaly (i.e. underperformance of new issues) was introduced by Ritter, (1991). This was initiated as along-lasting debate and identified various propositions responsible for the long-run underperformance. The window of opportunity hypothesis develops the nexus between the timing of issuance and underperformance. It is generally argued that during the hot market period firms overprice their issues resulting in the yield low returns for the investors in the long run (Ritter, 1991). Similarly, Loughran and Ritter, (1995) also support the notion of the window of opportunity hypothesis which illustrates that to get the fruitful outcomes of the high IPO activity period, the firms manage to overprice their issues. In this way, newly listed firms also raise funds and investments from the market at excessive prices (Mumtaz et al., 2016). This excessive amount is raised without having any substantial growth prospects and opportunities (Lee, 2012; Loughran and Ritter, 1995). As a result, these issues would not be able to justify the high pricing, and the market adjusts their value with real valuation and pricing. Previous studies have widely documented the hot issue market and IPO underperformance (Ritter, 1998; Kaneko and Pettway, 2003; Khurshed, Kostas and Saadouni, 2016; Ali, 2017). The firms going public in the hot market are overly optimistic growth prospects and perform substantially worse than other IPOs (Mumtaz et al., 2016). Impresario or fads hypothesis explains that generally investment banks intentionally underprice their underwritten IPOs to generate more demand of their IPOs in the market, so that investors could get more return on a listing day (Mumtaz et al., 2016). With this perspective, these investment banks intend to create their positive and professional identity in the market that underwriters are giving good investment advice and proving profitable opportunities for investors. This hypothesis develops that initial returns and

subsequent underperformance have a strong and direct relationship. This illustrates that higher underpricing leads to a higher probability of subsequent correction of share prices which subsequently results in underperformance of IPOs. Earlier studies have attempted to test the fads hypothesis in IPO market (Fama *et al.*, 1969; Bondt and Thaler, 1985; Aggarwal and Rivoli, 1990; Aggarwal, Leal and Hernandez, 1993) and impresario hypothesis (Chepeta and Jardine, 2014) using the 'underpricing' as one of the explanatory variables in the regression. The divergence of opinion hypothesis explains the uncertainty about IPO which causes the overvaluation on the first trading and subsequent underperformance for the long-run. This hypothesis developed and empirically endorsed by Miller (1977, 2001) which illustrates that the divergence of opinion on the first trading day can generate more demand and higher overvaluation cause the IPO underperformance in the long-run. He found the strong and positive association between the magnitude of divergence of opinion among investors and the long-run performance of IPOs. The rationale of this theory is based on the optimistic views of the prospective investors about the IPOs that mostly optimistic investors tend to buy the IPOs from the market that pertain more divergent opinions about futuristic performance and worth of the firm. This also explains that uncertainty about futuristic performance and real worth of the firm gives birth to the difference of opinion among both the optimistic and pessimistic perspective investors, resulting in overvaluation on the first trading day. Subsequently, over time as realistic views and information flow in the market, the divergence of opinion tends to reduce and adjustment takes place in the prices, which results in underperformance. This evidence has been tested by prior studies (Miller, 2001; Kooli and J. M. Suret, 2004; Guo, Lev and Shi, 2006) using after-market price variability to determine the 'divergence of opinion hypotheses'. An entrenchment theory develops the relationship between the management and long-run performance. When managers gain power in the company, they may be able to use the firm in their own interests which eventually increases the ownership control, thus, entrenchment negatively influences the valuation of new issues in long-run. Earlier studies (Mazzola and Marchisio, 2002; Sahoo and Rajib, 2010) empirically found that entrenchment effect is likely to be more prevalent in family business which significantly underperform IPOs in the long run (Chahine, 2007). Post-issue promoter group holding (PIPH) is also used as a proxy for managerial entrenchment to test the entrenchment effect in measuring the long-run performance.

2.2. The regulatory environment of the alternative market

The AIM is a sub-market of the London Stock Exchange which was launched on 19 June 1995. This market allows smaller, less-viable companies to issue shares with a more flexible regulatory system than it is in force on the main market. Upon its launch, AIM consisted of only 10 companies valuing collectively at £82.2 million. By the end of 2017, more than 2.000 companies were actively traded in the sub-

market, with an average market cap of £80 million per listing (Hore, 2016). AIM has also started to become an international exchange, often due to its low regulatory burden, especially concerning the *US Sarbanes- Oxley Act*. At this date only about a quarter of AIM-listed companies would qualify to be listed on a U.S. stock exchange even before the Sarbanes–Oxley Act (Doidge and Stulz, 2007).

The regulatory model of AIM is based on a comply-or-explain option that lets companies that are floated in AIM either comply with few rules or explain why it has decided not to comply with them. The purpose of this market was to facilitate and promote trading opportunities for small and medium enterprises (SMEs). During the past two decades, only 21.9% of new issues were listed on the LSE (known as the main market) whereas 78.1% listed on the alternative markets (Mendoza, 2008). There are few reasons to expect that the price behavior of firms listed on LSE and AIM are significantly different. First, no specific criterion is required to qualify for the listing on the AIM. Second, firms do not require any particular financial track record, and lastly, no minimum requirement in terms of size or number of shareholders (Mendoza, 2008). This phenomenon gives birth to new discourse that would have the same consequences in the short-run and long-run if the firm goes public in the sub-market? The difference in the institutional characteristics of the two markets i.e. the main market and AIM motivated us to identify the factors that affect IPO pricing dynamics in alternative markets. To explain the above theories, empirical research examines various determinants and proxies that are perceived to be related to the long-run performance of IPOs.

3. Methodology

3.1. Econometric equation

In this study, we use the Buy and Hold Abnormal Return (BHAR) technique to determine the long-run pricing performance of IPOs. Following Loughran and Ritter (1995), BHAR for firm *i* at time *t* is computed as:

$$BHAR_{it} = \prod_{t=1}^{\tau}[1 + R_{it}] - 1]$$

(1)

$$BHAR_{it} = \frac{1}{n}\sum_{i=1}^{n}[\prod_{t=1}^{T}[1 + R_{it}] - \prod_{t=1}^{T}[1 + R_{mt})]$$

(2)

where R_{it} represents the return of stock *i* at time *t* and R_{mt} indicates the return on the benchmark index (FTSE-AIM 100). To determine the market adjusted normal

returns, the corresponding FTSE-AIM 100 is used as a benchmark index for each IPO firm. *n* denotes the number of IPOs. We also identify the robust factors of long-run performance by developing the following equation:

$$
\begin{aligned}
BHAR = {} & \beta_0 + \beta_1(Up_i) + \beta_2(LDel_i) + \beta_3(Osub_i) + \beta_4(Offersize_i) + \\
& + \beta_5(LIR_i) + \beta_6(FinLev_i) + \beta_7(Firm's\ age_i) + \beta_8(Firm\ size_i) + \\
& + \beta_9(Mkt - Ret_i) + \beta_{10}(Mkt - vol_i) + \beta_{11}(crisis_i) + \beta_{12}(hot_i) + \\
& + \beta_{13}(RIS_i) + \beta_{14}(Board\ size_i) + \varepsilon_i
\end{aligned}
\tag{3}
$$

where Up is the first day underpricing of IPO and LDel is the listing delay which is the natural logarithm of the number of days separating the closing of subscription and the first day of trading. Osub (oversubscription) is the number of shares demanded by the number of shares offered and offer size is the number of shares issued multiplied by offer price. LIR is the ratio of long-term investment in total assets of the firm, FinLev (financial leverage) is calculated as the book value of long-term debt to total assets, a firm age is measured as the difference between the year of incorporation and going public and a firm size is the natural logarithm of the firm's total assets prior to IPO. Mkt-Ret (market return) is measured through FTSE-AIM 100 value-weighted index over three months before IPO. Mkt-Ret (market return) is measured through FTSE-AIM 100 value-weighted index over three months before IPO. Mkt_volt (market volatility) is standard deviation of market return over 245 days prior to going public. PIMD is the ratio of share owned by management and external shareholders, PIDH is ratio of share owned by directors and external shareholders, RIS is the ratio of institutional shareholdingand board size is the ratio of independent non-executive director (INEDs) at the board.

3.2. Statistical technique

The decades of endeavors have been made to explore the predictor of the long-run price performance of IPOs so far by many researchers but the question is to examine the robustness of variables of interest. According to Cooley and Leroy (1981), economic theory does not intricate as to which variables should be kept constant while employing any statistical technique or model. To tackle this limitation, (Leamer, 1983; 1985) developed the Extreme Bound Analysis (EBA). Practically, this techniques was firstly used by Levine and Renelt (1992). The various parallel models have been developed and used but the reliability of these models was questionable? The EBA technique is a useful and reliable method that is used to test the sensitivity of the desired outcomes to specification changes. It also reduces the uncertainty of model fitness and validity and reliability (Leamer, 1985). This study is an attempt to examine the robust predictors that influence the long-run performance of IPOs in the secondary market. In line with the EBA, we develop the following regression model (Moosa and Cardak, 2006):

$$BHAR_{it} = \beta_0 + \sum_{ip=1}^{n} \beta_c X_{ipi} + \mu_i \tag{4}$$

$$BHAR_{it} = \beta_0 + \sum_{ip=1}^{n} \delta_c X_{ipi} + \beta Q_i + \sum_{ip=1}^{m} \delta_c z_{ipi} + \mu_i \tag{5}$$

We first estimate the coefficient of the variable of interest 'Q' of which sensitivity and robustness is tested. To examine the sensitivity and robustness of the explanatory variables, we applied hundreds of regressions to predict the value of the coefficient of the respective variable. On the other hand, fixed variable(s) [X] are included in every set of regression and variable of interest Q and the set of Z variables are chosen from a predetermined pool of combinations of sets. The entire calculation of EBA is based on the coefficient value of the variable of interest Q. To test the significance of the equal- weighted BHAR which is equal to zero, Lyon, Barber, and Tsai (1999), we used the skewness adjusted t-statistics:

$$t = \sqrt{n} \times \left(s + \frac{1}{3}\hat{\gamma}s^2 + \frac{1}{\sigma n}\hat{\gamma} \right) \tag{6}$$

Where

$$s = \frac{\overline{BHAR_t}}{\sigma(BHAR_t)} \text{ and } \hat{\gamma} = \frac{\sum_{i=1}^{n}(BHAR_i - \overline{BHAR_t})^3}{n\sigma(BHAR_t)^3}$$

Where:

$\overline{BHAR_t}$: Sample mean of BHAR
(MR_t) : Standard deviation of BHAR
n : Total observations
$\hat{\gamma}$: An estimate of the coefficient of skewness. Adjusted t-statistics is used to overcome the skewness problem.

4. Empirical data and analysis

4.1. Sample and data

Our population of the study is divided into two main categories i.e. local and dual-class (cross-listed) IPOs in AIM during the period from July 1995 to December 2016. During this period, 2121 news issues have been placed on AIM including 1,713 local IPOs and 408 foreign firms issued IPOs on AIM for secondary listing (Figure 1 and Table 1). It is important to note that more than 75% of new issues

were issued on the AIM and only 25% in the main market during the 1995-2016 period. The total market capitalization of the submarket was £87,903 million and £36,540 million was collected from IPOs activities. The period of 2001 to 2010 was categorized as the hot activity period wherein more than 60% of IPOs issued in AIM.

Table 1: Position of IPOs in AIM (1995-2016)

Year	Number of Companies	Firm's Market Value (£m)	New Money Raised (£m)
1995	16	208	69
1996	95	1,757	504
1997	72	844	299
1998	37	603	185
1999	59	674	274
2000	179	4,667	1395
2001	94	1,716	435
2002	61	1,339	433
2003	67	1,902	990
2004	243	6,386	2,412
2005	335	12,299	5,632
2006	278	17,786	9,315
2007	182	12,385	6,262
2008	38	2,508	917
2009	13	666	610
2010	47	3,024	1,012
2011	45	1,572	525
2012	43	1,780	643
2013	62	2,751	974
2014	80	8,065	2,472
2015	33	1,973	470
2016	42	3,001	710
Total	2121	87,903	36,540

Note: This table depicts the IPOs market performance of AIM during the period of 1995 to 2016. During the period 2001-2010 more than 60% of IPOs were issued in AIM. The year 2000, and the period 2004-2007 are categorized as hot market activity where IPOs were made more than an average.

Source: *London Stock Exchange statistics*

Figure 1:
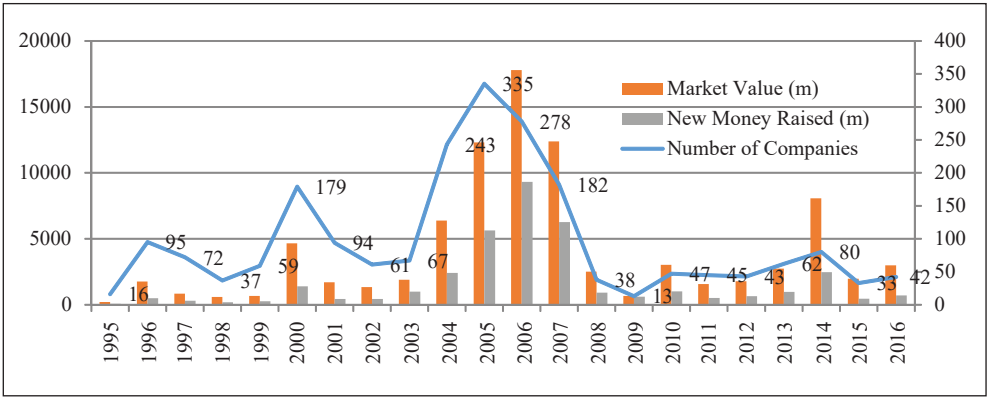
Source: *London Stock Exchange statistics*

To examine the long-run pricing performance, this study employs 320 IPOs (15% of the overall population) listed on AIM during the period between 2001 and 2016 using systematic sampling. After the screening of the data, 292 firms were left to perform statistical analysis. We collected the monthly data for the long-run performance of IPOs from Yahoo finance and monthly historical data of LSE from their respective websites. Furthermore, firm related characteristics were obtained from the IPO prospectus and annual reports.

4.2. Long-run pricing performance of overall sample

In order to explain the long-run performance of various categories of IPOs, we divided our sample into three subgroups i.e. local incorporated IPOs, companies converted from private/mutual association to public limited and foreign companies. Table 2 depicts the average of the change in the earning that investors gain by passively putting their investments on the 1st day of trading, holding different categories of shares for the period of 36months. Secondly, to test the significance that the equal- and the value-weighted market return is equal to zero, Lyon, Barber, and Tsai (1999) suggested the skewness adjusted t-statistics has been applied.

Table 2: Aftermarket BHAR of local, demutualized and cross-listed IPOs

	Local IPOs			Demutualized IPOs			Cross-listed IPOs		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	N	Mean	Std. Deviation
BHAR1	280	17.19*	10.93	20	23.91**	6.80	52	20.54**	4.56
BHAR2	280	18.09**	12.63	20	22.91**	7.03	52	20.38**	4.54
BHAR3	280	18.90**	22.13	20	22.90**	7.28	52	20.29**	4.63
BHAR4	280	17.63*	22.66	20	23.83**	8.04	52	20.41**	4.85
BHAR5	280	17.57*	22.61	20	23.50**	7.83	52	20.37**	5.13
BHAR6	280	17.49*	23.71	20	22.73**	8.16	52	20.47	5.38
BHAR7	280	18.39**	24.70	20	22.27**	8.35	52	20.55	5.64
BHAR8	280	19.14**	26.50	20	21.98**	8.38	52	20.50	5.57
BHAR9	269	19.78**	27.34	20	22.21**	8.59	52	20.45	5.65
BHAR10	269	19.28**	28.83	20	22.69**	8.63	52	20.28	5.59
BHAR11	264	19.54**	27.89	20	22.60**	9.10	52	19.97	5.79
BHAR12	260	18.05*	28.40	20	22.90**	8.85	52	19.90	6.02
BHAR13	259	16.55	26.00	20	22.89**	8.84	52	20.00*	6.17
BHAR14	257	15.82	22.69	20	22.57**	9.04	52	19.97	6.40
BHAR15	253	15.69	23.62	20	22.46**	8.74	52	19.78	6.44
BHAR16	250	16.31	24.19	20	22.66**	7.97	52	19.76	6.78
BHAR17	250	17.01	27.92	20	22.27**	8.32	52	19.97	7.20
BHAR18	248	15.13	26.98	20	22.01**	8.25	52	20.13*	7.31
BHAR19	248	14.09	26.72	20	21.97**	8.02	52	20.19*	7.42
BHAR20	244	14.54	27.99	20	21.88**	7.91	52	20.40*	7.59
BHAR21	241	13.67	29.04	20	21.60**	7.83	52	20.61*	7.83
BHAR22	241	13.79	28.33	20	21.50**	8.17	52	20.53*	7.91
BHAR23	240	13.61	27.38	20	21.44**	8.79	52	20.59*	7.85
BHAR24	240	12.78	28.07	20	21.59**	9.07	52	20.83*	8.00
BHAR25	238	13.10	29.04	20	21.92**	9.47	52	20.87*	8.37
BHAR26	238	18.29	60.12	20	21.96**	9.96	52	20.78*	8.49
BHAR27	226	11.95	30.31	20	21.47**	11.62	52	20.60*	8.43
BHAR28	226	13.18	31.77	20	21.58**	11.63	52	20.82*	8.63
BHAR29	224	12.60	32.04	20	21.14**	11.98	52	20.71*	8.73
BHAR30	223	13.13	32.48	20	21.02**	12.11	52	20.43*	8.59
BHAR31	223	13.00	32.34	20	20.65**	12.36	52	20.67*	8.82
BHAR32	222	13.10	33.24	20	20.43**	11.99	52	21.09**	9.50
BHAR33	222	13.32	33.55	20	19.64*	11.77	52	21.14**	9.52
BHAR34	221	13.76	34.15	20	19.35*	11.49	52	21.14**	9.74
BHAR35	221	12.89	34.06	20	19.34*	11.58	52	21.32**	10.04
BHAR36	220	11.92	33.78	20	18.79*	11.89	52	21.44**	10.55

Note: This table exhibits long-run price performance of a sample of 292 that consists of 220 newly listed IPOs, 20 demutualized firm's IPOs, and 52 Cross-listed IPOs listed on the AIM from 2001 to 2016. To test the significance skewness adjusted t-statistics is used. * and ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

In, local IPOs investor earns (BHAR = 17% to 20% $p < 0.05$) in short-run period but in long-run, diminishing trend is observed which reduces earning till 11% ($p > 0.05$). Likewise, in demutualized IPOs, the same diminishing trend in the long-run has been observed from 23% to 19% but these returns are significant at 95% ($p < 0.05$). On the other hand, investors earn significant abnormal returns (BHAR = 20% to 22%, $p < 0.05$) in cross-listed IPOs, and the uprising trend is observed from the short- to long-run period. It is further deduced that investors earn more returns by investing in demutualized IPOs relative to local IPOs in the long-run period. Besides, investors do enjoy more returns those invested their savings in cross-listed IPOs as compared to local and demutualized IPOs in AIM holding for 36 months.

4.3. Long-run pricing performance of different industries

Further to explain the long-run price performance of various industries, we divided our sample on the basis of industries. Table 3 depicts the comparative analysis of the long-run pricing performance of IPOs of various industries listed on AIM. Findings of the study reveal that mining, oil and gas, and electricity producers report the highest return (BHAR = 23.51%, 22.50% and 25.51%, $p < 0.05$) respectively in the short-term period as compared to other industries. Likewise, investors earn more returns in the long-run period by investing in media and telecom, industrial and construction material and oil and gas industries (BHAR = 25.49%, 22.32%, and 24.26% $p < 0.05$) respectively.

Table 3: Industry and long-run IPOs performance

Sector	BHAR1	BHAR6	BHAR12	BHAR18	BHAR24	BHAR30	BHAR36
Mining	23.51**	23.41**	23.80**	19.06	18.48	16.09	16.27
	(8.95)	(12.50)	(22.05)	(24.11)	(29.23)	(27.88)	(24.88)
Others	20.25**	24.18**	19.74*	24.77**	24.15**	23.02**	18.60*
	(7.76)	(15.55)	(19.62)	(32.83)	(31.33)	(35.25)	(34.49)
Media and Telecom	21.56**	20.69*	21.30**	21.26**	21.37**	28.10**	25.49**
	(8.62)	(10.50)	(19.44)	(24.00)	(26.36)	(30.74)	(38.69)
Software and computer	21.96**	20.34*	26.31**	24.78**	21.45**	17.27	15.21
	(6.65)	(10.47)	(18.24)	(23.27)	(21.97)	(27.02)	(28.25)
Travel services	15.81	19.98*	25.32**	27.17**	26.65**	20.96**	17.81
	(5.33)	(12.07)	(16.64)	(29.69)	(34.26)	(32.28)	(26.01)
Support Services	21.65**	18.44*	17.33	10.50	9.06	10.92	15.71
	(8.77)	(14.69)	(21.44)	(21.75)	(21.59)	(27.30)	(41.59)
Industrial and Construction Material	21.67**	22.09**	28.72**	25.99**	21.39**	25.98**	22.32**
	(7.11)	(12.21)	(21.79)	(27.64)	(28.17)	(35.26)	(31.69)
Real Estate	14.32	24.56**	26.61**	29.61**	11.77	18.36	17.73
	(19.04)	(12.81)	(17.10)	(34.41)	(38.93)	(46.86)	(48.64)
Pharmaceuticals and Health care	21.84**	22.14**	19.39*	16.35	13.42	13.35	4.49
	(8.86)	(14.34)	(16.27)	(17.63)	(21.40)	(33.78)	(23.71)
Financial Services	21.07**	18.53*	20.84**	20.00*	17.23	23.77**	16.71
	(8.76)	(8.90)	(20.81)	(28.54)	(26.25)	(35.98)	(27.95)
Electronic and Electrical Equipment	21.33**	21.79**	30.63**	18.57	14.36	17.18	19.37*
	(6.06)	(7.58)	(24.89)	(21.78)	(22.61)	(20.30)	(23.57)
Oil and Gas sector	22.50**	22.26**	22.40**	27.03**	26.57**	26.90**	24.26**
	(7.25)	(12.68)	(16.66)	(27.27)	(24.23)	(37.49)	(30.10)
Chemical	18.80	19.34*	27.87**	26.08**	19.50*	18.86*	8.91
	(12.01)	(22.90)	(33.02)	(31.40)	(24.27)	(33.25)	(28.94)
Electricity Producer	25.51**	23.84**	25.10**	25.09**	21.03**	13.28	10.97
	(7.64)	(13.69)	(16.01)	(24.29)	(33.77)	(38.22)	(17.96)

Note: This table exhibits long-run price performance IPOs of various industries listed on the AIM from 2001 to 2016. To test the significance, skewness adjusted t-statistics is used. * and ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

Other industries such as software, travel services, support services, pharmaceutical, financial services, and chemical industries produce low returns as compared to mining, oil and gas, and electricity in short-run and media and telecom, industrial and construction material and oil and gas industries in the long-run period.

4.4. Long-run pricing performance and market condition

Table 4 reveals the long-run pricing performance of various categories of IPOs which were issued in hot-where IPOs were issued more than average and cold market period. Investors earn more returns in hot market period (BHAR = 23% to 25%, $p < 0.05$), and (BHAR = 21% to 24%, $p < 0.05$), in cold market (17% to 19%, $p < 0.05$) and (BHAR = 12% to 16%, $p < 0.05$), in short-term and long-term period respectively.

Table 4: Market condition and long-run IPOs performance

Market Condition	BHAR1	BHAR6	BHAR12	BHAR18	BHAR24	BHAR30	BHAR36
Cold Market	17.829**	18.848**	20.577**	19.343**	16.556*	16.247*	12.920*
	(8.42)	(12.86)	(20.00)	(26.94)	(28.65)	(32.92)	(31.95)
Hot Market	25.109**	23.878**	25.03**	23.86**	21.54**	24.92**	21.19**
	(7.50)	(11.38)	(19.89)	(25.61)	(24.69)	(32.93)	(28.99)

Note: This table exhibits long-run pricing behavior of IPOs listed on AIM during the period of hot and cold market. This also depicts the window of opportunity hypothesis. To test the significance, skewness adjusted t-statistics is used. * and ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

It deduces that BHAR increases as market sentiment are in hot activity relative to cold activity period. This supports the window of opportunity hypothesis explaining that during the hot IPO market period firms overprice their issues resulting in the yield low returns for the investors in the long run (Ritter, 1991). As a consequence, IPOs underprice in the short-run which results in subsequent underperformance. This evidence is positive and strongly influences each other.

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4.5. Long-run pricing performance and offer price

Table 5 illustrates the size of the issue price and the long-run price performance of IPOs. We classify the IPOs into issue price size quartile based on the range of IPOs issue price in AIM from 2001 to 2016. It deduces that medium-size offer price i.e. second and third quartile produces more returns (BHAR = 22.39%, 21.83%, P < 0.05) respectively in short-run and (BHAR = 19.02%, 17.86%, P < 0.05) respectively in long-run relative to low offer price and high offer price.

Table 5: Issue price and long-run IPOs performance

Issue Price	BHAR1	BHAR6	BHAR12	BHAR18	BHAR24	BHAR30	BHAR36
Issue Price ≤ 25	20.579**	19.808**	19.596**	18.157**	14.992*	14.042*	12.753
	(8.63)	(11.63)	(17.87)	(24.57)	(26.00)	(27.39)	(29.06)
Issue Price > 25 and < 70	22.396**	20.384**	25.098**	22.722**	19.162**	23.058**	19.020*
	(7.65)	(12.63)	(22.38)	(27.23)	(24.22)	(36.59)	(32.25)
Issue Price > 70 and < 120	21.833**	22.729**	21.107**	20.063**	21.617**	22.750**	17.862*
	(7.21)	(12.69)	(19.19)	(26.64)	(27.56)	(33.71)	(29.84)
Issue Price > 120	20.176**	22.833**	24.494**	25.015*	20.978*	22.195**	17.916*
	(11.215)	(12.719)	(19.57)	(26.96)	(30.65)	(33.66)	(31.74)

Note: This table exhibits nexus between issue price and long-run price performance. This also depicts the ex-ante uncertainty hypothesis. To test the significance, skewness adjusted t-statistics is used. * and ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

Generally, issues are floated at fixed price mechanism in AIM so that investors may prefer to invest in IPOs where offer price is in medium range – neither lowest nor the highest because the issuer gathers pricing information from institutional investors and individual investors with a high net worth through a bidding process to build interest in investment in the company's shares.

4.6. Long-run pricing performance and firms' market capitalization

Table 6 explains the long-run price performance based on the firm's market capitalization in AIM. We classify the IPOs into market capitalization size quartile based in AIM from 2001 to 2016. Small size firms report higher abnormal returns (BHAR = 23.01%, to 22.52%, P < 0.05) in short-run but in long-run performance of large size firms was on the higher side (BHAR = 22.39%, 21.83%, P < 0.05) relative to low and medium-size firm.

Table 6: Market share of firm and long-run IPOs performance

Market Capitalization	BHAR1	BHAR6	BHAR12	BHAR18	BHAR24	BHAR30	BHAR36
Market Capitalization ≤ 23 (£m)	23.017**	22.200**	22.521**	21.164**	18.388*	18.378*	14.299
	(7.41)	(13.09)	(21.11)	(26.24)	(27.33)	(34.30)	(29.77)
Market Capitalization > 23.46 and < 50.59 (£m)	19.351*	18.763*	18.815*	20.117**	15.523	20.986*	18.055*
	(11.26)	(10.52)	(19.36)	(25.01)	(23.76)	(32.07)	(32.04)
Market Capitalization > 50.59 and < 107.33 (£m)	20.662**	21.760**	25.665**	23.004**	21.966**	20.112**	17.605
	(6.97)	(12.89)	(17.83)	(28.41)	(28.63)	(30.18)	(33.85)
Market Capitalization > 107.33 (£m)	19.048**	21.554**	26.967**	23.425**	23.632**	27.759**	23.879**
	(9.44)	(12.20)	(19.07)	(27.32)	(28.48)	(34.81)	(27.48)

Note: This table displays market volume of the firm i.e. small, medium and large size firm and long-run pricing pattern. This also depicts the signaling hypothesis To test the significance, skewness adjusted t-statistics is used. * and ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

This support "signaling hypothesis" that sometimes large firms intentionally underprice/overprice their issuance to differentiate their status in the market from small size firm. As a consequence, IPOs underprice in the short-run result in subsequent underperformance in the long-run. Various studies for instance (Fine et al., 2017; Pandya, 2016) reported that firm size does affect the long-run price performance of IPOs. Similarly, in the AIM market, firm size has a significant impact on underpricing (Amini and Keasey, 2013) and subsequent underperformance of IPOs in the long-run (Acedo-Ramírez and Ruiz-Cabestre, 2016).

4.7. Long-run pricing performance and offer size

Table 7 illustrates the impact of offer size on the long-run price performance of IPOs in AIM exhibiting that the IPOs in three of the four categories based on offer size and longer-term performance over three years. Small offer size issues earn more returns (BHAR = 22.90% to 21.72%, P < 0.05) relative to medium size and large size issue proceeds in short-run period but on flip side large issue proceeds earns higher returns (BHAR = 25.35% to 26.31%, P < 0.05) relative to medium size and small size issue proceeds in long-run.

Table 7: Offer size and long-run IPOs performance

Offer Size	BHAR1	BHAR6	BHAR12	BHAR18	BHAR24	BHAR30	BHAR36
Offer Size ≤ 3 (£m)	22.902**	20.997**	21.681**	21.721**	17.205	15.308	11.629
	(7.71)	(13.72)	(19.90)	(26.37)	(26.06)	(30.12)	(26.43)
Offer Size > 3 and < 8.0114 (£m)	22.188**	22.386**	23.528**	21.390**	19.077	23.375**	17.200
	(7.49)	(12.72)	(22.82)	(28.12)	(29.42)	(40.76)	(35.57)
Offer Size > 8.0114 and < 18.26 (£m)	20.038**	21.175**	20.515**	18.618	14.479	17.589	16.925
	(11.63)	(11.29)	(18.00)	(23.55)	(22.81)	(27.43)	(27.79)
Offer Size > 18.26 (£m)	19.657**	20.438**	25.291**	24.195**	25.356**	26.319**	22.863**
	(7.50)	(11.62)	(19.11)	(27.38)	(28.31)	(32.62)	(32.80)

Note: This table shows the interrelationship between magnitude of offer size and long-run price performance which further elaborates the ex-ante uncertainty hypothesis. To test the significance, skewness adjusted t-statistics is used. * ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

This evidence supports the ex-ante uncertainty hypothesis because issues yielding the lowest gross proceeds underperform significantly. This also elaborates that large offer size needs more money to be used for the development and growth of the firm as well as investing in optimal investment opportunities resulting in higher returns in the long-run.

4.8. Long-run pricing performance and initial returns

Table 8 exhibits initial returns earned by investors result in a subsequent adjustment in the long-run in AIM. Lower underpricing in short-run result in higher returns in long-run (BHAR = 18.40% to 23.20%, P < 0.05) relative to higher underpricing in short-run (BHAR = 08.49% to 16.38%, P < 0.05). This support Impresario or fads hypothesis which explains that firm intentionally underprices their underwritten IPOs to generate more demand of their IPOs in the market, so that investor could get more return on first day trading in market (Mumtaz et al., 2016).

Table 8: Initial underpricing and long-run IPOs performance

Underpricing	BHAR1	BHAR6	BHAR12	BHAR18	BHAR24	BHAR30	BHAR36
Underpricing ≤ -2.92%	22.519**	23.262**	26.323**	25.622**	24.081**	27.264**	23.201**
	(9.67)	(12.72)	(22.79)	(27.95)	(28.95)	(36.11)	(34.46)
Underpricing > -2.93% and < 1.300%	20.879**	20.840**	21.836**	21.071**	19.334	18.362	18.406
	(6.36)	(8.64)	(14.43)	(17.21)	(16.74)	(17.39)	(18.93)
Underpricing > 1.300% and < 9.69%	20.375**	21.428**	23.502**	21.996**	16.803	19.887	16.380
	(9.14)	(12.75)	(21.35)	(31.70)	(27.13)	(37.21)	(33.60)
Underpricing > 9.69%	21.435**	19.168*	18.588	16.671	15.131	15.330	8.498
	(9.51)	(14.84)	(19.96)	(25.64)	(32.38)	(36.97)	(32.16)

Note:　This table depicts the interrelationship between initial returns of IPOs and long-run price performance which further explain the dimension of 'divergence of opinion hypotheses' and impresario or fads hypothesis. To test the significance, skewness adjusted t-statistics is used. * and ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

This hypothesis also elaborates that the initial return and subsequent under-performance are strongly and positively associated with each other. Generally, it is also observed in previous literature for instance (Mumtaz et al., 2016) that the higher the underpricing on the first trading day leads to higher underperformance in long-run.

4.9. Descriptive analysis and Pearson correlations

The descriptive analysis of outcome and criterion variables depicts that long-run return (BHAR) of selected sample 14% on an average and short-run returns (MAAR) were 10% (Table 9). On average 21 days were observed in listing IPOs on the alternative market which indicates that listing process of AIM is not complicated as compared to the main markets. Firm size and offer size are reported an average 42 million pounds and 17 million pounds respectively which indicate that most firms were SMEs. These firms were an average 31% levered with small ages (< 2 years) at the time of offering. This evidence illustrates that majority of small IPOs are incorporated and working in the AIM. According to Amini, Keasey, and Hudson (2012), access to market-based equity finance is easier for these small firms in capital as well as financial market. Likewise, market returns were between an average 2% and -4 % in AIM with small volatility (-0.491) indicating stability of the market. The mode values of dummy variables comprise crisis period and hot market. During the crisis period, few issues were listed whereas firms preferred to issue IPOs in the hot market activity.

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Table 9: Result of Pearson bivariate correlation

	Mean	Std. Dev.	BHAR	UP	Lisdely	FSize	LITA	Fin-Lev	OfSize	MktR	MktV	age-firm	RIS	Crisis	Hot	OSub	BSize
BHAR	14.89	10.11	1														
UP	10.12	09.14	-.168**	1													
LisDely	21.11	16.17	.004	-.144**	1												
FSize	42.91	70.67	.077	-.236**	.189**	1											
LITA	15.16	12.81	.038	-.012	-.053	-.242**	1										
FinLev	31.01	11.10	-.112*	.010	-.008	.002	-.085	1									
OffSize	17.52	37.17	.085	-.155**	.091	.513**	.119*	-.032	1								
MktR	2.11	2.01	-.010	-.008	-.036	-.019	.035	-.057	.065	1							
MktV	-0.491	-0.161	.026	.005	-.007	.028	-.011	-.014	.004	.055	1						
agefirm	1.23	2.45	.145**	.048	-.006	.012	-.003	.084	.003	-.031	.050	1					
RIS	12.31	07.84	.033	.060	-.102	-.059	.033	-.153**	-.031	-.002	.014	-.026	1				
Crisis	0 (mode)	--	-.009	.101	-.078	-.138*	-.026	-.043	-.030	.024	.042	.017	.044	1			
Hot	1 (mode)	--	-.116*	-.041	-.035	.201**	-.079	.056	.055	-.095	-.046	-.062	-.028	-.225**	1		
OSub	15.18	12.09	-.127**	-.094	.125*	-.002	.043	-.073	-.035	.059	-.044	-.003	.072	-.132*	-.207**	1	
BSize	1.12	1.21	.194**	-.115*	-.002	.109*	.016	-.050	.084	-.043	.009	.092	.034	-.035	.065	-.044	1

Note: BHAR at end of 36th Month's returns (in %) Up is first day underpricing of IPO (in %) and LDel is the listing delay which is natural logarithm of the number of days separating the closing of subscription and the first day of trading (No. of Days). Osub (over subscription) is the number of shares demanded by the number of shares offered and offer size is the number of shares issued multiplied by offer price (in %). LIR is ratio of long-term investment in total assets of firm (in %) , FinLev (financial leverage) is calculated as the book value of long-term debt to total assets (in %), firm size is measured as the difference between year of incorporation and going public (in a years) and firm'size (in million pounds) is natural logarithm of the firm's total assets prior to IPO. Mkt-Ret (market return) is measured through FTSE-AIM 100 value-weighted index over three months prior to IPO. Mkt-Ret (market return) is measured through FTSE-AIM 100 value-weighted index over three months prior to IPO (in %). Mkt_volt (market volatility) is standard deviation of market return over 245 days prior to IPO (in %). RIS is ratio of institutional shareholding (in %) and board size is ratio of independent non –executive director (INEDs) at board. Crisis is dummy variables where 1 for crisis period 2007-08 and otherwise 0. Hot period is also dummy variable 1 for hot and 0 for cold market.
* and ** represent significance level at the 1, and 5% respectively.

The over subscription is 8% on average that determines the equilibrium of market. This further describes that IPOs demand and supply sides are properly balanced. The numbers of independent non-executive directors were between 1 and 2 non-executive directors in board of directors of listed firm of AIM. The correlation matrix indicates that no variable is highly correlated with each other which further reduce the probability of multicollinearity among variables.

4.10. Determinants of IPOs' long-run pricing performance

To provide more comprehension and strength in the exploration of robust factors which are responsible for the long-run performance of IPOs, we also tested regression for each characteristic related to IPO process which explains the long-run performance of IPOs such as issue-specific, firm-specific, market-specific and governance-related characteristics and the simultaneously overall combination of these characteristics. Table 10 depicts that issue-specific factors suggest that underpricing and oversubscription from IPOs characteristics emerged as potential contributors of long-run performance of IPOs. Higher the underpricing more the probability of subsequent correction to adjust share prices in long-run phenomena resulting in substantial underperformance of IPOs.

In prior literature, various attempts have been made to test the fads in the IPO market (Fama *et al.*, 1969; Bondt and Thaler, 1985; Aggarwal and Rivoli, 1990; Aggarwal, Leal and Hernandez, 1993) and impresario hypothesis (Chepeta and Jardine, 2014) using 'underpricing' as one of the explanatory variables in the regression model. Likewise, financial leverage and firm size from firm-specific characteristics come out as significant determinants of the long-run price performance of IPOs. On the other hand, the hot market period from market-specific characteristics shows a significant impact on the long-run price performance of IPOs. Similarly, In prior literature, various studies documented the nexus between hot issue market and IPO underperformance for instance(Ritter, 1998; Kaneko and Pettway, 2003; Khurshed, Kostas and Saadouni, 2016; Ali, 2017). IPOs going public in the hot issue period are overly optimistic growth prospects perform substantially worse than the other IPOs (Mumtaz, Smith, and Ahmed, 2016).

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Table 10: Result of ordinary least square

	Issue Specific			Firm Specific			Market Specific			Governance Related			Overall Model
	Local	CL	Dem	Local	CL	Dem	Local	CL	Dem	Local	CL	Dem	
UP	-1.121	-1.712	-1.312										-0.782
	(3.93)**	(3.43)**	(3.32)**										(2.39)*
Lidel	0.131	0.150	0.123										0.220
	(0.36)	(0.97)	(1.32)										(0.39)
Ovsub	-0.212	-0.312	-0.352										-0.132
	(3.13)**	(4.13)**	(3.13)**										(2.23)**
Offer size	0.014	0.024	0.027										0.001
	(1.31)	(1.44)	(1.54)										(0.35)
LIR				0.118	0.123	0.281							0.001
				(0.87)	(1.12)	(1.29)							(0.54)
Fin-Lev				-1.954	-1.541	-2.110							-1.131
				(2.03)*	(3.53)**	(2.89)**							(3.76)**
Firm's Age				0.372	0.341	0.211							-0.258
				(2.97)**	(0.89)	(1.17)							(0.98)
Firm size				0.211	0.190	0.201							0.237
				(3.56)**	(2.45)**	(2.56)**							(2.77)**
Mkt-Ret							-2.650	-2.110	-1.801				0.056
							(0.40)	(0.89)	(0.53)				(0.01)
Mkt-Vol							2.781	2.901	2.388				1.366
							(1.67)	(1.41)	(0.91)				(0.28)

	Issue Specific			Firm Specific			Market Specific			Governance Related			Overall
	Local	CL	Dem	Local	CL	Dem	Local	CL	Dem	Local	CL	Dem	Model
Crisis							-0.480	-0.480	-0.480				-0.240
							-0.660	-0.660	-0.660				(0.54)
Hot							-0.715	-0.234	-0.561				-1.270
							(3.22)**	(2.22)*	(4.11)**				(5.07)**
RIS										0.120	0.126	0.121	0.127
										(3.78)**	(3.20)**	(3.87)**	(3.98)**
Board size										2.134	4.551	3.761	2.976
										(7.38)**	(10.38)**	(11.38)**	(23.70)**
_cons	1.313	1.231	1.313	1.516	2.110	1.781	1.451	1.361	1.141	1.451	1.90	1.457	2.312
	(0.46)	(0.89)	(0.46)	(0.18)	(1.11)	(1.19)	(1.16)	(1.18)	(1.89)	(1.23)	(0.910)	(1.90)	(1.78)
R^2	0.101	0.121	0.100	0.120	0.101	0.110	0.121	0.009	0.067	0.061	0.063	0.057	0.27
N	220	52	20	220	52	20	220	52	20	220	52	20	292

Note: Local depicts local IPOs, CL stands for cross-listed and dem depicts demutualized IPOs. This table exhibits sample of 392 that consists of 220 newly listed IPOs, 20 demutualized firm's IPOs and 52 Cross-listed IPOs listed on the AIM from 2001 to 2016. OLS has been used at each possible level of factors that influence the pricing performance of IPOs in long-run. * and ** show the significance at 1 and 5% level respectively.

Source: Authors' calculations.

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Likewise, there is a positive association between the long-run performance and the structure and strength of corporate governance in AIM. The result shows the significant impact of board size on long-run price performance. This ultimately provides an estimate of the agency's tradeoff magnitude to the insiders of the firm. The potential focus on the IPOs has allowed the researcher to investigate the role played by the governance when the firm begins to operate as a public company. If the firm has a more structured and independent board than the long-run performance would be better. This hypothesis supports the agency explaining the role of board independence in the long-run performance of IPOs.

4.11. Result of EBA

The estimation of EBA assumes that firm size is an important determinant in identifying the long-run performance of IPOs in AIM (Colombelli, 2010). Table 11 predicts that the size of the firm size inversely proportion to long-run performance which shows long-run underperformance of large-sized firms are expected to be lower in the presence of higher initial returns. This evidence corroborates the divergence of opinion hypothesis. When initial returns would be higher and the share prices revert to their equilibrium lowering the level of underperformance. Prior literature reported the positive relationship between underpricing and firm size which shows that underpricing decreases due to large-sized of the firm (Sahoo and Rajib 2010; Diro Ejara and Ghosh 2004; Mumtaz, Smith, and Ahmed 2016). The lower magnitude of underpricing causes the probability of subsequent correction takes place to adjust the long-run IPO prices that result in substantial underperformance.

The evidence relating to the domicile of IPOs illustrates that majority of small IPOs are incorporated and working in the London-based market. According to Amini, Keasey, and Hudson (2012), access to market-based equity finance is easier for London-based firms. Additionally, AIM is characterized by a substantial concentration of SMEs, most of which are located in the constituency of London. Considering the lower costs of start-up, the origination of these firms on innovative ideas as a new startup in universities and acceptance of these startups by London-based investors have the significant effect on the growth and survival of these firms (Amini and Keasey, 2013) which posit the higher probability of success of these small IPOs in AIM as compared to large-sized firms.

Table 11: Comparison of Extreme Bound Analysis (EBA) with traditional techniques

	Overall IPOs (OLS)	Overall IPOs (EBA)	Local IPOs (OLS)	Local IPOs (EBA)	Cross-listed IPOs (OLS)	Cross-listed IPOs (EBA)	Demutualized IPOs (OLS)	Demutualized IPOs (EBA)
Firm Size	-0.178	-0.2910	-0.540	-0.610	-0.673	-0.340	-0.980	-0.349
	(3.13)**	(2.90)**	(3.30)**	(3.70)**	(4.10)**	(4.25)**	(4.12)**	(3.89)**
Underpricing	-0.283	-0.211	-0.763	-0.563	-0.361	-0.581	-0.675	-0.541
	(2.89)**	(3.14)**	(3.94)**	(3.52)**	(4.94)**	(2.54)**	(2.94)**	(4.13)**
Fin-Leve	-1.170	-1.241	-1.926	-1.116	-1.213	-1.241	-1.130	-1.151
	(2.94)**	(3.16)**	(3.82)**	(3.51)**	(3.32)**	(3.16)**	(2.82)**	(3.81)**
Firm Age	0.213	0.191	0.112		0.761		0.012	
	(2.95)*	(3.11)*	(3.03)*		(1.03)		(1.03)	
LIT	0.124		0.124		0.142	0.411	0.312	
	(1.31)		(1.31)		(4.31)**	(3.61)**	(3.21)**	
Hot Period	0.123	0.312	0.029	0.139	0.011		0.241	0.211
	(3.93)**	(4.61)**	(1.97)*	(2.32)**	(1.32)		(4.11)**	(3.82)**
Board Size	1.123	1.871	2.967	3.163	1.881	1.312	3.101	1.127
	(4.87)**	(4.89)**	(5.83)**	(12.83)**	(3.45)**	(6.51)**	(4.96)**	(2.83)**
_cons	0.561	0.671	0.217	0.173	0.453	0.512	0.651	0.213
	(1.12)	(1.56)	(0.29)	(1.14)	(0.67)	(1.34)	(1.27)	(1.19)
R^2	0.22	0.23	0.20	0.21	0.12	0.14	0.10	0.11
N	292	292	220	220	52	52	20	20
AIC	32.112		32.112		13.112		10.631	
SBIC	32.231		32.231		12.231		11.411	
HQIC	32.215		32.215		12.215		10.315	

Note: This table exhibits sample of 392 that consists of 220 newly listed IPOs, 20 demutualized firm's IPOs and 52 Cross-listed IPOs listed on the AIM from 2001 to 2016. Extreme Bounds Analysis (EBA) was used to predict the robust factor explaining the BHAR after 36th month of trading. Total of 1001 combinations using n!/(k!(n-k)! formula of 4 regressors (4 level combination of variables of interest) from the Z(nx13) vector were used in this process for 36th month. Detail of model is VIF 10 (thumb of rule) but in real term it is reported between 1-5, confidence level 0.95., and CI 0.95. The table also depicts the comparison of estimation results between traditional methods derived from the OLS and EBA technique on 36th months of trading periods. AIC = Akaike's Information Criterion, SBIC = Schwarz's Bayesian Information Criterion, HQIC = Hannan-Quinn Information Criterion, and EBA = Extreme Bounds Analysis. Traditional methods are specified on the basis of permutations (1002 regressions) and the best combination is selected on the basis of their smaller values of AIC, SBIC, and HQIC.
* and ** represent significance level at the 1, and 5% respectively.

Source: Authors' calculations

The rationale behind this evidence is that new startup based on innovative and unique ideas, where public shareholders especially locally business graduates are involved in generating the financial synergies in the short-and long-run. The contemporary evidence suggests many factors influencing IPO ability to survive in the aftermarket for the long-run such as the size of the firm, age of the firm, industrial sector, and uniqueness of products and services marketed by the firm. According to Audretsch and Lehmann (2005), human capital knowledge and intellectual property of the firm has greater influences on the survival and growth of firm even that firm's ownership structure don't matter in long-run. This supports the findings of our study that the probability of growth and survival of small firms is higher relative to large firms in AIM which further produces the higher returns for small IPOs in the short- and long-run.

To measure the sensitivity and the robustness of the factors affecting the long-run performance of IPOs in an alternative market, we compare the results of the EBA technique with traditional methods which include the Akaike's information criterion (AIC), the Schwarz's Bayesian information criterion (SBIC) and the Hannan-Quinn information criterion (HQIC) as shown in Table 9. We select the lower values of information criteria and derive fewer variables related to market, firm, and issue specific characteristics. The application of the EBA technique finds that the model specification is limited to firm size, underpricing, financial leverage, firm age, hot market, and boar size. Alternatively, traditional techniques (e.g. AIC, SBIC, and HQIC) recommend firm size, underpricing, financial leverage, firm age, long-term investment ratio, hot market, and boar size selected based on the lower value of information criteria.

5. Discussion of the results

We report that IPOs over-performed in the long-run which shows that the alternative market is more favorable and provides conducive environment for new issues. This result is not consistent with previous IPO literature in the long-run except for the studies by Dutta (2016) and Bird and Ajmal (2016). The logic behind such type of findings is (a) AIM provides the more favorable environment, (b) no strict criterion to qualify for listing on AIM and ongoing trading, and (c) alternative market is dedicated to small enterprise and cross-listed IPOs. Also, the size of the firm has emerged as a robust predictor of the long-run performance of IPOs which shows that large-sized firms underperform less while the small-sized firms underperform more. Previous studies document the positive relationship between underpricing and firm size. This reflects that large-sized firms earn higher abnormal returns on a listing day (Sahoo and Rajib 2010; Diro Ejara and Ghosh 2004; Mumtaz, Smith, and Ahmed 2016). In short, large-sized firms provide a higher probability of subsequent correction of share prices in the long-run which results in substantial underperformance of new issues.

Contrary to this, underpricing is negatively associated with long-term performance. If the underpricing is higher than the aftermarket performance of the IPOs will be lower (Mumtaz, Smith, and Ahmed, 2016; Pandya, 2016). As a result, the net impact of firm size on the long-run performance of IPOs is negative.

Last but not least, underpricing, financial leverage, hot IPO activity period, and the ratio of independent non-executive directors from issue-specific, firm-specific, market-specific and governance related characteristics respectively appear as potential factors affecting the long-run performance of IPOs. Higher the underpricing, more the possibilities of subsequent correction to settle down the share prices in the long-run which results in substantial underperformance. IPOs going public in the hot issue period are overly optimistic growth prospects perform substantially worse than the other IPOs (Mumtaz, Smith, and Ahmed 2016). If the firm has a more structured and independent board, then the long-run performance would be lower. This hypothesis supports the agency hypothesis explaining the role of board independence in the long-run performance of IPOs.

In short, the alternative investment market is functioning as an uplifting forum for SMEs. In the main market, these firms are not obtaining positive returns and their growth is also limited. Small firms face difficulty to earn positive abnormal returns in the main market. Ritter, Signori, and Vismara (2012) shed light on the phenomenon by exploring three reasons of low returns of small firms in the main market including (a) regulatory overreach- compliance costs of being a public listed company are higher in the main market, (b) market conditions hypothesis- small IPOs has been depressed by lower market valuations and (c) economies of scope- small firms being acquired. The theoretical insights of our study are very useful for firms and portfolio investors in the second market. For future research, the role of corporate governance in the long-run performance of IPOs may be examined due to weak governance mechanism in the second market.

6. Conclusion

The study is deliberated upon to test the proposition of the long-run pricing performance of IPOs listed in the second market. For this purpose, the data of 292 IPOs has been used to test the proposition by applying the EBA technique. We report that IPOs earned significant positive abnormal returns for 36 months while the size of the firm has emerged as a robust predictor of long-run performance. The higher level of underpricing leads to a higher probability of subsequent price correction in the long-run thereby resulting underperformance of IPOs. Contrary to this, this study found the lower underpricing in the short-run and higher over performance in the long-run. We identified that underpricing, financial leverage, hot IPO activity period, and the ratio of independent non-executive director from

issue, firm, market, and governance-related characteristics respectively appear as potential factors affecting the long-run performance.

Our evidence also supports the window of opportunity hypothesis, entrenchment theory, and fads hypothesis. It deduces that if the firm is going in public during the favorable market condition, it generates undue optimism in prospective investors about the performance of IPOs. In other words, aftermarket pricing performance of IPOs depends on the information about the intrinsic worth of IPO and investor's sentiment, which is publicly available in the market at the time of the offering. In short, noise traders are presumed to be higher return taker at the time of offering. They are more convinced or ready to pay the high prices (concerning the intrinsic value of IPO shares) to acquire the shares sold in the offering. Likewise, interconnections of board members with other stakeholders of firms, such as investors, investment banks, and regulators will positively influence the performance of an IPO firm.

For instance, independent board members with strong industry linkages can enhance the overall pace of firm for human and social capital and can also develop substantive functioning of the firm by providing access to information and strategic partnership with potential investment pools. This leads to the projection of optimistic views and perceptions among these stakeholders concerning the long-run performance of IPOs. Board members with social interlocks can also help to reduce "legitimacy deficit" that IPO firms suffer in the eyes of prospective investors and market analysts since "responsible look" of a firm represented on the board gives substantiation to the rest of investor's community of the intrinsic soft value and worth of the organization. Secondly, an empowered board can also eliminate the monopolist interference and involvement of management in the strategic decision making of a firm, which will ultimately add value in the long-run performance of IPOs. It is therefore suggested that the ratio of the independent non-executive director may be extended to get more fruitful results in the long-run. These findings suggest that prospective investors can develop and diversify their portfolio in an alternative market. The findings of the study have also practical value for those investors who are especially interested in earning abnormal excess returns in an alternative market.

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Dugoročna stabilnost razine cijena lokalnih i dvostrukih inicijalnih javnih ponuda (IPO-a) na tržištu alternativnih ulaganja

Abdul Wahid[1], *Muhammad Zubair Mumtaz*[2]

Sažetak

Ranija istraživanja potvrđuju da su inicijalne javne ponude (IPO) kratkoročno podcijenjene, a dugoročno daju slabe rezultate. U gotovo svim studijama istraživači analiziraju rezultate uspješnosti IPO-a koristeći skupove podataka visoko likvidnih tržišta. Međutim, cjenovno ponašanje IPO-ova na tržištu alternativnih ulaganja (AIM) je drugačije. S razlogom se očekuje da će se cjenovna uspješnost IPO-a na AIM-u značajno razlikovati od performansi IPO-a na tradicionalnim tržištima, ponajprije zbog smanjene likvidnosti AIM ponude, kao i zbog oskudnih informacija u usporedbi s tradicionalnim tržištima. Da bi testirali svoje tvrdnje, odabrali smo s popisa AIM-a 292 IPO-a u razdoblju između 2001. i 2016.godine i primijenili analizu ekstremnih granica (EBA) kako bismo utvrdili čimbenike koji utječu na dugoročne performanse. Ovo istraživanje potvrđuje da na alternativnim tržištima ulagači ostvaruju značajne pozitivne prinose ukoliko zadrže dionice u periodu od tri godine, a cjenovne razlike ovise o veličini poduzeća. Iz navedenog proizlazi da se ulaganje u mala poduzeća čini profitabilnijim u usporedbi s investicijama u velika poduzeća u AIM-u. Nadalje, u ovom radu ispituju se statistički dokazi vezani uz pitanje mogu li prvi ulagači u IPO u dugom roku očekivati prekomjerno visoke prinose.

Ključne riječi: *IPO, dugoročna stabilnost razine cijena, analiza ekstremnih granica, tržište alternativnih ulaganja (AIM)*

JEL klasifikacija: *G12, G14, C1*

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Reexamination of the determinants of firms' growth in periods of crisis[*]

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Abstract

The recent financial crisis has underlined the necessity to recognize why some firms and economies are more severely affected while others are more resilient to crisis and how different financial characteristics affect firms' growth path. In order to explore these issues empirically, we reexamine the determinants of corporate growth during the crisis and post-crisis period (2008-2013) on the sample of 10 Central and East European countries belonging to two different regional groups – "Visegrad four" and the group of former Yugoslavian countries. Our analysis covers the sample of 3,660 firm-year observations. We model firm growth as a function of two country-specific variables (inflation and capital market liquidity) and four company-specific variables (financial leverage, asset turnover, profit margin and ratio between cash flow and assets). Our study indicates the importance of infrastructure prerequisites and macroeconomic policies for the companies' growth in the conditions of crisis. Our results reveal a specific relation between leverage and firm growth during the crisis period, whereby the impact of leverage is perceived by a comprehensive result of the degree of firm indebtedness, the level of capital market development, the position of banking sector and the cost of debt. Finally, our results show some intriguing patterns in firm profitability – growth as well as asset efficiency – growth relation.

Key words: *firm growth, crisis, capital market, country-specific variable, company-specific variable*

JEL classification: *G30, N20, M20, P30*

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1. Introduction

In the wake of the global financial crisis, the issue of firm growth becomes a new dimension. The environment characterized by the growing risks, investors' hesitation and depressed investments, limited availability of financial sources, rising financial expenses and cost of capital, implies the decline of firm output. Consequently, firm growth is disrupted and negative growth rates are frequently associated with the crisis. Recovery of enterprises must be accompanied by removal of structural imbalances, creation of a simulative business environment and conditions for sustainable growth at the level of the individual companies. All the above mentioned implies the need for reexamination of the impact of the key determinants of the company growth.

Even though a large body of literature has been concerned with the examination of factors influencing firm growth, these studies mainly cover non-recession period. This study aims at providing insights to bridge this gap by offering evidence for the financial determinants of firm growth in the context of two groups of economies at the different stage of development (Visegrad group and ex-Yugoslav countries) during the crisis and post crisis period. Both groups of national economies were extremely vulnerable to economic shocks. However, differences in country specific settings appear to have important impact of firm' capacity to resist the recession.

In this paper we test impact of key independent variables on firm growth which is measured by a change in the asset value in the current in relation to the previous year. The independent variables are divided into two groups: macro variables (reflect the business environment in which companies operate) and micro variables, i.e. the determinants of growth at the company level.

Access to financial resources depends on the level of liquidity of a country's financial sector. As financial liquidity reduces the cost of external financing to financially dependent firms, it has a substantial supportive influence on the rate of firm growth (Rajan and Zingales, 1998). The economic crisis causes an increase in the cost of capital and reduces investments, which adversely affects the firm growth. Narrowing of competition in the financial markets led to the lack of financing sources, the increase of cost of borrowing and the falling of profitability. Overall, all these have restrictive impact on firm growth. Based on the theories and the previous empirical findings, we come to the **Hypothesis 1:** *Capital market liquidity has a positive impact on firm growth.*

Strengthening of the national currency is not favorable for exporters, since it raises the price of exported products; the competitiveness of export-oriented enterprises is falling, while the current account deficit is growing. On the other hand, a weakening of the national currency causes the introduction of the currency clauses and the emergence of negative exchange differences in borrowing in foreign currency,

which results in increasing of the total financial expenditures and reducing the yield for owners. In the original study on sustainable growth, Higgins (1977) and Higgins (1984) conclude that inflation has a negative impact on sustainable growth. The well-known Tobin's study (1965) points to a two-sided influence of inflation on firm growth. Negative effect is a consequence of a decline in the sales to asset ratio. On the other hand, so-called *Tobin effect* describes a possible positive impact on growth by lowering real interest expense. Based on the theories and the previous empirical findings, we come to the following **Hypothesis 2:** *Inflation has a neutral impact on firm growth*.

According to theory, the increase in financial leverage leads to the increased profitability and growth as long as the return on asset is higher than the cost of capital. Knudsen (2011) gives evidence that high pre-recession growth and pre-recession debt ratio make firms more vulnerable to recessions. Irrespective of the fact that in times of economic crisis there is a reduced possibility of borrowing due to the increased financial risk and an increase of the cost of capital, generally it is logical to expect a positive effect of financial leverage on growth. Based on theory and previous findings, we propose **Hypothesis 3:** *The leverage of a company has a positive impact on its growth*.

Under normal business circumstances, it is realistic to expect a positive correlation between business efficiency and growth. In times of economic crisis, due to the decline in operating activity which is not accompanied by the same decline in fixed costs, expected slower growth of revenues from sales would result in a decline in profit margins and a drop in efficiency. These processes, as a result of the reduction of available internal sources of financing, could narrow space for sustainable growth. Accordingly, **Hypothesis 4:** *The efficiency ratio of a company, measured by assets turnover ratio, has a positive impact on its growth*.

Different theories on growth and profitability offer contrasting perspectives of the relationship between them (the Theory of financial constraints (Jang and Park, 2011), the Agency theory (Soininen et al., (2012), the Kaldor and Verdoorn's Law in economics (Kaldor, 1996), (Verdoorn, 1949). In agreement with the majority of the academic proofs, we are testing the validity of the positive effect of profitability on firm growth and formulate **Hypothesis 5:** *Profitability has a positive impact on firm growth*.

Internal finance plays an important role in achieving the growth of company by overcoming financial constraints. According to a hierarchy theory (Myers and Majluf, 1984), firms prefer to fund themselves with resources generated internally before resorting to the market. In these circumstances, firms with large cash flows will grow faster, and thus a positive correlation between cash flow and firm growth is expected. However, during the economic crisis, especially in countries where capital markets are inactive and where bank loans are expensive, reluctance of

investors due to unfavorable conjuncture may affect that the increase in cash flows does not lead to growth. We propose **Hypothesis 6:** *A positive correlation between cash flow and firm growth is expected*.

By testing the above cited hypotheses, our research points out to the importance of infrastructure prerequisites and macroeconomic policies for the companies' growth in the conditions of crisis, and reveals some specific relations between firm financial characteristics and growth during the crisis period. The contributions of the paper are twofold. Firstly, to the best of our knowledge this is the first attempt of a comparative analysis of a hierarchical set of determinants of firm's grow in the specific sample of two groups of CEE countries. Secondly, we proved the evidence that some determinants of firm growth may have different importance in different country settings and different economic cycles.

The paper is structured as follows. A brief literature review is given in Section 2. The descriptions of methodology and the context of analysis are presented in Section 3. Section 4 describes the dataset and the research analysis, while Section 5 discusses the regression findings. In the last section we provide conclusions, emphasize some limitations of the study and propose the objectives of future research.

2. Literature review

A wide range of firm growth determinants is analyzed by several theories, such as neoclassical economic theory, behavioral economic theory, stochastic growth theory, and various models of learning and selection, which are linked to the stochastic firm growth theory. The main implication of the classical model is that firm growth is always limited by the optimum firm size. Behavioral approach and its "managerial theory" suggest that firms can be oversized due to the division between the control and ownership structures. Behaviourist economists (Baumol, 1959; Penrose, 1959; Chandler, 1962) explain that managers maximize their own satisfaction instead of the firm's value. Stochastic growth models (Gibrat, 1931; Champernowne, 1973), aim at identifying the presence of stochastic factors that influence firm behaviour and to study the inequality and concentration among firms. According to Gibrat (1931) there is no relationship between the size of a firm and its growth. Firm growth is, in reality, the outcome of a multiplicative process and both internal and external factors that affects the initial size. The main characteristics of the learning and selection models are that they link firms´ chances to survive with the dynamics of firms and their level of efficiency (Jovanovic, 1982; Ericson and Pakes, 1998; Geroski, 1995).

In different theories, firm growth is considered to be a consequence of numerous factors, such as demographic characteristics, financial factors, research and development and innovation activity. At the macro level, the most explored have

been: gross domestic product, inflation, corporate income tax rate, size of the market, or level of stock market development. Empirical studies on the firm growth and its determinants have been realized in almost all European countries, in different periods and taking into account various samples. For the purpose of this study, the most valuable are the results of the papers concentrated on firms' growth in circumstances of crisis (Gertler and Gilchrist, 1994; Hardwick and Adams, 2002; Fort et al., 2013; Geroski and Gregg, 1996; Knudsen, 2011; Kim and Barrett, 2002) as well as the studies done in the CEE countries (e.g. by Grinberger and Nehrebecka, 2015; Strielkowski, 2012; Studena, 2004; Mrak et al., 2000; Konings and Xavier, 2002).

A comparative analysis regarding firm growth determinants in CEE economies has been performed in several papers. Burger et al. (2017) analyze what kind of CEEs firms' characteristics makes some of them more resilient to crisis than the others. Mateev and Anastasov (2010) emphasize that beside size and age, other firm specific characteristics such as leverage, current liquidity, future growth opportunities, internally generated funds, and factor productivity are important factors in determining a firm's growth and performance. Perić and Vitezić (2016) examine whether growth rates of manufacturing and service industries are independent of firm size during the period of economic crisis and show that turnover growth is positively associated with companies' size during the observed period of economic recession 2008–2013. Overall, the comparative studies on determinants of firm growth in the CEE countries are limited. This study aims to fill a gap in the literature by reexamining the determinants of firm growth in the context of two groups of economies at the different stage of development during the crisis period, 2008-2013.

3. Methodology

The study of the impact of economic crisis on individual national economies and broader regional groups of countries which experienced similar paths during transition and the prospects for their recovery and achievement of desired growth rates, raises important growth-related issues: Do the key determinants of growth, defined in various research studies, have the same impact on growth in normal business conditions and in times of crisis? Do the key determinants of growth have the same effect on growth in all transition countries, regardless of the speed of transition, their financial strength or their ability to deal with the consequences of the crisis?

There is no agreement in the existing literature on the firm growth measurement. Garnsey et al. (2006) emphasize that firm growth can be measured in terms of inputs (investment funds, employees), in terms of the value (assets, market capitalization, economic value added) or outputs (sales revenues, profits). Additionally, growth can be measured in absolute or relative terms. Growth in sales, total asset and employment, as the most used ways of operationalizing firm growth, are according

to Freel and Robson (2004) relatively uncontroversial (methodologically) and easily available, resulting in the increase of the scope for cross study comparability. In order to explore its determinants, we measure firm growth by a relative change in the asset value in the current in relation to the previous year. By examining the relative changes of total assets as a measure of growth, we capture a broad range of activities undertaken by the firm. As firms grow, they expand not only their physical capital, but also gross working capital. Moreover, examination of the change in total assets enables us to make a prediction about the relationship between firm growth and internal finance. By choosing relative change in the asset value as the dependent variable, we stay close to the model of Glancey (1998) and Norvaisiene and Stankeviciene (2007).

Our approach in this study is to relate firm growth not with the traditional determinants (such as age or size) but to other specific determinants associated with a firm's financial constraints during crisis period. These constraints come both from the environment (such as challenges driven by inflation and the capital market liquidity) and internally, from a firm's financial position and strength. In line with Manova et al. (2009) and Burger et al. (2013), we examine indebtedness as one of the main factors that restrains firms' growth in economic recession. Following Aggarwal (2015), we create a variable that records the effectiveness with which a firm's management uses its assets to generate sales in periods of crisis. In our model firm profit margin captures the fundamental factor that impacts the long-term growth prospects of a company and defines the opportunities for investments. In order to capture the influence of internally generated capital on firm growth during crisis period, a variable cash flow to total assets is constructed.

In order to empirically test the relationship between firm's growth and six independent variables, we employ the model in line with Aggarwal (2015), and Matev and Anastasov (2010):

$$GR_{it} = \alpha + \beta_1 IR_{it} + \beta_2 CML_{it} + \beta_3 FL_{it} + \beta_4 AT_{it} + \beta_5 PM_{it} + \beta_6 CF_{it} + \varepsilon_{it}$$

where GR_{it} – firm's growth represented by the year to year change in total assets of i-firm in t-year, IR_{it} – inflation rate (%) of country, where i firm is located in t-year, CML_{it} – capital market liquidity in t-year measured for the stock exchange where company i is listed, FL_{it} – financial leverage of i-company in t-time, AT_{it} – firm i's asset turnover in t year, PM_{it} – company i's profit margin in t-year, CF_{it} – cash flow to total assets of i firm in t year.

The structure of our dataset permits the use of panel data methodology which can control for firm heterogeneity, and reduce collinearity among the variables that are contemplated (Arellano and Bond, 1991). The model is employed using a panel regression approach over three samples: general, ex-Yugoslavian and Visegrad sample. Panel regression allows us to control variables that change over time

alongside with the business cycle but not across companies. For each sample, we performed the Hausmann test in order to determine if a model with fixed or random effects is more appropriate. In the case of all samples, the Hausmann test suggests that the model with entity fixed effects is more appropriate. We tested model for multicollinearity using VIF (variance inflation factor) and the results show that (all VIFs are between 1 and 10), there is no collinearity problem between variables.

4. Empirical data and analysis

We investigated the determinants of firm's growth in the crisis and post-crisis period over a sample of listed companies from Central-Eastern European countries. All countries in the sample can be classified as emerging economies and we believe that results of this study can be generalized to some extent to companies from other emerging economies.

Our research includes two internally relatively homogeneous groups of countries: the countries belonging to the so-called "Visegrad Group" (Poland, Hungary, the Czech Republic and Slovakia) and the countries that constituted the former Yugoslavia (Bosnia and Herzegovina, Croatia, North Macedonia, Montenegro, Slovenia and Serbia). The countries within the same group have similar cultural characteristics, similar geographical and geopolitical positions and share a common tradition in many areas. The groups differ from each other in terms of the speed of transition, time of the accession to the European Union, efficiency in developing market and regulatory institutions, political stability, etc.[4]

As far as economic performance is concerned, there are also significant differences between these groups of countries. The Visegrad Group ("Visegrad Four" or simply "V4"), was formed with the aim of strengthening regional cooperation and collaboration in the fields of common interest. The V4 joined the European Union in 2004. The members of this group had completed the transition process more quickly, as measured by the speed of reaching the activity volume from the period immediately preceding the transition. After the initial phase marked by a decline in economic activity and negative GDP growth rates which had lasted until 1992, these countries rather quickly entered the zone of relatively stable GDP growth and remained there until the onset of the economic crisis whose effects began to manifest themselves in the financial statements of companies starting from 2008 (Figure 1).

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[4] Additional research on social, organizational, ecological and cultural characteristics of observed countries could offer more detailed insight into determinants of growth. However, the research on those variables is beyond the scope of this paper. The main idea of the paper is to reexamine the financial determinants of firms' growth in periods of crisis. Thereby, we examine the effects of frequently used financial determinants in order to establish whether the impact of those determinants changes in crises compared to stable business environment.

Figure 1: Growth in real GDP – Visegrad Group
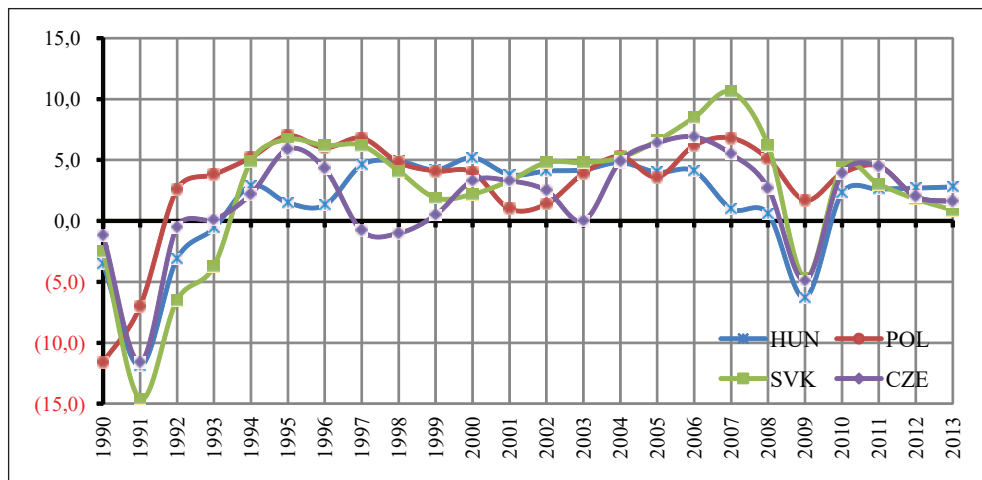
Source: Author's calculation according to data obtained from Transition Reports 1999-2013 and
        Eurostat

On the other hand, the transition period lasted much longer in the countries that constituted the former Yugoslavia (hereinafter referred to as the ex-YU countries). These countries are also in different stages of the European integration process. Real GDP growth rates were very unsteady, with the differences between some countries that make up the ex-YU group being far more pronounced compared to the countries belonging to the V4 (Figure 2).

Figure 2: Growth in real GDP – EX-YU countries
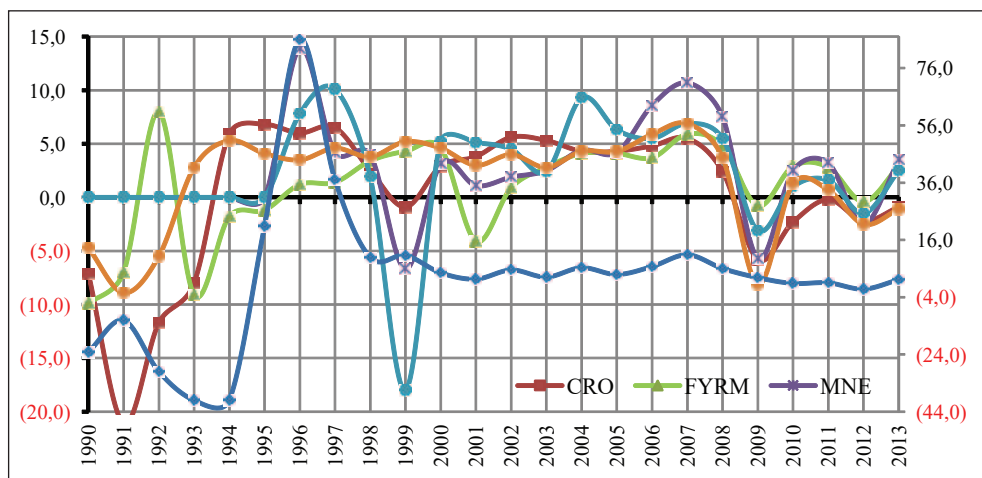
Source: Author's calculation according to data obtained from Transition Reports 1999-2013

However, a long period of coexistence within the common state (SFRY), close historical and cultural ties, shared tradition in many areas, geographical proximity and economic relations have contributed to the homogeneity of this group of countries, at the same time making it different enough from the V4.

The recovery, which had been announced in 2010 and 2011, did not result in the desired growth rates in either of the groups of countries by 2013. Generally speaking, the growth was quite modest from 2011 to 2013. For the purpose of our analysis, we decided to observe precisely the period between 2008, when the effects of the crisis had first appeared in the financial statements, and 2013, when the growth rates from the pre-crisis period had not been reached yet (with the exception of Hungary whose growth rate was very low in 2007), which can be clearly seen in Figure 3.

Figure 3: GDP growth 2007 vs 2014
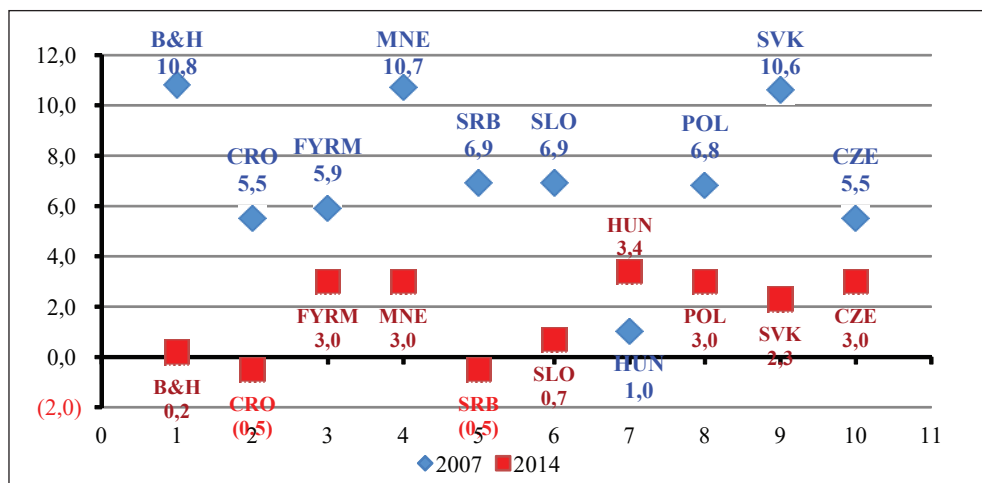
Source: Author's calculation according to data obtained from Transition Reports 1999 and 2013

That is the case with both groups of countries. The period from 2008 to 2010, in which negative growth rates were recorded in 2008 and 2009, and the period of sluggish growth from 2010 to 2013 seems very interesting to observe.

Due to a growing level of debt and increased financial risks, the credit ratings of most ex-YU countries were downgraded. Bearing in mind their difficulties in maintaining fiscal balance, investment decline and increasing indebtedness, these national economies were extremely vulnerable to economic shocks. On the other hand, relatively stable macroeconomic environment, more efficient implementation of structural reforms, greater commitment to the development of market and regulatory institutions and improved market efficiency resulted in the enhanced

competitiveness of the V4 countries. Such circumstances led to a greater resistance to negative effects of the economic crisis.

The decline in economic activity often leads to the growth of the debt, the fall in profitability and the employment as well as to the increase of the bankruptcy risk. In addition, the decline in the volume of business activity limits the possibilities for financing that would correspond to the target capital structure, which leads to slow or negative growth. Consequently, in such new circumstances there is the need to review the impact of the key determinants of the company growth.

We use annual data from financial statements (acquired from Amadeus database), and macroeconomic data, which were acquired in Eurostat and World Bank database, websites of selected national banks and Federation of European Securities Exchanges database and official web sites of various stock exchanges. Our sample is limited to non-financial companies listed on the stock exchange. Thereby, companies whose shares were not traded in the analyzed period are excluded from the sample. Further, we limit our sample to medium and large-sized companies with more than 10 million euros of total assets.[5] Firms with negative book value are also excluded. The final sample consists of 3,660 firm-year observations, from which 1,736 are included in ex-Yugoslavian and 1,924 in Visegrad sample (Table 1).

Table 1: Sample size and structure by country and group

Country	Stock Exchange	Initial sample	2008	2009	2010	2011	2012	2013	Total
Bosnia and Herzegovina	Sarajevo SE and Banja-Luka SE	72	71	71	71	71	72	71	427
Croatia	Zagreb SE	102	99	100	100	98	98	97	592
North Macedonia	Macedonian SE	13	0	0	0	0	0	0	0
Montenegro	Montenegro SE	20	13	15	18	20	19	1	86
Serbia	Belgrade SE (BGSE)	77	77	76	76	76	77	76	458
Slovenia	Ljubljana SE	30	29	29	29	30	29	27	173
No. of observations		314	289	291	294	295	295	272	1 736
Czech Republic	Prague SE	7	7	7	7	7	7	7	42
Hungary	Budapest SE	16	13	13	15	16	16	16	89
Poland	Warsaw SE	307	216	240	278	307	307	307	1 655

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[5]   We opted for 10 million euros of total assets as the minimum threshold. Since the thresholds in analyzed countries differ, we decided to include all large and medium-sized companies that satisfy this condition. Since we measured firm growth by growth of assets (dependent variable), we used assets alone as the criterion for measurement the size of the company. Bearing in mind all of the above mentioned, as well as the fact that only the liquid companies on regulated segments of the capital markets remained in the sample, we consider that the formed sample is representative enough for generalization of conclusions on companies listed on the stock exchange in emerging markets.

Country	Stock Exchange	Initial sample	2008	2009	2010	2011	2012	2013	Total
Slovakia	Bratislava SE	24	21	21	24	24	24	24	138
No. of observations			354	257	281	324	354	354	354	1 924
No. of observations (Total)			668	546	572	618	649	649	626	3 660

Source: The data were obtained from Amadeus database according to prevoiusly defined crietria

The focus of the study is on the crisis and post-crisis period and therefore the analyzed period covers six years: 2008-2013. The descriptive statistics of both dependent and explanatory variables are shown in Table 2.

Table 2: Descriptive statistics

TOTAL SAMPLE								
Variables	Min.	Max.	Mean	Median	St. Dev.	Variance	Skewness	Kurtosis
Asset Growth	-3.062	1.000	0.043	0.026	0.220	0.049	-2.654	39.940
Inflation rate (%)	-0.400	12.200	3.490	3.700	2.506	6.228	1.341	5.354
Capital Market Liquidity	0.004	1.572	0.136	0.153	0.152	0.023	4.967	38.641
Financial Leverage	0.001	1.810	0.444	0.435	0.221	0.049	0.278	3.085
Asset Turnover	0.000	11.259	0.864	0.697	0.798	0.636	2.993	21.345
Profit Margin	-1.000	1.000	0.029	0.028	0.241	0.058	-0.826	11.895
Cash Flow to Total Assets	-2.004	1.376	0.056	0.050	0.099	0.010	-4.654	116.038
ex-Yugoslavian sample								
Asset Growth	-3.062	1.000	0.019	0.006	0.180	0.033	-3.431	59.559
Inflation rate (%)	-0.400	12.200	3.888	2.200	3.326	11.063	0.956	2.993
Capital Market Liquidity	0.010	0.175	0.054	0.040	0.041	0.001	1.849	5.892
Financial Leverage	0.001	1.000	0.411	0.393	0.239	0.057	0.329	2.293
Asset Turnover	0.000	7.833	0.648	0.505	0.593	0.351	3.115	23.180
Profit Margin	-1.000	1.000	0.015	0.016	0.240	0.570	-0.567	10.981
Cash Flow to Total Assets	-2.004	1.376	0.051	0.044	0.096	0.009	-5.051	148.747
Visegrad sample								
Asset Growth	-3.162	0.918	0.065	0.056	0.245	0.062	-2.441	31.879
Inflation rate (%)	0.600	6.300	3.131	3.700	1.301	1.692	-0.785	2.563
Capital Market Liquidity	0.004	1.572	0.210	0.179	0.176	0.031	4.901	31.589
Financial Leverage	0.008	1.810	0.474	0.470	0.198	0.039	0.420	4.466
Asset Turnover	0.001	11.259	1.067	0.913	0.905	0.819	2.769	18.828
Profit Margin	-1.000	1.000	0.042	0.039	0.242	0.059	-1.073	12.938
Cash Flow to Total Assets	-1.211	0.625	0.072	0.073	0.108	0.016	-3.910	47.072

Source: Authors´calculations

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In order to test interdependence between variables, we calculate correlation matrix over a general sample consisted of ex-YU and Visegrad companies (Table 3) and show that there is no strong correlation between any of investigated variables. The results within ex-YU or V4 sample provide similar results showing lack of correlation between any of two pairs of variables.

Table 3: Correlation matrix of independent variable and six independent variables

Variables	GR	IR	CML	FL	AT	PM	CF
GR	1,000						
IR	0,004	1,000					
CML	0,016	0,036	1,000				
FL	0,000	0,058	0,081	1,000			
AT	-0,162	0,107	0,148	0,263	1,000		
PM	0,039	0,077	0,051	-0,249	0,032	1,000	
CF	-0,219	0,090	0,103	-0,208	0,236	0,526	1,000

Source: Authors´ calculations

The established systematization of explanatory variables, including country and company-specific variables, has largely determined the order of topics that will be discussed in this part of the paper. The analysis of the variables belonging to the first group aims to draw attention to the importance of infrastructure prerequisites and macroeconomic policies for the companies' growth in the conditions of crisis, while the insight into the variables of the second group is intended to shed some light on the impact of individual characteristics of companies on their growth. In all the models presented in Table 4 F-test is lower than 0.05, which demonstrates that all coefficients in the model are different from zero.

R-squared and adjusted R-squared show that model explains more than 65% (55%) i.e. 43% (31%) of variance of firm's growth for Visegrad and ex-Yugoslavian sample respectively. The model exhibits almost the same explanatory power in the case of a total sample, respectively 43% (R-squared) and 31% (adjusted R-squared). The difference in explanatory power suggests that variables diversely affect a firm's growth in ex-Yugoslavian and Visegrad countries.

Table 4: Regression model results for three samples: general, ex-Yugoslavian and Visegrad countries

Independent variable	General sample				ex-Yugoslavian countries				Visegrad countries			
	Coeff.	Std. error	t-statistic	p-value	Coeff.	Std. error	t-statistic	p-value	Coeff.	Std. error	t-statistic	p-value
(Constant)	0.88701	0.095	9.37	0.000	1.02108	0.113	9.03	0.000	0.29298	0.061	4.77	0.000
IR	0.00662	0.007	0.98	0.328	0.00107	0.008	0.14	0.889	0.02444	0.007	3.73***	0.000
CML	0.58122	0.192	3.03***	0.002	2.05754	0.464	4.43***	0.000	0.03914	0.063	0.62	0.535
FL	-0.07696	0.190	-0.40	0.686	-0.20827	0.236	-0.88	0.377	0.34831	0.111	3.14***	0.002
AT	-1.15973	0.062	-18.56***	0.000	-1.41900	0.080	-17.64***	0.000	-0.58062	0.032	-17.94***	0.000
PM	0.62448	0.099	6.32***	0.000	1.01057	0.135	7.49***	0.000	-0.07213	0.046	1.57	0.118
CF	-2.32204	0.229	-10.13***	0.000	-3.38222	0.113	9.03***	0.000	0.68955	0.061	4.77***	0.000
Prob> F	0.0000				0.00000				0.0000			
R-squared	0.4380				0.43930				0.6599			
Adjusted R-squared	0,3155				0.31710				0.5581			
Root MSE	0.7085				0.70770				0.1882			

Notes: *** Significance at 1% level, ** significance at 5% level, * significance at 10% level.

Source: Authors' calculations

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5. Results and discussions

The results of the analysis indicate that over the observed period inflation (as measured by the median) was slightly higher in the V4 (3.70) than in the ex-YU countries (2.20). In the case of ex-YU countries, the frequency distribution curve is skewed to the right, which means that the mean is sensitive to extreme values that appear at the right end of the curve, while the situation is completely reverse when it comes to the V4 countries. The results of regression analysis show that the impact of inflation on growth is statistically significant at the level of 1% only in the case of the Visegrad Group.

On the other hand, despite a lower median, standard deviation and variance are many times higher in the ex-YU countries compared to the Visegrad Group, which indicates a greater volatility of inflation expectations and increased risk. Due to the unpleasant experience of hyperinflation during the 1990s, price stability has gained particular importance in the ex-YU countries. More pronounced fluctuations in prices increase the uncertainty of national economies making them less attractive to both domestic and foreign investors. Besides, the key policy rates, which were many times higher in the ex-YU countries than in the EU, had an adverse impact on borrowing terms and conditions. The high cost of capital resulted in low levels of return on equity, quite often negative. We believe that the investors' abstinence from making substantial investment under such conditions was one of the reasons why inflation had neutral impact on growth.

A positive correlation between the capital market liquidity and growth exists only in the case of the ex-YU countries. In this regard, we must be aware of the fact that the liquidity of capital markets of the V4 is significantly higher (mean = 21.0%) relative to the ex-YU countries (mean = 5.4%). The capital markets in ex-YU countries have failed to reach a desired level of attractiveness to investors, especially after the first waves of privatization. Insufficient liquidity leads to increased investment risk and higher transaction costs, at the same time providing speculators with the opportunity to achieve greater returns than on liquid markets. Due to extremely expensive banking sources of funding and lack of foreign investment, companies are forced to seek alternative sources of funding. Since our analysis does not cover all companies, but predominately those that are to some extent involved in capital markets, it is realistic to expect that at least some of them raise funds through primary issue of shares and corporate bonds. Therefore, despite the risk aversion of investors, it comes as no surprise to find out that the increase in liquidity contributes to the companies' growth.

Perhaps more surprising is the finding that the liquidity of capital markets does not represent a statistically significant variable of growth in the V4 countries. It seems that this factor is becoming less relevant to the companies' growth in the conditions of an easier access to alternative sources of funding and availability of

additional external sources of funding under more favorable terms. Furthermore, it follows that the investors in more developed capital markets are more cautious in the conditions of crisis than the investors oriented to less developed markets. In the early stage of development, capital market liquidity is of crucial importance. Above a certain point of development capital market liquidity is apparently of lesser importance for the firm's growth.

When it comes to the V4 countries, the analysis has shown a positive correlation between financial leverage and companies' growth. The average level of debt of these countries amounts to around 47%. A positive effect of financial leverage occurs when companies have access to alternative sources of funding and can borrow under favorable terms to finance profitable projects. Consequently, a return that exceeds the costs of debt is distributed to shareholders, net income is increasing, which enhances borrowing capacity and ensures sustainable funding of asset growth. Such trends stimulate the growth of companies.

Regression analysis indicates no statistically significant correlation between financial leverage and growth in the case of ex-YU countries. This is quite unexpected given the fact that these companies are less leveraged (mean = 41.1%, median = 39.3%), giving more room for additional borrowing. Such a result seems surprising only at first glance. A negative effect of financial leverage happened to the great number of companies that constitute this group. Lack of alternative sources of funding and the consequent high interest rates on bank loans, inclusion of a currency clause and considerable changes in foreign exchange rates often significantly reduce net income of companies and push them into the zone of loss. In such circumstances, net income is shrinking, while increasing risk leads to a higher cost of capital. In general, companies that belong to different analyzed groups also have different structures of operating and financial expenses, but the companies from the ex-YU countries are to a much greater extent burdened with financial expenses (Malinić and Milićević, 2013). We think that these trends are the main reason why financial leverage has not been a statistically significant determinant of growth.

Descriptive statistical analysis shows that during both the crisis and the post-crisis period the values of return on assets (profit margin multiplied by asset turnover) were very low, amounting to 4.5% for the V4 and to only 0.98% for the ex-YU countries. As far as profit margin is concerned, a statistically significant positive correlation between profit margin and growth exists only in the case of ex-YU countries. On the other hand, asset turnover is negatively correlated with growth at all sample levels (ex-YU, V4, and total).

From the theoretical point of view, a positive correlation between profit margin and growth is unequivocal (Higgins, 2009: 127–131). Higher profit margins imply higher income, greater availability of internal sources of funding and increasing

borrowing capacity, which generally should have a positive impact on growth. This is even more obvious in the countries with less developed capital markets owing to the fact that in the absence of more attractive external sources of funding companies often have no choice but to rely on internally generated sources and reinvest the largest portion of their income. Since profit margins tend to be rather low in the years of crisis, the growth that can be achieved in this way is modest. On the other hand, the absence of correlation between profit margin and growth in the case of Visegrad Group may be due to substantial dividend payments and greater reliance on external sources of funding.

In the context of this research, it is more interesting to observe changes in asset turnover as a determinant of a company's profitability and growth. Turnover has a multiplier effect on return on assets, which means that an increase in turnover, coupled with stable profit margin, enhances profitability. The results obtained at all level (ex-YU, V4, and total) seem very surprising as they indicate that increased efficiency of asset management has a negative impact on growth. In order to better understand this trend, we should take into account two facts. First, average profit margins in each of analyzed groups of countries are very low; the analyzed sample includes some companies that achieved positive profit margins, but also a considerable number of those with negative profit margins. The potential presence of a negative effect of financial leverage is certainly one of the causes of such performance. Second, the above-mentioned multiplier effect of asset turnover on the rate of return works in both directions. When a rising asset turnover is accompanied by a negative profit margin, the rate of return will decline. Taking all this into account, we conclude that when there are companies with negative profit margins, an increase in asset turnover can trigger a decline in profitability, which in the conditions of scarce favorable external sources of funding and a negative effect of financial leverage will hamper growth. However, this issue needs extended investigation in further research.

Cash flow/Total assets ratio reflects a company's ability to finance growth from internally generated sources, thus, a positive correlation between this variable and growth is expected. This is confirmed only in the case of the companies belonging to the Visegrad Group. However, while interpreting these results it is necessary to bear in mind two facts. First, the research relates to the crisis and post-crisis period, when the real opportunities for growth were limited. Secondly, we have already pointed out that the V4 countries were in a much stronger financial position in the period before the economic crisis in relation to the ex-YU countries, i.e. less vulnerable to external shocks. It is also possible that the companies from different samples, depending on their financial predispositions, allocate cash flow in different ways.

As regards this particular case, we believe that the results that were obtained for the ex-YU countries were mostly due to different structures of cash inflows and

outflows from operating activities. For the purposes of this paper we defined cash flow as the sum of net income and depreciation costs, which is not so unusual practice. But, such an approach leaves out the changes in working capital and short-term liabilities from the cash flow from operating activities. In the conditions of crisis companies that do not have adequate financial strength (which are certainly more numerous in the ex-YU than in the V4 countries), are prone to encounter serious liquidity problems. Illiquidity, as a typical feature of insufficiently developed national economies in the conditions of crisis, leads to difficulties with the collection of receivables, reduction in inventory investment to the amount that is sufficient to maintain the existing activity level, and decrease in advance payments. In a situation like this, companies often unduly delay their payments to suppliers, which is especially common in the countries in which the bankruptcy legislation is not effective (Denčić Mihajlov et al., 2015). In these circumstances, the liquidity is what matters most, while the growth is of secondary importance. Therefore, it may happen that a decline in the cash flow as the sum of net income and depreciation costs is accompanied by a simultaneous increase in the cash flow from operating activities, which could lead us to different findings. The problem is that the increase in accounts payables beyond an acceptable level does not generate cash flow that could be sustained in the long run (Wild et al., 2004). Anyway, there is still room for further research in this field.

The refined economic insights of our study are as follows: first, the key financial determinants of growth in stable business conditions, examined in numerous research studies, can have a different impact on growth in times of crisis. Second, the impact of the same financial determinants of growth can have a different effect on the company growth in different business environments. Third, during crisis periods and the conditions of scarce favorable external sources of funding, investors need to be more cautious, since the asset turnover – profitability relation in combination with negative effect of financial leverage may inhibit firm growth. Fourth, during the crisis period, the capital markets in ex-YU countries became less attractive with higher uncertainty for investors and the increase of cost of capital. Our findings imply that policymakers in these countries should reconsider the key factors that fuel their economy, while firm managers should recognize and select those characteristics that predominantly cause their firm to grow better during crisis periods and under unfavorable macroeconomic conditions. Business managers should strengthen the firm internal finance and asset efficiency, and cautiously manage firm leverage. Policy makers, on the other hand, may pursue to deter a financial crisis and improve the economy by giving priority to capital market development, quality of institutional and political environment. As it is found in the case of V4 group, the importance of capital market liquidity is becoming less relevant to the companies' growth at the capital markets that do not face challenges regarding the availability, diversity, and pricing of financial instruments.

The evidence provided in this study is relevant to decisions aiming at improving the effectiveness of policy makers on capital market operations as well as management on firm's activity. The main contribution of the paper is applicable to selected Central and East European countries, but is broadly applicable to other developing market contexts. The fact that financial crises repeat (Reinhart and Rogoff, 2009) implies the need for the appropriate responses to them. To be able to better respond to the challenges of financial crisis in the future, we indicate that firms have to identify the significance of the impact of individual determinants of growth and, accordingly, to choose the types of behavior that will ensure greater resistance to the crisis situations and a faster recovery if they occur. The governments should build appropriate monetary policy and encourage capital markets development and greater market diversity, so that the next crisis will not produce harmful consequences on the firm growth and the sustainability of the whole economy.

6. Conclusions

This paper, being focused on the analysis of the impact of particular macro and micro variables on the companies` growth during the crisis and post-crisis period, led us to several conclusions.

Firstly, during the analysed crisis and post-crisis period (2008-2013) some of the very same determinants of growth at the company level and at the economy level may have a different impact on growth depending on the economic features of regional groups to which companies belong. Countries that managed to make more progress in transition, to implement structural reforms in a timely manner, to successfully complete the process of European integration, to develop institutional infrastructure on a sound basis (the Visegrad Group), were better prepared to cope with the crisis than others (the ex-YU countries). The first group turned out to be far more resilient to shocks arising from the crisis and succeeded in adapting more quickly, while the second group, due to its greater vulnerability, suffered more severe consequences of the crisis.

Secondly, there is a close relationship between the quality of business environment and macroeconomic policies on the one hand, and growth, on the other. Given that in the conditions of crisis the key policy rates are kept at low levels, export-oriented economies tend to benefit from moderate and stable inflation. In such circumstances, the competitiveness of both companies and national economies increases which positively affects growth. The findings relating to the Visegrad Group have confirmed this fact. On the other hand, a positive correlation between the liquidity of capital market and growth, found in the case of ex-YU countries, indicates that countries with undeveloped capital markets urgently need alternative sources of funding. In this respect, the creation of favorable business environment requires a clear vision

and strategy for capital market development, especially in the countries in which the banking sector holds a monopoly. In the period of the crisis, the daunting challenge for economic policy-makers is to act in time and to create macroeconomic environment which will energize growth, instead of limiting its prospects.

Thirdly, the availability of alternative sources of finance and lower cost of debt in the V4 countries, on the one hand, and a monopoly position of banking sector, expensive loans, significant changes in foreign exchange rates and the consequent high financial expenses in the ex-YU countries, on the other, clearly demonstrate the effects of borrowing on growth. The monopoly position of banking sector, exerted through expensive loans, jeopardizes the growth of national economies and, due to an unfair distribution of income between creditors and shareholders, discourages new investment and growth. Further, when profit margins are predominately negative (as is often the case in ex-YU countries during the crisis), an increase in asset turnover will lead to a fall in growth owing to the multiplier effect of asset turnover on the rate of return. Finally, a positive correlation between cash flow and growth that is detected at the V4 sample is quite expected. Also, there is no need to worry much about completely different results that were obtained for the ex-YU countries. Assuming that the trend in cash flow from operating activities is diametrically opposite to the trend in the sum of net income and depreciation, the findings would be expected to be different. However, this issue requires further exploration.

In the end, we should also outline some limitations of this research. First, in accordance with the study objectives, the obtained results are presented at the levels of two distinctive groups of countries. The fact that both groups include the countries which differ from one another in many ways, pinpoints the need for additional research in this field. Second, this research, unlike others that have focused exclusively on companies that constitute stock indices, has enabled us to increase sample and achieve a higher level of generalization of findings. However, we should bear in mind that the assets of companies that make up stock indices are the most liquid, particularly in less developed markets, which would potentially raise the quality of the analysis, but the possibility of generalization of findings would be reduced. Third, the explanatory variables at the company level are based on the information from financial statements, which are subject to manipulation and need additional caution. However, we are inclined to believe that, despite inherent risks, the quality of reporting in the companies that actively participate in capital markets are higher relative to other companies.

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Preispitivanje odrednica rasta poduzeća tijekom kriznih perioda

Dejan Malinić[1], *Ksenija Denčić-Mihajlov*[2], *Konrad Grabiński*[3]

Sažetak

Nedavna financijska kriza je istakla potrebu razmatranja zašto su neke firme i ekonomije ugroženije, dok su druge otpornije na krizu i kako različite financijske karakteristike poduzeća mogu utjecati na rast poduzeća. S ciljem empirijskog istraživanja ovih pitanja, analizirali smo odrednice korporativnog rasta tijekom kriznog i post-kriznog perioda (2008. – 2013.) na uzorku od 10 zemalja srednje i istočne Europe koje pripadaju dvjema različitim regionalnim grupama – "Višegradska četvorka" i grupi zemalja bivše Jugoslavije. Naša analiza obuhvaća uzorak od 3,660 opažanja. Rast poduzeća razmatran je kao funkcija dvije makro varijable (inflacija i likvidnost tržišta kapitala) i četiri varijable povezane s karakteristikama poduzeća (financijska poluga, obrt imovine, profitna marža i odnos između novčanog toka i imovine). Istraživanje ukazuje na značaj infrastrukturnih preduvjeta i makroekonomske politike za rast poduzeća u kriznim uvjetima poslovanja. Naši rezultati također ističu specifičan odnos između financijske poluge i rasta tijekom kriznog perioda, pri čemu se utjecaj financijske poluge analizira kao sveobuhvatan rezultat stupnja zaduženosti poduzeća, razine razvoja tržišta kapitala, položaja bankarskog sektora i cijene duga. Konačno, naši rezultati ukazuju na intrigantnu prirodu veze između profitabilnosti i rasta, kao i između učinkovitosti upravljanja imovinom i rasta poduzeća u kriznim periodima.

Ključne riječi: *rast poduzeća, kriza, tržište kapitala, makro varijalbe, varijable povezane s karakteristikama poduzeća*

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The key factors affecting entrepreneurship: a comparative analysis[*]

Małgorzata Jabłońska[1], Joanna Stawska[2]

Abstract

The purpose of the article is to identify the factors determining the rate of entrepreneurship in selected regions of Poland and the Czech Republic, two neighboring countries, within the period 2007 – 2017. This period includes the time of the financial and economic crisis, which could have influenced the entrepreneurship determinants in the regions under study in varying degrees. The differentiation of the impact of selected variables on the entrepreneurship rate had its basis in many elements. To achieve this objective, the following research methods were used: presentation of statistical data, statistical and econometric research methods – the logarithmic panel model with delays. The article also emphasizes the importance of entrepreneurship for the development of a country's economy. Considering the high level of competitiveness in local and global markets, enterprises should pay increasing attention to micro-environment and some regional conditions, because an enterprise depends on these conditions and may influence many of them. The results of the research and thus the contribution and their added value are as follows: an increase in local entrepreneurship is positively transferred to the growth of international entrepreneurship, while R&D expenditure and average remuneration in the economy are the crucial factors influencing the development of entrepreneurship.

Key words: *entrepreneurship, SMEs, finance, regional development*

JEL classification: *R11, R12, F65, M13, L26*

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1. Introduction

Entrepreneurship is a multi-faceted phenomenon; hence entrepreneurship research covers numerous academic fields in several different forms. Entrepreneurial opportunities depend on many factors, including the development of private services compared to public service provision and the evolution of the household. Since the end of the eighties of the last century, the balance of services has shifted towards the commercial provision of many services due to several important factors such as privatization, deregulation and a decreasing tax wedge and social security in many countries. Also, the government can influence the resources and skills of individuals by subsidizing information and advisory services, loan guarantees and other direct support systems. In addition, the cultural environment also influences a personal approach to entrepreneurship, which places cultural patterns among the important factors affecting a level of entrepreneurship.

Entrepreneurship is an important element of any economy. In most countries, economic authorities are trying to stimulate the level of entrepreneurship in their countries because enterprises make a significant contribution to economic growth. That is why we decided to examine the impact of selected variables on the degree of entrepreneurship in selected border regions in Poland and the Czech Republic.

The objective of this research is to identify the variables determining entrepreneurship in selected regions of Poland and the Czech Republic. When justifying the selection of these regions, it should be noted that the border areas of Poland and the Czech Republic were selected for analysis for several reasons, namely:

– these are economically close countries;

– border areas of both countries are located in close proximity to each other which gives an opportunity for comparisons in geographically and environmentally similar areas;

– different political conditions allow for objective verification of various, important factors affecting the degree of entrepreneurship in border areas, however, located in two different countries.

The Polish-Czech trade exchange has been growing dynamically since both countries joined the European Union. Poland, apart from Germany and France, is the third strategic trading partner for the Czech Republic. The Czech Republic is also an important partner for Poland in the investment and capital sphere, in particular in such industries as refining, modern technologies, nuclear energy, nanotechnologies and even space research. Cooperation with the Czech Republic can contribute to the growth of innovation and entrepreneurship, given that these countries occupied close places in the rankings describing the ease of doing business in 2019: Poland 40 and the Czech Republic 41.

What is also worth mentioning is a growing cross-border cooperation on the Polish-Czech border. Dolnośląskie voivodship cooperates with three regions of the Czech Republic: Liberec Region (agreement of 25 February 2003), Pardubice Region (agreement of 22 April 2003) and Hradec Kralovy Region (agreement of 16 October 2003). Opole voivodship conducts international cooperation with the Olomouc Region on the basis of a partnership agreement signed on 9 July 2002. The cooperation of the regions is aimed at tightening relations between the communities on both sides of the border and developing the local economy.

Analyzing the impact of selected indicators on the degree of entrepreneurship in selected regions, we noticed that this impact is very diverse and factors affecting entrepreneurship cover a wide spectrum of disciplines. These are sociological, economic, behavioral, social and other factors. On this basis, we have formed the first hypothesis: *the impact of selected variables on the entrepreneurship rate in the discussed regions of Poland and the Czech Republic was diverse and related to many other socio-economic factors*. However, we noticed that some of these variables have a stronger impact on entrepreneurship, which is why we have put forward two more hypotheses. The second hypothesis is as follows: *R&D expenditures have an impact on the growth of local entrepreneurship in the surveyed regions*; and the third hypothesis: *the development of entrepreneurship in the studied regions depends on the value of average remuneration in the regions*.

This analysis was carried out to fill the gap on the subject in the literature because according to the current state of the authors' knowledge, such studies have not been conducted.

The structure of the paper is as follows. Section One presents the findings of a review of studies on the theoretical foundations of mechanism shaping entrepreneurship. In section Two, a statistical analysis of selected variables affecting entrepreneurship was carried out. In Section Three, our model of the variables affecting the entrepreneurship rate is introduced. The last section presents conclusions.

2. Literature review

The phenomenon of entrepreneurship is widely described in the literature. The studies on regional entrepreneurship have been conducted by such researchers as Brock, Evans, 1989; Hébertand Link, 1989; Dees (1998); Van Praag, (1999); Faris (1999). Many authors have written about entrepreneurship in various aspects. Audretsch, Thurik, Verheul, Wennekers (2002) emphasized that an important determinant of entrepreneurship is a regional policy, which is conducive to the development of entrepreneurship and economic growth. Minniti (1999) wrote about positive aspects of entrepreneurship in the context of self-employment. Similarly, Carree, A.J van Stel, Thurik and Wennekers, (2002) emphasized a

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positive, significant relationship between entrepreneurship and employment growth and economic development. Audretsch and Thurik, (2001, 2004) described the importance of the contribution of knowledge and ideas in the so-called "entrepreneurial economy"; Grilo, Thurik (2004) have expanded the concept of *Eclectic Framework* describing entrepreneurship, which covers various currents of literature and disciplines. Others like Leković, Berber (2019) proved statistically significant connections between motives of entrepreneurship, innovation or internationalization and the development of enterprises. Entrepreneurship primarily results from the multi-faceted nature of this issue, which goes far beyond the area of economics alone, and is located on the border of many other sciences, including psychology, sociology or economic geography (Hills, Lumpkin, Singh, 1997; Dees, 1998). This is an important feature in the context of seeking entrepreneurship determinants.

In this article, we focus on the approach to enterprise description proposed by Gartner (1988), for whom entrepreneurship is a set of processes related to the emergence of new and the development of existing business entities. In the second approach, developed by Faris (1997), however, entrepreneurship is treated as one of the forms of social behavior and examined from the point of view of the personal characteristics of entrepreneurial individuals. In this case, this definition is not only limited to the economic sphere, but it is extended to aspects related to human activities (except existential ones). This approach is too broad and entrepreneurship is difficult to measure in the context of the research carried out in our work.

The greater the participation of entrepreneurs in the economic life of a country or region, the greater the chances the development of this area. The entrepreneur is focused on perceiving new economic opportunities and further introduces new ideas to the market – according to the Schumpetarian approach (Wennekers and Thurik (1999). The decisions made by the entrepreneur ultimately affect the location, form and use of goods, resources or institutions (Hebert and Link (1989).

One of the first and most important attempts to empirically measure the phenomenon of entrepreneurship was the study undertaken in the late 1990s as part of the Global Entrepreneurship Monitor (GEM) project. This study was conducted at the level of selected countries, assuming that entrepreneurship is expressed through any attempt to start a new venture, such as self-employment, setting up a new business entity or expansion of an existing enterprise (Minniti, 1999). These studies indicate that entrepreneurship is playing an increasingly important role in the global economy and that it makes a significant contribution to economic growth.

Audretsch and Thurik (2001 and 2004) write about moving away from large companies towards small, mainly new companies, which is a significant change, not just a temporary deviation from the main trend. These authors define this new economic period, based less on the traditional contribution of natural

resources, labor and capital, and more on the input of knowledge and ideas as an "entrepreneurial economy". Paradoxically, the increase in uncertainty creates opportunities for small and young companies, resulting in higher entrepreneurship rates. We note that a higher degree of entrepreneurship is rooted not only in large companies but more often in these smaller, young enterprises.

In recent years, along with competitiveness and innovation, entrepreneurship has become one of the most important issues related to the analysis of economic growth processes. One of the factors that increases competitiveness and, consequently, the increase in entrepreneurship of a given economy is the increase in innovation (Dziuba, 2014). Entrepreneurship is treated as an important indicator of this growth, as evidenced by the role ascribed to entrepreneurship development in creating regional policy at the national and regional level (Sechster, 1999; Jabłońska, Stawska, Czechowska 2019). In addition, it is worth noting a strong link between entrepreneurship and innovation (Hills, Lumpkin, Singh, 1997). Over the past two decades, entrepreneurship has become a key point of interest of economic politicians across Europe. Moderate economic growth combined with high unemployment stimulated expectations regarding the potential of entrepreneurship as a source of creating new jobs and economic growth (Audretsch, Thurik, 2000; Carree, Thurik, 2002). This is especially visible in the case of industries looking for innovations, such as green enterprise among the textile sector (Burzyńska, Jabłońska, Dziuba, 2018).

The phenomenon of emerging small businesses is more than ever seen as an entrepreneurial tool that not only contributes to employment and social and political stability, but also contributes to innovation and increased competitiveness. Many economists, based on econometric evidence, suggest that entrepreneurship is a determinant of economic growth (Audretsch and Thurik, 2000; Audretsch, et.al. 2002; Carree and Thurik, 1999; Carree, et.al. 2002; Audretsch, Carree and Thurik, 2002). Some authors such as Audretsch et. al. (2002) believe that due to the lack of entrepreneurship, economies would incur costs associated with lost economic growth. However, the positive and statistically significant relationship between entrepreneurship and economic growth has been undeniably verified in a wide spectrum of observation units, including a plant, enterprise, industry, region and country. In the face of growing concerns related to unemployment, employment, growth and international competitiveness in global markets, decision-makers have responded to these phenomena with a desire to create new companies, see Reynolds et. al. (2000). Initially, European decision-makers relatively slowly recognized these links between entrepreneurship and economic growth, but since the mid-1990s this view has spread quickly (European Commission, 2000).

Zoltan et al. (2012) on the basis of a cross-sectional panel of time series based on a country-specific measure of entrepreneurship, noticed that the activity of enterprises in fact positively contributes to economic growth. In addition, they emphasize

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that countries with a higher degree of entrepreneurship are consistently showing a higher level of economic growth. The results indicate the importance of a country's policy that not only promotes investment in R&D but also takes into account the role of the intermediation mechanism such as entrepreneurship.

The OECD emphasizes that self-employment is also an important source of entrepreneurship and growth especially for small businesses – with the potential to increase employment in the long run (OECD, 2000).

In another study conducted in six countries from Central and Eastern Europe, an exploratory sample of 12,027 respondents and 457 fast-growing entrepreneurs was created. It was noted that the motives of entrepreneurship, innovation and internationalization of the new venture have a statistically significant connection with the rapid growth of enterprises in the studied region of Southeastern Europe (Leković, Berber, 2019).

Grilo, Thurik (2004) describe a study that uses the *Eclectic Framework* which explains entrepreneurship covering various streams of literature and various disciplines. *The Eclectic Framework* combines factors that shape the demand for entrepreneurship on the one hand, and influence the supply of entrepreneurs on the other. This enables an insight into the role of public policy defining the channels through which the demand or supply of entrepreneurship can be shifted. The study used polynomial logit using data from 15 EU Member States, Norway, Iceland, Liechtenstein and the US to determine the impact of demographic and other variables on different levels of entrepreneurial involvement. The data used came from two Eurobarometer surveys on entrepreneurship (2003, 2004) with over 20,000 observations. Among explanatory variables, in addition to demographic variables, the survey examined such characteristics as how the respondents perceived administrative complexities, availability of financial support, approximate risk tolerance, respondents' preferences for self-employment and country-specific effects. One of the surprising results was that the perception of the lack of financial support does not have a discriminatory effect on various ways of entrepreneurial involvement.

Additionally, the tax system is a good example of the entrepreneurship determinant, which is very diverse in different countries. The tax system may be favorable to entrepreneurship or inhibiting entrepreneurship. Ambiguously written regulations, rules, frequent changes in tax law, expiration clauses and various levels of regional and national taxation significantly affect the degree of entrepreneurship of a given country or region. In addition, immigration policy and regional development policy dealing with (sub) urbanization processes affect the age composition and dispersion of employees in a given area, respectively (OECD, 1998).

Audretsch, Thurik et al. (2002) describe the scope of determinants that explain the level of entrepreneurship, including economic and social factors. In addition, they also list political factors that may also affect the level of entrepreneurship. Government can

influence entrepreneurship in various ways, e.g. directly through specific measures and indirectly through general measures. For example, by establishing a competitiveness policy, the government can influence the market structure and indirectly, a number and type of entrepreneurial opportunities. Generally, the level of entrepreneurship in a given country can be explained by making a distinction between the supply side (labor market perspective) and the demand side (product market perspective; market capacity) of entrepreneurship. Similarly, entrepreneurship determinants can also be studied according to a certain level of analysis. This means that a distinction can be made between micro-, meso- and macro-levels of entrepreneurship. The subjects of research related to these levels of analysis are, respectively: individual entrepreneur or business, industry sectors and the national economy. Research at the micro-level focuses on the decision-making process of individuals and on the people's motives for self-employment. Research on the decisions of people taking up employment or self-employment mainly focuses on personal factors such as psychological characteristics, formal education and other skills, financial assets, family background and previous professional experience. Research at the meso-level of entrepreneurship often focuses on market-specific entrepreneurship determinants, such as profit opportunities and entry and exit opportunities. In turn, the macro perspective focuses on a number of environmental factors, such as technological, economic and cultural variables, as well as government regulations.

In the literature, the most common measures of entrepreneurship include, the number of active enterprises per 1000 inhabitants; the number of employed persons per one active entity; the number of employed persons in active enterprises per 1,000 inhabitants; the amount of revenues per one employee; cost level indicator; average salary level; the size of investment outlays per one enterprise or the growth rate of start-ups. In this study, the growth rate of start-ups was used as a measure of entrepreneurship (Gries, Naude, 2009). Based on the literature, we made a selection in our study of determinants that, in our opinion, significantly affects the degree of entrepreneurship in the examined border regions of Poland and the Czech Republic.

3. Methodology

The dynamics of socio-economic processes forces the use of modern knowledge, reliably and faithfully reflects the essence of occurring phenomena and processes. Undertaking analysis of the course of entrepreneurship changes in regions over time, the use of econometric modeling methods that provide objective, accurate and comprehensive knowledge of the studied reality is deeply justified.

The econometric methods used, in particular the logarithmic panel model with delays, in the study is an irreplaceable source of instrumental knowledge necessary

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for application in current social, economic, technical and educational policy, on the other hand in planning and forecasting the development of entrepreneurship in Polish regions and the Czech Republic. What is more, it is new compared to the regional entrepreneurship research conducted so far, which largely focuses on qualitative research. In their empirical research on entrepreneurial phenomena, researchers used data sets such as the Panel Study of Entrepreneurial Dynamics (Carter, et. al. 2003; Davidsson, 2003; Liao and Welsch, 2008, Curtin and Reynolds 2018) and the Comprehensive Australian Study of Entrepreneurial Emergence (Davidsson, Steffens and Gordon, 2011).

According to the latest achievements in the field of entrepreneurship, there is a growing interest in developing methods that will show the theoretical and practical significance of the results developed, including quantitative research. In the research conducted so far on the development of the phenomenon of regional entrepreneurship, a linear econometric model was used using the classical least squares method (KMNK) (Walczak, Żołądkiewicz, 2015) or describing panel data (Meyer, 2017). The premise for use in the study of a dynamic panel model using delayed variables is the specifics of the study. Entrepreneurs often decide to develop or discontinue operations based on previous events.

The general form of such a model can therefore be written as:

$$log\_business\_indic_{it} = \alpha_0 + \beta_1 \cdot log\_income\_munici_{it} +$$
$$+ \beta_2 \cdot log\_average\_salary_{it} + \beta_3 \cdot log\_inw\_exp_{it} + \beta_4 \cdot log\_social\_benefits_{it} +$$
$$+ \beta_5 \cdot log\_unepmit + \beta_6 \cdot log\_exp\_B + R_{it} + u_{it}$$

where:

– parameters β_k mean the elasticity of the entrepreneurship rate relative to the k-th model explanatory variable, so they are interpreted as a relative change in the entrepreneurship rate as a result of a 1% increase in the k-th model explanatory variable,

The random component is decomposed into two components:

– α_i a component that reflects the group effect (fixed effect – FE or random effect -RE, depending on the Hausman test results) and the appropriate random component v_{it}

$$(v_{it} \sim N(0, \sigma_v^2).$$

In dynamic terms, the value of the independent variable depends on its lagged (by one period) value and on the values of the explanatory variables included in the model. The process of estimating a dynamic panel model is most often carried

out using the generalized method of moments (GMM), after first transforming the model to the form of the first differences. The model after transforming into the first differences model has the form (Bond, 2002; Ahmed, et al. 2014):

$$\Delta y_{it} = \gamma \Delta y_{t-1} + (\Delta \mathbf{x}_t^T)\hat{\mathbf{a}} + \Delta \upsilon_t$$

This removes the fixed effects, specific to individual objects from the model. Due to the fact that the lagged dependent variable is included in the model, the phenomenon of first-order autocorrelation often occurs, because if the random component, i.e. ε_{it} is independent, their first differences are subject to the first-order autocorrelation scheme. The occurrence of second-order autocorrelation in this model would consequently lead to failure to meet moment conditions and incompatibility of the estimator, which would mean the wrong selection of instruments used in the model estimation process. For this reason, it is extremely important to test whether the dynamic model has second-order autocorrelation, i.e. AR (2) (Brañas-Garza et al., 2011; Bun, Sarafidis, 2013).

4. Empirical data and analysis

Based on the results of theoretical research and availability of specific statistical data, variables that reflect various aspects of entrepreneurship development in the Polish and Czech border regions were specified. Entrepreneurship at the voivodship level in Poland, (the regions in the Czech Republic), was defined by means of an indicator specifying the number of registered enterprises of the MSME (Medium, Small and Micro Entreprices) sector per 100 people at working age. Analyzing the average value of this indicator in the years 2007-2017 (see Figure 1) it can be stated that in the Czech regions, covered by the survey, the average value of this indicator significantly exceeded the Polish values. In the Czech Republic, the entrepreneurship rate was around 16 companies per 100 people at working age, while in Poland the value of this indicator slightly exceeded 10. The Liberec Region (average 18.63) turned out to be the most entrepreneurial among the examined regions, while the Silesian Voivodship turned out to be the least enterpreneurial. (average 9.70).

The purpose of the econometric model, constructed for the study, is to describe the relationship between the entrepreneurship rate, which determines the number of enterprises per number of working-age population – and explanatory variables. The set of explanatory variables considered here is not complete and in no case can be considered closed. Due to the difficult access to data and the assumed time horizon, the work was based on the analysis of selected factors only, largely of a financial nature, which may foster (or inhibit) the development of entrepreneurship.

Figure 1: Entrepreneurship rate in 2007-2017 in the analyzed regions.
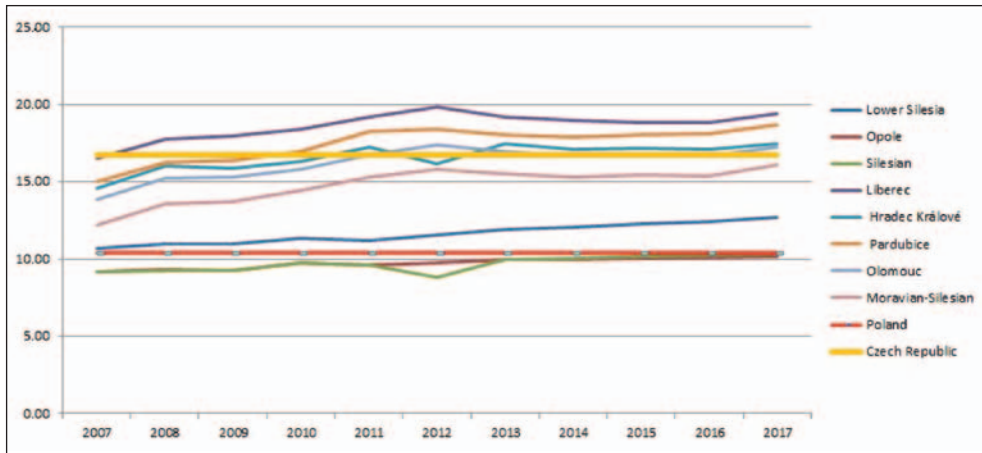
Note: Authors' calculations based on Local Data Bank, Statistics Poland [www.bdl.gov.pl] and Czech Statistical Office [https://www.czso.cz]

Simplification of reality in econometric models involves taking into account only the most important factors (variables) affecting the dependent variable. In addition to the variables used in the cross-sectional time-series models in the study, specific non-measurable, constant over time and object-specific factors, called group effects and/or non-measurable but period-specific factors called time effects, were also taken into account (see: Baltagi, 2005). The variables are stationary, LLC tests performed it. For explanatory variables in the model it was decided to choose the following set:

– inw_exp – share of municipal investment expenditure in total expenditure (%) – positively correlated with the dependent variable in the model;

– average_salary – average gross monthly salary in the enterprise sector (constant prices in euros) – positively correlated with the dependent variable in the model;

– unepm_ – share of registered unemployed persons in the number of working age population (%) – positively correlated with the dependent variable in the model;

– *income_munici* – total revenues of municipalities per capita (constant prices in euros) – positively correlated with the dependent variable in the model;

– social_benefits – average social benefits in the economy (constant prices in euros) – negatively correlated with the dependent variable in the model;

– exp_B+R – expenditure on R&D in the economy per capita (constant prices in euros) – positively correlated with the dependent variable in the model;

– *business_indic* – entrepreneurship indicator – the number of active enterprises per 100 people at working age.

The table below provides basic descriptive statistics of variables that were selected for the study.

The table presents the values of basic descriptive statistics for the above variables (mean, median, standard deviation, coefficient of variation, coefficient of skewness). These values were determined on the basis of the values of these variables collected at the the municipality level in 2007-2017. Based on the results obtained, the following drawn conclusions are as follows:

Table 1: Values of basic descriptive statistics for Polish and Czech regions covered by the survey

Polish regions					
	average	median	standard deviation	Coefficient of variation	Coefficient of skewness
income_munici	1,276.70	1,225.60	251.71	0.197	0.558
average_salary	892.92	894.53	108.16	0.121	0.027
inw_exp	0.172	0.179	0.040	0.231	-0.291
social_benefits	0.031	0.032	0.0036	0.115	-0.296
unepm_	0.062	0.062	0.013	0.210	-0.293
exp_B+R	50.65	47.08	28.98	0.572	0.551
business_indic	10.36	10.08	1.062	0.102	0.721
Czech regions					
	mean	median	standard deviation	Coefficient of variation	Coefficient of skewness
income_munici	999.03	1,000.80	114.43	0.114	0.0665
average_salary	752.36	752.11	35.388	0.047	-0.142
inw_exp	0.255	0.258	0.0472	0.184	-0.078
social_benefits	155.72	163.68	44.128	0.283	-0.059
unepm_	0.0611	0.051	0.026	0.426	1.21
exp_B+R	161.25	152.41	18.228	0.299	0.597
business_indic	16.74	16.70	1.63	0.097	-0.361

Note: Author's calculations based on Local Data Bank, Statistics Poland [www.bdl.gov.pl] and Czech Statistical Office [https://www.czso.cz]

1. The vast majority of the analyzed variables are characterized by a similar average level in Poland compared to the Czech regions selected for the survey. Significant

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differences are evident when comparing the aforementioned entrepreneurship rate (the average for Polish regions in the years 2007 – 2017 was 10.36 companies per 100 people at working age, while in the Czech regions the average value of this indicator was slightly higher than 16 companies per 100 people at working age. Significant differences are evident in the following variables: social benefits (in Poland 0.031 euros per person and in the Czech Republic 155 euros) and expenditure on R&D (in Poland 50 euros per person and in the Czech Republic 161 euros per person).

2. The variation in most of the examined features is moderate (values of coefficients of variation range between 10% and 57% in Poland and 4% and 42% in the Czech Republic). It should be noted that in the Czech Republic the variation of salaries is the smallest (4% vs. 12% in Poland), and the variation of the share of the unemployed is the highest (42% vs. 21% in Poland). In Poland, in turn, the most varied variable is expenditure on R&D – approx. 57%. In the Czech Republic this parameter also belongs to one of the most varied ones (30%).

3. The variables examined include those characterized by right – and left – sided asymmetry. Right – sided asymmetry means that the regions under study have below-average feature values. Both in Poland and the Czech Republic these are municipal revenues and R&D expenses. The opposite situation occurs in the case of a variable which specifies the amount of investment expenditure or social benefits.

In the next stage of the study, an attempt was made to construct an econometric model that explains changes in the rate of entrepreneurship. Factors that may potentially affect changes in the rate of entrepreneurship include (in accordance with the purpose of the work) primary factors describing the financial condition of municipalities located in Poland in the border area with the Czech Republic and in municipalities bordering Poland located on the Czech side. For comparison, the study was carried out in three variants (for municipalities located in the Lower Silesian, Opole and Silesian voivodships, for Czech municipalities that are located in the regions of Liberec, Hradec Králové, Pardubice, Olomouc and Moravian-Silesian, and for all groups of regions). Data for the model cover the years 2007-2017. Further variants were constructed separately for municipalities of Polish provinces and municipalities located in the Czech Republic. The log-linear (power) form of the model was adopted, which was estimated based on panel data, taking into account group effects (fixed effects – FE or random effects – RE), differentiating individual objects (municipalities).

The table below presents the results of the estimation of dynamic panel models, in which the logarithm of the entrepreneurship index is the dependent variable (the results of the two – according to the authors – the best variants are presented). The standard error of residuals is Vu% of the average level of the independent variable and is less than 10%, which is a sufficient adjustment of the model to empirical data (in each of the presented variants it is less than 10%).

Table 2: Dynamic panel estimation using 64 observations (eight regions – 3 Polish and 5 Czech regions). Dependent variable (Y): Log_ business_indic

Variables	Basic variant	Improved variant
log_ business_indic (-1)	0.063 (1.352)	0.067** (2.193)
log_ business_indic (-2)	-0.054 (-0.6844)	-0.0581** (-2.128)
const	0.0032 (0.7195)	0.003364 (0.8779)
log_ income_munici	- 0.0169 (-0.0769)	
log_ average_salary	-0.7493 (-1.398)	-0.7776 *** (-4.235)
log_ inw_exp	-0.1312*** (-3.727))	-0.13113 *** (-3.859)
log_ social_benefits	0.0216 *** (2.869)	0.0216 *** (3.711)
log_ unepm_	-0.1149*** (-6.009)	-0.1184*** (-7.786)
log_ exp_B+R	0.1609*** (8.707)	0.1592*** (8.783)
Residual sum of squares	0.446452	0.442266
Residual standard error	0.090096	0.08869
AR (2) test	z = -1.61318 [0.1067] No autocorrelation p> 0.05	z = -1.52006 [0.1285] No autocorrelation p> 0.05

Note: * P <0.1, ** p <0.05, *** p <0.01. Values for t-Student statistics are given in round brackets.

Source: Authors' calculations

Taking into account all regions selected for the study, it turned out that the dependent variable, i.e. the rate of entrepreneurship, was influenced by the explanatory variables, expenditure on investments in municipalities, expenditure on social benefits, the share of the unemployed in the number of working age population and expenditure on R&D. The variable describing the income of municipalities, which has no impact on the development of the described phenomenon, was eliminated from the group of factors that stimulate the formation of the entrepreneurship measured by the rate of involvement of people at working age in running their own business.

Table 3: Dynamic panel estimation using 45 observations (5 Czech observations).
Dependent variable (Y): Log_ business_indic

Variables	Basic variant	Improved variant
log_ business_indic (-1)	-0.0800 (-0.9151)	- 0.1524*** (-3.023)
const	0.0072* (1.876)	0.00693 ** (2.004)
log_ income_munici	-0.1040** (-2.539)	- 0.1470** (-2.497)
log_ average_salary	0.5242*** (3.733)	0.6959 *** (4.551)
log_ inw_exp	-0.05593 (-0.9471)	
log_ social_benefits	0.1034 (1.355)	0.09877 (1.419)
log_ unepm_	-0.09768 ** (-2.012)	- 0.0886 * (-1.888)
log_ exp_B+R	0.09659 *** (6.453)	0.1041*** (3.599)
Residual sum of squares	0.128423	0.117416
Residual standard error	0.058914	0.055587
AR (2) test	z = -0.912349 [0.3616] No autocorrelation p> 0.05	z = -0.944709 [0.3448] No autocorrelation p> 0.05

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Values for t-Student statistics are given in round brackets.

Note: Authors' calculations

Conducting a more detailed analysis that explains the impact of individual explanatory variables on the rate of entrepreneurship in the studied regions, taking into account their location and the environment in which they operate, will indicate the main differences and similarities between the regions. The table above presents the estimated variants of the model, that describes the impact of explanatory variables on the dependent variable (entrepreneurship rate) in the regions of Liberec, Hradec Králové, Pardubice, Olomouc and Moravian – Silesian. The study showed that the current value of entrepreneurship rate in the years 2007-2017 in the Czech regions was determined primarily by expenditure on R&D and average wages in the economy (both variables are characterized by a positive impact on the entrepreneurship rate) and the lagged dependent variable. Importantly, the variables describing the value of social benefits and the share of investment expenditure turned out to be irrelevant to the development of the described phenomenon, which clearly distinguishes this variant of the model from the one constructed for the whole sample.

Table 4: Dynamic panel estimation using 27 observations (3 Polish observations).
Dependent variable (Y): Log_ business_indic

Variables	Basic variant	Improved variant
log_ business_indic (-1)	0.00331 (0.02531)	-0.004391 (-0.03153)
const	0.00050 (0.1676)	0.001195 (0.6211)
log_ income_munici	0.6513 *** (5.175)	0.6610 *** (4.801)
log_ average_salary	- 0.6931 *** (-6.592)	-0.7279 *** (-6.475)
log_ inw_exp	- 0.0225 (-0.8467)	
log_ social_benefits	0.431*** (10.25)	0.4393*** (8.214)
log_ unepm_	0.1841*** (21.90)	0.1750*** (16.02)
log_ exp_B+R	0.07294 *** (6.036)	0.0692 *** (9.617)
Residual sum of squares	0.103518	0.103553
Residual standard error	0.073813	0.071956
AR (2) test	z = -912282 [0.3616] No autocorrelation p> 0.05	z = -0.923612 [0.3557] No autocorrelation p> 0.05

Note: * $p < 0.1$, ** $p < 0.05$, *** $< p\, 0.01$. Values for t-Student statistics are given in round brackets.

Note: Authors' calculations

The last version of the study concerns the estimation of variables affecting the rate of entrepreneurship in the Polish regions bordering the Czech Republic. Based on the collected data, it turned out that the following factors had a strong impact on the development of entrepreneurship, municipal incomes, average wages in the economy, the level of social benefits, the share of the unemployed and expenditure on R&D. The share of investment expenditure and the lagged dependent variable, are the variables that do not affect the dependent variable.

5. Results and discussions

Entrepreneurship is a very important economic category, especially from the point of view of the development of economies. Entrepreneurship research is largely based on an analysis of the SME sector, which plays a key role in the country's economic development. The conducted empirical study on factors influencing the development of entrepreneurship in Poland and the Czech Republic showed numerous differences and similarities.

In all estimated variants of the model, the impact of R&D expenses and average remuneration in the economy turned out to be significant. However, the impact of these variables varies from one region to another. In the border regions of the Czech Republic, the flexibility of the entrepreneurship rate in the current period relative to the expenditure on R&D variable ranges between 0.11 and 0.12, while in the examined regions of Poland a weaker effect was noted – here the flexibility does not exceed 0.10. This slightly different level of flexibility is related to the innovation of these two countries. Although both Poland and the Czech Republic were among the so-called *moderate innovators*, there are significant differences in expenditure on innovation, in the number of implementations and patents, etc. (SII index for 2016 for Poland was 54.8 and for the Czech Republic 84.4 (European Scoreboard, 2017)). Enterprises located in the Czech Republic are focused on innovation and make their growth dependent on it, hence the flexibility of this variable in relation to the rate of entrepreneurship in these regions is higher. The level of average wages in the economy also has a different, but significantly significant impact on the entrepreneurship rate, both in relation to the entire sample and the separately examined regions. In the examined regions of the Czech Republic, the impact of this explanatory variable on the entrepreneurship rate was positive. This demonstrates that people are motivated to start their own business; they are not forced to do so by the lack of a job. In Poland, however, we have the opposite effect. The study showed that in the years 2007-2017 the impact of the average level of wages in the economy negatively affected the development of entrepreneurship. The collected data indicate that a significant increase in wages in the Polish economy took place after 2010, and wages were at a level comparable with wages in the Czech regions studied, and even higher. It can therefore be concluded that running one's own business at a certain level of remuneration in the economy is not attractive, therefore, the level of remuneration for these regions (saturated with a large number of micro enterprises) had a negative impact on the creation of new companies.

In the estimated variants of the model, the influence of the lagged dependent variable on its current value turned out to be different. In the regions of the Czech Republic studied, the impact of this variable turned out to be statistically and negatively significant (the elasticity of the entrepreneurship rate in the current period relative to the entrepreneurship rate from the previous period ranges between – 0.08 and -0.15), while in Polish regions this variable had no real impact on entrepreneurship. Regions located on the Polish side belong to the most saturated voivodeships in terms of entrepreneurship, hence the rate of entrepreneurship in the current period does not react under the influence of changes in the rate of entrepreneurship from the previous period.

The impact of the variable describing social benefits on the entrepreneurship rate is an interesting phenomenon. In the provinces located on the Czech side this variable

turned out to be statistically insignificant. This confirms the hypothesis about the positive motivation to start one's own business. In Polish regions, however, this variable strongly and positively affects the rate of entrepreneurship (flexibility of 0.4).

In the examined regions in Poland and the Czech Republic, the impact of investment expenditure on the entrepreneurship rate was insignificant. On the one hand, this may be due to the fact that the short-term effects of European integration and, at the same time, integration of regions, often do not reflect investment expenditure incurred at the initial stage of convergence. This particularly applies to the specifics of investment expenditure on the development of entrepreneurship. Expenditure incurred in the financial perspectives 2007-2013 and 2014-2017 for investment purposes such as "business-related" infrastructure should bring definite effects in the long run. Therefore, in the initial phase, the increase in expenses was not directly felt by entrepreneurs. On the other hand, however, the decreasing size of the population due to migration means that the most entrepreneurial and talented inhabitants of a given region often fail to recognize the benefits of stimulating entrepreneurship in the initial phase of European integration, and leave the region and emigrate to more developed EU regions.

6. Conclusions

The article attempts to identify variables determining entrepreneurship in selected regions of Poland and the Czech Republic. In addition, it was assumed that the impact of selected variables on the entrepreneurship rate in the discussed regions of Poland and the Czech Republic was diverse and related to many other socio-economic factors.

In the study, in which all the selected regions were included, it turned out that the entrepreneurship rate as the independent variable was significantly affected by the following variables, expenditure on investments in municipalities, expenditure on social benefits, the share of the unemployed in the number of people of working age and expenditure on R&D.

On the other hand, in the model in which only Czech regions were taken into account, the current value of entrepreneurship rate was mostly affected by expenditure on R&D as well as by average remuneration in the economy and the lagged independent variable. However, municipal incomes and the share of the unemployed in the number of people of working age also had a significant impact on the entrepreneurship rate. On the other hand, the results of the study, conducted for Polish regions indicate that the following variables had a significant impact on the entrepreneurship in the years 2007-2017, municipal incomes, average wages in the economy, the level of social benefits, the share of the unemployed and

expenditure on R&D. It must be noted that in the study conducted for all regions, as well as the Czech and Polish regions, only expenditure on R&D and average remuneration in the economy occurred in all the examined groups.

The differentiation of the impact of selected variables on the entrepreneurship rate in Poland and the Czech Republic had its basis in many elements that influenced selected determinants of entrepreneurship. Such significant differentiating factors include, cultural conditions, the structure of the business sector, market legislation, tax environment, and social security systems. In addition, it is worth emphasizing the role of the level and pace of economic development and to what extent they have a moderating or intermediary influence on the variables selected for the study. The role of the level of remuneration in relation to the income from self-employment is also important.

Enterprises should pay increasing attention to the micro-environment and regional conditions, because the enterprise depends on these conditions and may affect many of them.

Generally, it might be worth considering more in-depth research concerning the factors affecting the degree of entrepreneurship in border areas based on an extensive survey among entrepreneurs operating there.. Such a survey would enable isolating the most important factors affecting entrepreneurship in the examined group.

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Ključni čimbenici koji utječu na poduzetništvo: komparativna analiza

Małgorzata Jabłońska[1], *Joanna Stawska*[2]

Sažetak

Svrha ovog rada je identificirati čimbenike koji određuju stopu rasta poduzetništva u odabranim regijama Poljske i Češke, dviju susjednih zemalja u period od 2007. do 2017.godine. To razdoblje uključuje vrijeme financijske i ekonomske krize, koja je u različitim omjerima mogla utjecati na odrednice poduzetništva u različitim regijama. Diferencijacija odabranih varijabli i njihovog utjecaja na stopu poduzetništva temelji se na mnogim elementima. Da bi se postigao postavljeni cilj, primjenjene su sljedeće istraživačke metode: prezentacija statističkih podataka, statistička i ekonometrijska metoda istraživanja – logaritamski panel model s vremenskom odgodom. U radu se također ističe važnost poduzetništva za gospodarski razvoj zemlje. S obzirom na visoki stupanj konkurentnosti na lokalnom i globalnom tržištu, poduzeća bi trebala posvetiti sve veću pozornost mikro-okruženju i nekim regionalnim uvjetima, jer poduzeće ovisi o tim uvjetima i može utjecati na mnoga od njih.Rezultati istraživanja, a time i doprinos i njihova dodana vrijednost, su sljedeći: porast lokalnog poduzetništva pozitivno se prenosi na rast međunarodnog poduzetništva, dok su ulaganja za istraživanje i razvoj i prosječne naknade u gospodarstvu ključni čimbenici koji utječu na razvoj poduzetništva.

Ključne riječi: *poduzetništvo, MSP, financije, regionalni razvoj*

JEL klasifikacija: *R11, R12, F65, M13, L26*

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Water extended input-output analysis of the Croatian economy[*][1]

Saša Čegar[2]

Abstract

The main objective of this paper is to identify the most important direct and indirect sources of water use in the Croatian economy and, based on that, to identify the key drivers of water use in the process of Croatian national production. For this purpose, water extended input-output model was constructed and empirically applied in the paper, based on which the indicators of direct, indirect, and cumulative water intensities of production sectors in the Croatian economy have been quantified and analysed, including their cumulative and indirect water use multipliers. Using the aforementioned model, the paper also assesses and analyses domestic, net imported, and total water footprints of production sectors in the Croatian economy, as well as the relative strength of pull-and-push effects of their water use. For the purpose of model construction, the last published input-output table of the Croatian economy for 2010 and the reference data of the Croatian official water statistics were used. The results of the model indicate that direct and indirect water use flows in the Croatian economy are mostly determined by intermediate processes of generating and using the output of the power, chemical, and oil-processing sector. Through the application of the model, it has also been found that these sectors dominate in the structure of the total water footprint of the Croatian economy, whereby the Republic of Croatia, overall, achieves a surplus in the international exchange of virtual waters. Given the new findings on indirect and cumulative water use flows in the Croatian economy, the author's recommendation is that the multiplicative effects of inter-sectoral dependencies in the processes of national production on the total water use must be taken into account when conducting future activities of planning, management, and protection of Croatian water resources.

Key words: *Croatian economy, extended input-output analysis, indirect water intensity, cumulative water intensity, water footprints, forward and backward linkages*

JEL classification: *C67, E01, E10, F18, Q25*

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1. Introduction

Water is a source of life that has no alternative; therefore, constant availability of clean and healthy water is imposed as a *conditio sine qua non* of preserving the integrity and sustainability of ecosystem services, meeting basic human needs, and stability of the socio-economic development of mankind. Due to the fact that all forms of life on Earth and all human activities depend more or less on water, it is particularly important to understand the nature and complexity of the interactive relationship between water and national economies. National economies represent the basic macroeconomic framework for the research and management of the economy and the environment; it is therefore necessary to explore all phenomena that affect the dynamics and intensity of water-use flows in national economies.

When it comes to the interaction between national economies and water, it is important to point out that water is not only one of the most important fundamental elements of the existence of the biosphere, but is also used as an irreplaceable input in different production and service sectors. Given that water-intensive sectors are linked to other sectors through value-adding chains, water is integrated directly or indirectly into the production of all final goods and services. This is because the sectors forming the production systems of national economies are not self-sufficient entities; they are interconnected and conditioned in such a way that the production of each sector involves a part of the production of other sectors. Therefore, changes in the level or structure of final production in the national economy affect the flows of water use along intertwined national and international chains of its value creation.

The problem is that direct water use indicators are still predominantly used in the preparation of analytical background for the planning and management of water resources in most countries, including the Republic of Croatia. Since water policy should be an integral part of a wider framework for sustainable development management, lack of knowledge of indirect drivers of water use certainly reduces the efficiency and quality of planning and management of national water resources. In other words, without the establishment of mechanisms and activities for regular measurement and monitoring of water use flows within interaction and feedback effects between economic and production sectors, decision-makers cannot predict development scenarios or circumstances that require more sophisticated life-cycle measures to regulate the impact of growth and diversification of national economies on the consumption of water resources.

The Republic of Croatia is relatively rich in water resources, which in the context of the international community's prediction that water will become a strategic resource of the 21st century represents enormous potential for the Croatian economy.[3]

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[3] According to Aquastat, Croatia annually has 24,185.0 m³ of total renewable water resources per capita, ranking 5th in Europe and 31st in the world. Although the water balance of Croatia is

This was recognised by the *National Water Management Strategy (2009)*, which emphasises that water resources are of primary national interest to the Republic of Croatia; therefore, their protection and management policy must be defined and implemented in accordance with the highest standards of sustainable development. This implies, among other things, the achievement of complementarity between priorities for the conservation of water resources and priorities related to economic growth and development. This *de facto* creates a scientific and practical need to explore direct and indirect water-use flows in the Croatian economy.

When discussing the relevance of certain methodologies for assessing and analysing direct and indirect water-use flows in the national economy, two basic approaches can be identified in the literature: *the bottom-up* approach and *the top-down* approach. *The bottom-up* approach starts from a specific output, and then, according to the functional (i.e. process) principle, detects water-use flows related to the production and consumption of this output. For example, the best-known *bottom-up* approach for assessing cumulative pressures on water resources is the water footprint calculation methodology (cf. Hoekstra et al., 2011). However, *bottom-up* methodologies have limited capacity for comprehensive assessment and analysis of cumulative water use generated by the flows of production and consumption of goods and services in the national economy. This is because, from a *bottom-up* perspective, it is very difficult to systematically cover all processes that directly or indirectly support a certain production and supply chain, and thus precisely balance all the water-use flows in these processes (cf. Giljum et al., 2013, pp. 13–14).

In order to overcome this problem, the methodology of input-output analysis is most often used in scientific research practice, since it enables the application of *the top-down* approach in quantifying cumulative pressures on the environment and natural resources. In the context of water use, this means that the starting point are sectoral indicators of direct water use, which must then be integrated into input-output data of the national economy. The complex data compilation created in this way enables the application of special mathematical procedures (i.e. input-output models) for calculating direct, indirect, and cumulative water use for each sector into which the national economy is divided (cf. Chapter 3). Since water extended input-output models represent the comprehensive, yet simple tools for quantifying water-use flows along entire value chains of production and distribution, these models have a standard and very wide application in the field of research of the relationship between economy and water resources (cf. Chapter 2). This is also the main reason why the author chose this methodology for the realisation of the

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characterised by a relatively high coefficient of dependence on external water resources (76.6%), the total annual volume of water abstraction in the Republic of Croatia amounts to only 3.7% of its inland water resources.

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main objective of this paper, which is to quantify and analyse direct, indirect, and cumulative effects of production activities in the Croatian economy on water use and on that basis identify key water-intensive sectors and key drivers of water use in the Croatian economy.

2. Literature review

It is generally known that the methodological framework of input-output analysis provides a comprehensive and consistent basis for the determination and quantification of direct and indirect intersectoral dependencies within the production system of the national economy, but also for the consideration of its connection with foreign economies. Although some forms of analysis of intersectoral relations can be found in earlier economic literature (cf. Kurz & Salvadori, 2000), the main initiator and creator of input-output analysis is considered to be Professor Wassily Leontief, who was awarded the Nobel Prize for Economics (cf. Leontief, 1986). Practical application of input-output analysis methodology was initially mainly limited to assessing and analysing the impact of different components of final demand on domestic production, gross value added, and employment (i.e. Mikulić et al., 2014, p. 77). However, ever since the theoretical and methodological assumptions for expanding the analytical framework of traditional input-output models with quantitative data on resource consumption and emissions to the environment have been established in the 1960s, input-output analysis has become a widely accepted empirical tool in the field of research of economic-environmental relations (cf. Cruz, 2002, p. 3). The extended input-output models enable quantification of direct and indirect environmental pressures generated by production sectors[4] in order to meet final demand in the national economy; therefore, they provide a comprehensive analytical basis for identifying key sources and drivers of environmental pressures in the national economy (cf. Tukker et al., 2006, pp. 19–31).

The expanded or hybrid input-output analysis[5] was initially most used in the research of the impact of individual economies on energy consumption and greenhouse gas emissions while, due to the lack of disaggregated data on economic pressures on water resources, it was very rarely used in the research of water issues (cf. Duarte & Yung, 2011). However, after the UN Statistical Department published in 1993 a manual *System of Integrated Environmental and Economic Accounts* (SEEA) that proposed methodological guidelines for linking environmental statistics with

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[4] In the context of input-output analysis, all sectors producing goods and providing services are called production sectors.

[5] Extended input-output models that combine monetary and non-monetary data are called hybrid input-output models.

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the system of national accounts, statistical institutions in many countries began to use economic classifications in collecting, organising, and publishing data in the field of water statistics.[6] This has provided basic preconditions for a more intensive application of input-output analysis in the research of economic pressures on water resources, which in the last 20 years contributed to the strong development of this specific scientific and research area.

Based on literature review, it can be concluded that input-output methodology can be used for analysis of different aspects of water-economy nexus. For example, Eunnyeong et al. (1999) analysed the characteristics of the intermediate linkages of the water supply sector and based on that assessed its role and importance in the economy of South Korea. Through the input-output methodology, Lenzen and Foran (2001) analysed the multiplicative effects of population growth and household consumption on water use in Australia's economy. Velazquez (2006) conducted an input-output analysis of direct and indirect water use in the economy of the Spanish province of Andalusia. Using the extended input-output analysis method Kobayashi and Oyasato (2008) estimated the total water consumption of Japan, including the quantities of water needed to produce imported goods and services. Yu et al. (2010) used the extended regional input-output model to assess domestic and net imported water footprints of economic and household sectors in South-East and North-East England. Based on the hybrid input-output model, Qin (2011) determined which sectors directly and indirectly contribute the most to water use in the economy of the Haihe River catchment area in China. Hristov et al. (2012) investigated the impact of cross-sectoral relations in the national economy on the consumption of water resources in the Republic of Macedonia. Yakovleva and Kudryavtseva (2013) used the extended input-output analysis method to assess the impact of foreign trade on total direct and indirect water demand in key industrial sectors of Russia. Di Cosmo et al. (2014) analysed key drivers of economic water use in the European Union using input-output methodology.

Although Croatian economic science has made a significant contribution to the theoretical and application development of input-output analysis (cf. Jurčić, 2000; Mikulić, 2018), to the best of the author's knowledge, by the time this paper was written, no empirical research had been published based on the application of the hybrid input-output analysis methodology on the example of the Croatian economy, whether in terms of water or any other natural resource or environmental components.

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[6] The SEEA framework has so far been revised several times and upgraded by various subsystems that are specially developed for accounting and monitoring of specific areas. In 2012, the *System of Environmental-Economic Accounts for Water* (SEEA-Water) was published as the first international standard for integrated water accounting. The current development of integrated water accounting at the global level has been elaborated in detail in Jian, Song & Li (2016).

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3. Methodology

The water extended input-output model of the Croatian economy is constructed in this part of the paper, and the basic assumptions and limitations of its application and data used in the model are explained.

3.1. Basic input-output model

If the production system of the national economy is classified into n sectors, the classical format of input-output table of the national economy may be extended with a single vector row containing data on the total annual direct water use for each of the n sectors (cf. Table 1).[7]

Table 1: Water extended input-output table

Output / Input		Intermediate use (demand)					Final use (demand)	Total output
	Sectors	1	$\cdots$	j	$\cdots$	n		
Intermediate inputs (supply)	1	x_{11}	$\cdots$	x_{1j}	$\cdots$	x_{1n}	f_1	X_1
	$\vdots$	$\vdots$		$\vdots$		$\vdots$	$\vdots$	$\vdots$
	i	x_{i1}	$\cdots$	x_{ij}	$\cdots$	x_{in}	f_i	X_i
	$\vdots$	$\vdots$		$\vdots$		$\vdots$	$\vdots$	$\vdots$
	n	x_{n1}	$\cdots$	x_{nj}	$\cdots$	x_{nn}	f_n	X_n
Primary inputs (supply)		p_1	$\cdots$	p_j	$\cdots$	p_n		
Total input		X_1	$\cdots$	X_j	$\cdots$	X_n		
Water inputs		w_1	$\cdots$	w_j	$\cdots$	w_n		

Source: prepared by the author

Elements of the intermediate use matrix in Table 1 are marked x_{ij}, where i is the sector that delivers intermediate products (i.e. output) and j is the sector that uses intermediate products (i.e. input). Thus, the x_{ij} mark represents a part of sector i's annual output used in the production of sector j. Since X_i denotes the gross value of production of sector i, and f_i denotes total final use of the production of the sector i, the entire national economy can be described by the following system of linear equations:[8]

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[7] The derivation and interpretation of the basic input-output model is based on: Frenger (1978, p. 274), Leontief (1986, pp. 22–27), Ten Raa (2006, pp. 14–23), Eurostat/European Commission (2008, pp. 486–489) and Miller & Blair (2009, pp. 10–34).

8 Since the total flows of use of inputs must be equal to the total flows of use of outputs, $X_j = X_i$.

$$X_i = \sum_{j=1}^{n} x_{ij} + f_i, \text{ for each } i = 1, 2, \ldots, \text{n} \tag{1}$$

The intensities of direct cross-sectoral relations, i.e. dependencies in output production, are expressed by the so-called *technical production coefficients* calculated as follows:

$$a_{ij} = \frac{x_{ij}}{X_j} \tag{2}$$

The technical coefficient a_{ij} represents a part of the production of the sector i used in the production of one unit of output of sector j. Therefore, the value of the total quantity of production inputs delivered by the sector i to sector j (x_{ij}) can be expressed as output function of sector j ($x_{ij} = a_{ij}X_j$). If this substitution is introduced into the equation system (1), the following expression is derived:

$$X_i = \sum_{j=1}^{n} a_{ij}X_j + f_i, \text{ for each } i = 1, 2, \ldots, \text{n}, \tag{3}$$

Assuming that a_{ij} are constants, and $f_1, \ldots, f_n$ default values, the equation system (3) in fact represents a system of n linear equations with n unknown variables that establish direct links between outputs of all n sectors. In this sense, the quantification of multiplicative (i.e. cumulative) effects of individual sector's unit production on the production of all other sectors is reduced to solving the mathematical problem of finding new values $X_1, \ldots, X_n$ arising from the change of any f_i. For this purpose, the equation system (3) can be presented in the matrix form:

$$x = Ax + f \tag{4}$$

wherein:

x – total output vector column (X_i)

A – matrix (nxn) of technical coefficients (a_{ij})

f – final demand vector column (f_i)

By solving the equation (4), the basic *Leontief input-output model of production* is obtained showing the correlation between the total output level of each sector and the level of final demand for the output of each sector:

$$x = (I - A)^{-1}f \tag{5}$$

wherein:

I – unit matrix (n×n)

$(I - A)^{-1}$ – Leontief Inverse Matrix (L, n×n)

The elements of the L matrix (l_{ij}) reflect the cumulative (i.e. total direct and indirect) effect of the unit change in the final demand for sector j's output on the production of the total sector i's output:

$$l_{ij} = \frac{\partial X_i}{\partial f_j} \tag{6}$$

3.2. Water extended input-output model and water multipliers

In the extension of the basic input-output model it is first necessary to connect water use with the production of each sector. The link between the total production flows of sector j and its direct water use can be expressed quantitatively by using the direct water use coefficient (d_j), i.e. direct water intensity of sector j:[9]

$$d_j = \frac{w_j}{X_j} \tag{7}$$

wherein:

w_j – total direct water use of sector j

X_j – value of the total inputs of sector j

In the input-output model, direct water use coefficients are presented in diagonal order matrix n ($\hat{d}$). By multiplying the matrix $\hat{d}$ with the L matrix, it is possible to calculate for each of the n sectors how much water needs to be used in the entire economy in order to produce one unit of their output:

$$T = \hat{d}(I - A)^{-1} \tag{8}$$

Matrix T is a square matrix of order n whose elements (t_{ij}) measure the total direct and indirect water use of the sector i which is necessary for the production of one unit of output of sector j.

Therefore, the sum of all elements in j^{th} column of this matrix (t_j) equals the cumulative (i.e. direct and indirect) water intensity of sector j. On the other hand, the sum of all elements in the ith row of the matrix (t_i) equals the cumulative water use in the sector i that is necessary for each of the n sectors to produce one unit of their own output. Water use multipliers can be calculated as follows:

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[8] The extract and interpretation of the water extended input-output model is based on: Velazquez (2006), Guan and Hubacek (2006), Qin (2011), and Hristov et al. (2012).

$$m_j = \frac{t_j}{d_j} \tag{9}$$

$$m_j^{ind} = m_j^d - 1 \tag{10}$$

The multiplier m_j shows for how much the cumulative water use of sector j will increase if its direct water use increases by 1 m³. The multiplier m_j^{ind} shows for how much indirect water use of sector j will increase if its direct water use increases by 1 m³.

Using the previously derived direct water use coefficient matrix ($\hat{d}$) and the cumulative water intensity matrix (T), it is possible to calculate the cross-sectorial water flow matrix (W):

$$W = T - \hat{d} \tag{11}$$

The newly obtained W matrix is a square matrix of row n, the columns of which reflect the structure of indirect water use for each of the n sectors. Therefore, the sum of all elements in j^{th} column of the W matrix (w_{ij}^{inter}) equals the total indirect water use of the j sector per unit of its output.

The W matrix can be converted into a matrix of technical coefficients of cumulative water use Q (q_{ij}) as follows:

$$q_{ij} = \frac{w_{ij}^{inter}}{d_j} \tag{12}$$

The technical coefficient of cumulative water use (q_{ij}) is the measure of cumulative water use of the sector i related to 1 m³ of direct water use of sector j. Therefore, the sum of elements in the jth column of the Q matrix is equal to the value of the indirect water use multiplier of sector j (cf. equation 10).

3.3. Input-output model of water footprint

The water footprint concept is broader than the previously derived indicators of direct, indirect, and cumulative water use because it also takes into account international virtual water flows in foreign trade (cf. Hoekstra & Hung, 2002; Hoekstra & Chapagain, 2008; Guan & Hubacek, 2006). Imports of virtual waters represent indirect domestic use of foreign water resources; therefore, it contributes to the water footprint of the importing country. By contrast, virtual water exports constitute indirect foreign use of domestic water resources; they therefore do not enter into the calculation of the water footprint of the exporting country. Thus, the total water footprint of the national economy is equal to the sum of the total water

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use in that economy (i.e. domestic water footprint) and net imported virtual waters (i.e. net imported water footprint).

Since the input-output analysis methodology of the national economy enables, among other things, quantification of direct and indirect effects of foreign trade, by using the water extended input-output model it is possible to calculate domestic, net imported, and total water footprints for all n sectors.

Domestic water footprint (DWF) is the total quantity of water used by domestic producers in the production of national output reduced by the amount of water used to produce the exported output:

$$DWF = \hat{d}_1(I-A)^{-1}\hat{f}_{dom} \tag{13}$$

wherein:

$\hat{d}_1$ – diagonal matrix of direct water use coefficients

$(I-A)^{-1}$ – Leontief Inverse Matrix

$\hat{f}_{dom}$ – diagonal matrix of domestic demand[10]

When calculating imported water footprints, it is assumed that the direct and indirect intensity of water use in the production of imported goods and services is the same as in domestic production (cf. Renault, 2002). Although this is an unrealistic assumption, because different countries have a different technological production base, the imported water footprints calculated in this way clearly indicate to what extent would national water resources be additionally burdened if a share of imports was substituted by domestic production. Taking into account this assumption, net imported water footprints (NIWF) are calculated as follows:

$$NIWF = \hat{d}_1(I-A)^{-1}(\hat{x} - \hat{m}) \tag{14}$$

wherein $\hat{x}$ and $\hat{m}$ are diagonal matrices of exports and imports.

Finally, the sum of the domestic and net imported water footprint provides an indicator of the total water footprint (TWF):

$$TWF = DWF + NIWF \tag{15}$$

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[10] Domestic demand is obtained by deducting the value of exports from the value of final demand (cf. Annex 1).

3.4. Pull and Push water use indices

Pull and Push indices measure the relative strength of *backward* and *forward* *linkages* of production sectors in the national economy. In the context of water use, *backward linkage* implies the effect of changing the final demand for output of sector j on water use in sectors that directly or indirectly meet its needs for production inputs. By contrast, *the forward linkage* implies the sensitivity of water use in the sector i to the change of the final demand for output of sectors that directly or indirectly use the output of the i sector *(*i.e. Yu et al., 2010, p. 1143).

The absolute strength of *the backward linkage* of sector j (B_j) is calculated as the sum of elements in j^{th} column of the cumulative water use coefficient matrix (T) (cf. equation 8):

$$B_j = \sum_{i=1}^{n} t_{ij} \tag{16}$$

The absolute strength of *forward linkage* is calculated using an alternative input-output model, which, according to its author, is called *the Ghosh input-output model*. Unlike the original *Leontief model* (cf. equation 5), *the Ghosh model* connects total output (X) and primary inputs (p) as shown below (cf. Davar, 2005; Maresa & Sancho, 2012):

$$x = (I - B)^{-1} p \tag{17}$$

wherein:

B – matrix ($n \times n$) of the technical allocation coefficients ($b_{ij} = x_{ij} / X_i$)

$(I - B)^{-1}$ – Ghosh Inverse Matrix (G, $n \times n$)

The elements of the G (g_{ij}) matrix reflect the overall effect of the unit change of the sector i's primary inputs on the total output of sector j. Therefore, the absolute strength of *the forward linkage* of sector i in terms of water use (F_i) can be calculated as the sum of elements in the ith row of the cumulative water supply coefficient matrix (V) obtained by multiplying the Ghosh Inverse Matrix by the diagonal matrix of direct water use coefficients ($\hat{d}$):

$$V = \hat{d}(I - B)^{-1} \tag{18}$$

$$F_i = \sum_{j=1}^{n} v_{ij} \tag{19}$$

Previously defined absolute strengths of *backward* and *forward linkages* of production sectors can be relatively expressed in the form of *Pull* and *Push water*

use indices (cf. Duarte & Sánchez-Chóliz, 1998; Alonso, 2004; Yu et al., 2010; Qin, 2011; Bekchanov, et al., 2014):[11]

$$PLI_j = \frac{B_j}{\frac{1}{n}\sum_{j=1}^{n} B_j} \qquad (20)$$

$$PSI_i = \frac{F_i}{\frac{1}{n}\sum_{i=1}^{n} F_i} \qquad (21)$$

If the value of *the Pull* index (PLI_j) of sector j is greater than 1, the unit increase of the final demand for the production of sector j will result in an above-average increase in water use in all sectors of the national economy. On the other hand, if the value of *the Push index* (PSI_i) of the sector i is greater than 1, the unit increase in the final demand for production of all sectors in the national economy will result in an above-average increase in water use in sector i.

3.5. Basic assumptions and limitations of the model

The designed water extended input-output model is a version of the so-called open static input-output model which is based on the following assumptions (i.e. Gretton, 2013, p. 4; Gupta, 2009, pp. 635–637):

1. All enterprises within a particular sector use the same technology and produce identical products, which implies full homogeneity of sectoral production.

2. All production inputs are perfect complements in the production process; therefore, there is no possibility of their substitution, i.e. all sectors have a fixed structure of production inputs and achieve constant yield on production volume.

3. All sectors have absolute adequacy of production capacities, which is why any increase in final demand is accompanied by a proportionate increase in national production.

Since these assumptions do not reflect the real economic reality, the following limitations in the application of this model can be recognised (i.e. OECD, 1992; Jain & Ohri, 2007, p. 234; NWT Bureau of Statistics, 2006, p. 8):

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[11] In the literature there are several approaches for measuring the relative strength of *backward* and *forward linkages* in the production system of the national economy. Indices defined by Rasmussen (1956), which are often used in literature, were used for research purposes in this paper. These indices measure the deviation of absolute strength of *backward* and *forward linkages* in relation to their average value.

1. Diversification of production assortment and production inputs is one of the basic business strategies for adjustment of companies to constantly changing market conditions; therefore, the assumption of complete homogeneity of sectoral production has no basis in economic reality.

2. The assumption that production factors are constantly available (i.e. sufficiency of production capacities) does not take into account the problem of collective competition over production factors. Therefore, in reality, certain sectors cannot significantly increase their production without taking over part of the resources needed to increase the production of other sectors.

3. Due to the assumption of constant return to scale, the model does not take into account the impact of the existence of economies and diseconomies of scale in different sectors on their demand for intermediate goods and thus on the multiplicative effects of their production on other sectors.

4. The assumption of the fixed structure of inputs and the inability to substitute them ignores the fact that growth or fall in demand for production inputs actually leads to a change in relative input prices, which can lead to the substitution of inputs in production and consequently to a change in intermediary relationships in the production system of the national economy. There are also numerous factors that can affect the productivity and efficiency of enterprises (e.g. knowledge, technology) and thus reduce or increase the degree of their dependence on certain intermediate inputs.

5. In practice, there is a significant interval of time between the collection of data necessary for the creation of input-output tables and their publishing, which brings into question the accuracy of technical production coefficients.

It is important to point out that all these limitations almost exclusively relate to the accuracy and reliability of open static input-output models as simulation and prognostic tools. On the other hand, their capacities and capabilities in the analysis of production systems and economic structures are still unique and even irreplaceable compared to other analytical tools and methodologies. The reason is that the A matrix (cf. equation 2) credibly reflects the technical structure of the production system of the national economy in a specific period of time and at a precisely defined level of its aggregate economic activity, which enables the practical application of the theory of overall interdependence in the empirical analysis of direct and indirect links between different parts of national economies as complex systems (i.e. Gerking, 1976, p. 2). Also, although the technical production coefficients in each national economy vary over time, they do not change so rapidly (cf. Sun & Wong, 2014; Hermannsson, 2010). Therefore, open static input-output models can be useful both as simulation and prognostic tools, but not in terms of precise quantification of multiplicative changes in the production system of the

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national economy that can be caused by certain endogenous or exogenous factors, but in terms of determining the direction and general extent of these changes. Therefore, the application of a static input-output analysis can certainly contribute to a better understanding of the impact of cross-sectoral dependencies on water use in the national economy, but also on other forms of economic pressures on natural resources and the environment.

However, there is an obvious empirical constraint on extended input-output models in quantification and analysis of indirect and cumulative flows of natural resource consumption and emissions into the environment, which is not pointed out in the literature. As a rule, data in satellite accounts of natural resources and the environment are presented according to standard classifications of economic activities based on the principle of main activity. On the other hand, data in input-output tables are obtained by transforming supply and use tables from *activity – product* form to *product – product* form. This implies a complex process of linking and reducing data expressed according to the classification of activities and data presented by product classification into a single sector classification based on the principle of homogeneous manufacturing sector (cf. Eurostat, 2008, pp. 295–297). The problem is that most companies in a certain country do not only carry out the main activity for which they are registered, but part of their total output includes goods and services which, according to the criteria of original economic origin, imply the pursuit of some other activities (i.e. secondary goods and services). Therefore, data on, for example, the total water use in individual economic activities are not fully equivalent to the total water use in similar homogeneous production sectors.[12] Therefore, in order to reliably and correctly interpret the results obtained by extended input-output models, the author recommends previous verification of the structure of output values by product types in the supply-use tables for each economic activity. If typical products are predominant in the total output of each economic activity, extended input-output models may produce high-quality and reliable results. However, if there is a significant share of secondary products in the total output of certain activities, it is necessary to interpret the results obtained with caution, especially if they are water-intensive secondary products.

3.6. Data sources

A symmetric input-output table of the Croatian economy for 2010, published in 65×65 format (CBS, 2015), was used in the construction of water extended input-output model of the Croatian economy. Since the available data on the economic

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[12] Therefore, it is necessary to develop statistical standards for the regular monitoring of environmental pressures and natural resources, which, in addition to the current economic classifications of activities, are based on the applicable economic classifications of products.

use of water are not organised according to the same level of aggregation (i.e. of detail) as input-output data, the original version of the input-output table is reduced to 24×24 format. For the purpose of this research, the production system of the Croatian economy was classified into 24 sectors (cf. Table 2).

Table 2: Classification of Production Sectors

Labels	Production sectors	Labels	Production sectors
1	Primary sector	13	Metallic sector
2	Mining and quarrying	14	Manufacture of computer, electronic and optical products and electrical equipment
3	Food sector[12]	15	Manufacture of machinery and equipment
4	Textile sector[13]	16	Manufacture of motor vehicles, trailers, semi-trailers and their transport equipment
5	Wood-processing sector[14]	17	Manufacturing of furniture and other manufacturing
6	Manufacture of paper and paper products	18	Repair and installation of machinery and equipment
7	Printing and production of recorded media	19	Power sector[15]
8	Oil-processing sector[16]	20	Water collection, treatment and supply
9	Chemical sector	21	Waste management and environmental remediation
10	Pharmaceutical sector	22	Construction
11	Manufacture of rubber and plastic products	23	Hospitality sector
12	Non-metallic sector	24	Other services

Source: Author's calculation

The newly formed input-output table has been extended along the vertical axis by adding one row which, in accordance with the classification of production sectors in Table 1, contains structured data on direct water use (cf. Annex 1). Data on direct water use in industrial sectors are taken over from the Statistical Report of

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[13] It also includes manufacture of beverages and tobacco products.

[14] It also includes manufacture of wearing apparel and leather products.

[15] Manufacture of wood and products of wood and cork, except furniture, including manufacture of articles of straw and plaiting materials.

[16] Electricity, gas, steam and air conditioning supply.

[17] It also includes manufacture of coke.

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the CBS for 2010 (CBS, 2011).[18] For the purpose of determining the direct water use in particular sectors as accurately as possible, part of the water statistics data had to be previously additionally processed or assessed. This primarily relates to the *power sector*. The reason is that most of the water used in *the power sector* is only passing through hydroelectric power plants, which means that the water can be used downstream again in other sectors. Therefore, in order to avoid the error of multiple calculation of directly consumed water, only quantities of *water related to production*, *water used for cooling the plant and water used for sanitary and other purposes* were taken into account in the *power sector*. Water intended for fish farming has a similar feature; therefore, this form of economic use of water is excluded from the assessment of the total annual water use in *the primary sector*. Water use in the primary sector was estimated based on data on the use of irrigation water (cf. Voća et al., 2014, p. 160) and data on quantities of water delivered in 2010 *to agriculture, forestry, and fisheries* from the public water supply system.[19] When estimating water use in the service part of the economy, only *the catering sector* is singled out in particular, since it is traditionally highlighted as a significant water consumer. Water use in this sector is estimated on the basis of the water use coefficient in tourist activities (cf. Voća et al., 2014, p. 92) and data submitted by the CBS on the total delivered quantities of water from the public water supply system in 2010. Assuming that the nature of service activities operations is such that they predominantly satisfy their water needs through the public water supply system, all remaining commercial and service activities in the input-output table of the Croatian economy are aggregated into a single *sector of other service activities*. The estimate of the total direct water use in the sector of *other service activities* was also made on the basis of data on the total delivered quantities of water from the public water supply system in 2010 provided by CBS.

4. Empirical data and analysis

In accordance with the methodology framework presented above, this part of the paper presents the results of input-output analysis of water use in the Croatian economy.

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[18] Since the input-output table referrs to 2010, for the sake of credibility of analysis and interpretation of calculated indicators, the official water statistics data for 2010 were used in the model.

[19] Data submitted by the CBS.

4.1. Characteristics of direct and indirect water use in the Croatian economy

The following table shows calculations of indicators of direct water use, indicators of direct, indirect, and cumulative water intensity and cumulative and indirect water use multipliers in the Croatian economy.

Table 3: Indicators of direct, indirect, and cumulative water use in the economy of the Republic of Croatia in 2010

Sector labels	Direct water use (m³)	Direct water intensity (m³/mil. HRK)	Indirect water intensity (m³/mil. HRK)	Cumulative water intensity (m³/mil. HRK)	Cumulative water multiplier	Indirect water multiplier
1	12,671,000.0	459.37	1,192.67	1,652.04	3.60	2.60
2	2,303,000.0	114.09	134.93	249.02	2.18	1.18
3	31,049,000.0	748.09	922.72	1,670.81	2.23	1.23
4	3,645,000.0	267.20	754.47	1,021.66	3.82	2.82
5	484,000.0	128.26	683.75	812.01	6.33	5.33
6	4,603,000.0	740.94	645.54	1,386.48	1.87	0.87
7	103,000.0	30.75	1,268.68	1,299.43	42.26	41.26
8	143,794,000.0	7,431.70	304.97	7,736.67	1.04	0.04
9	92,258,000.0	5,826.37	1,216.29	7,042.66	1.21	0.21
10	645,000.0	80.81	420.69	501.50	6.21	5.21
11	107,000.0	15.73	542.41	558.14	35.48	34.48
12	10,169,000.0	1,398.87	897.20	2,296.07	1.64	0.64
13	1,913,000.0	106.02	287.95	393.96	3.72	2.72
14	1,798,000.0	88.97	260.63	349.60	3.93	2.93
15	166,000.0	14.63	149.86	164.49	11.24	10.24
16	1,120,000.0	69.86	240.29	310.15	4.44	3.44
17	332,000.0	47.26	406.88	454.15	9.61	8.61
18	73,000.0	8.74	1,177.97	1,186.71	135.78	134.78
19	133,412,000.0	9,784.74	2,487.81	12,272.56	1.25	0.25
20	1, 621,000.0	523.89	832.32	1,356.20	2.59	1.59
21	154,000.0	26.45	1,293.06	1,319.51	49.88	48.88
22	1,948,000.0	40.21	812.77	852.97	21.21	20.21
23	15,412,000.0	475.02	886.71	1,361.73	2.87	1.87
24	35, 012,000.0	108.14	641.49	749.63	6.93	5.93

Source: Author's calculation

According to data in Table 3, in 2010 a total of 494.8 million m³ of water was used in the Croatian economy. In absolute terms, the most important direct water users were the *oil-processing sector* (with 29,06% share), *the chemical sector* (with 18.65% share), and *the power sector* (with 26.96% share). Also, significant direct water use was achieved by the *food sector* (with a share of 6.28%), and *non-metallic sector* (with a share of 2.06%). In the service part of the Croatian economy,

the largest direct water use was recorded in the *sector of other service activities* (with a share of 7.08%) and *the catering sector* (with a share of 3.11%).[20] On the other hand, *the primary sector* achieved only 2.56% of the total direct water use.[21]

Based on relativization of direct water use according to the realised value of annual output, it has been found that the most important direct water users also have significantly greater direct water intensity compared to other sectors. Thus, the highest direct water use per unit of output produced was recorded in *the power sector*, which consumed 9,784,74 m³ of water per million HRK of realised annual output (hereinafter referred to as: output unit). It is followed by *the oil-processing sector* (7.431.70 m³/mil. HRK), and *the chemical sector* (5.826,37 m³/mil. HRK). Therefore, the *chemical*, *oil-processing,* and *power sector,* apart from their absolute dependence, also have the highest relative dependence on water as a production input. Considering the achieved level of direct water intensity, all other production sectors are below the level of 1000 m³/mil. HRK (cf. Table 3). The exception is only the *non-metallic sector* which in 2010 directly consumed 1398.87 m³ of water per unit of output produced.

Figure 1: Sectors with the highest direct water intensity (2010, in m³/mil. HRK)
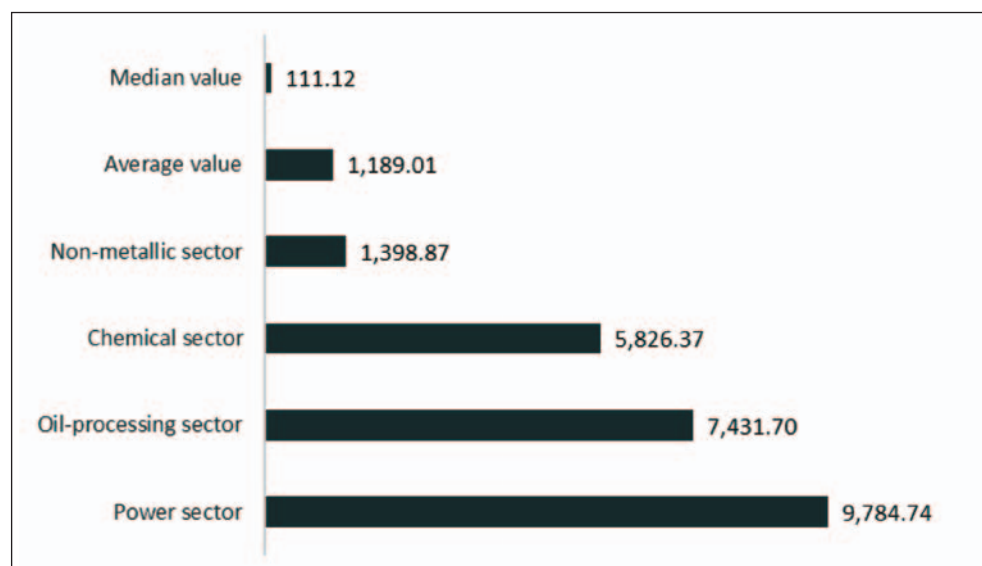
Source: Author's calculations

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[20] Since *the catering sector* achieves almost half of the direct water use of all other service activities, it represents the most important direct water user in the service part of the Croatian economy.

[21] The main reason for this is that agricultural production in the Republic of Croatia is predominantly based on the use of rainfall water, not large systems for irrigation of agricultural areas.

In the service part of the Croatian economy, *the sector of other service activities* recorded below-average direct water intensity of 108,14 m³/mil. HRK, while the *catering sector*, as the most important direct water user in the service sector, consumed 475.02 m³ of water per output unit. A similar level of direct water use per output unit was also recorded in the *primary sector* (459.37 m³/mil. HRK) (cf. Table 3).

According to the values of cumulative water intensity indicators (cf. Table 3), *the power, oil-processing, and chemical sector* are the most significant cumulative water users in the Croatian economy. The intensity of cumulative water use in these industrial sectors amounts to 12.272.56 in m³/mil. HRK, 7.736.67 in m³/mil. HRK, and 7.042.66 in m³/mil. HRK, respectively. Why these values are so high in relation to other sectors can be best explained by the performance of *the non-metallic sector*, which, despite taking a high fourth position in cumulative water intensity, has as much as 67.4% lower value of this indicator than *the chemical sector*. Still, the cumulative water intensity of all four sectors is dominantly determined by their direct water use (cf. Figure 2).

Figure 2: Structure of cumulative water intensity of the most important direct water consumers (2010, in m³/mil. HRK)
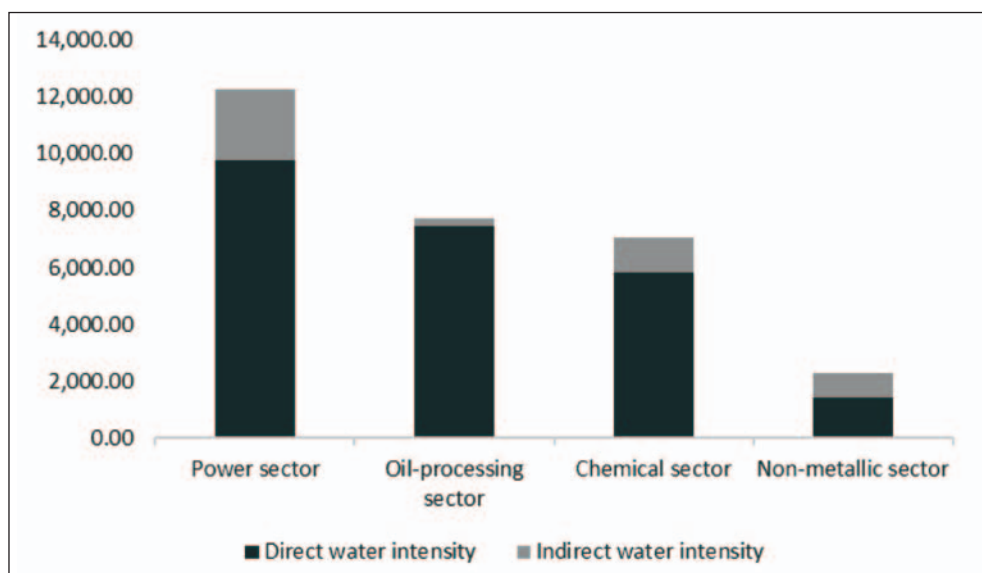
Source: Author's calculations

The data illustrated in the previous Figure 2 show that all the most important direct water users in the Croatian economy have relatively low indirect water use.[22] This

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[22] It is considered in the context of share of indirect water use in their cumulative water use.

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means that the Croatian economy needs considerably less amount of water to produce intermediate inputs consumed per output unit in *the power*, *oil-processing,* and *chemical sector* than the amount of water those sectors need to produce their own output unit. This is also confirmed by the multipliers of sectoral water use, the values of which result in the following relations (cf. Table 3):

– *the power sector for* each 1 m³ of directly consumed water indirectly consumes 0.25 m³ of water,

– *the oil-processing sector* for each 1 m³ of directly consumed water indirectly consumes 0.04 m³ of water,

– *the chemical sector* for each 1 m³ indirectly consumes 0.21 m³ of water.

Since *the power, oil-processing,* and *chemical sector* account for as much as three quarters of the total direct water use in the Croatian economy (cf. Table 3), it is apparent from the structure of their cumulative water intensity that the sectors recording the highest values of indirect water intensity indicators and indirect water use multipliers are in fact the main drivers of water use in the Croatian economy (cf. Figure 3).

Figure 3: Sectors with the highest indirect water intensity (2010, in m³/mil. HRK)
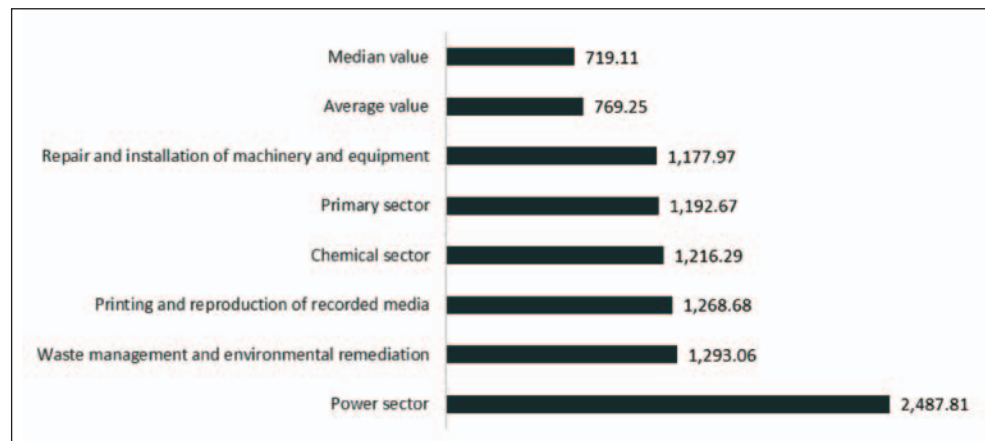
Source: Author's calculations

Although *the power sector* has a relatively small share of indirect water use in its cumulative water use per output unit (cf. Figure 2), this sector is, in absolute terms, still the largest indirect water consumer (2,487.81 m³/mil. HRK). This is because approximately 50% of the value of its intermediary consumption is realised through the use of its own production and the use of the production of *the oil-*

processing sector, which are in itself the largest direct water consumers (cf. Annex 1). Because of that, 95.58% of indirect water use of *the power sector* was caused by the use of own products and products of *the oil-processing sector* (cf. Annex 2). The same applies to *the chemical sector* where transactions between its internal activities are responsible for as much as 67.56% of its indirect water use (cf. Annex 1, Annex 2). Since a significant share of indirect water use per output unit in the mentioned sectors is *de facto* related to "internal water use", the results of indirect water intensity only further demonstrate the existence of high direct dependence of these sectors on water as a production input.[23] In this context, it can be concluded that the sectors *waste management and environmental remediation*, *printing and reproduction of recorded media*, and *repair and installation of machinery and equipment* have high indirect water intensity, which in turn amounts to 1,293.06 m³/mil. HRK, 1,269.68 m³/mil. HRK and 1,178.97 m³/mil. HRK. This means that water-intensive sectors participating in their production chain must consume significant amounts of water to meet their intermediate demand.

It is particularly important to decompose and consider the intensity of indirect water use of *the primary sector* (1,192.67 m³/mil. HRK). According to the data presented in Annex 2, except for *the chemical sector, the oil-processing sector, and the power sector,* the use of own production and *the food sector* have a significant share in the structure of the total indirect water use of *the primary sector* per output unit. Also, there is a visible and pronounced link between *the primary sector* and *the food sector* in terms of cross-sectoral transfers of virtual water, where, naturally, *the primary sector* also has a significant share in indirect water intensity of the *food sector*. This indicates that the production and supply chain of agricultural production in the Republic of Croatia is directly related to the exploitation of national water resources, which implies that the growth of agricultural production through increased irrigation could have significant multiplicative effects on indirect and direct water use flows.

Finally, it is important to understand that the sectors that have a relatively higher share of indirect water use in their cumulative water intensity also have potentially greater power to trigger economic water use, irrespective of their current level of direct and indirect water use compared to other sectors (cf. Figure 4).

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[23] A significant percentage of "internal water use" is also present in *the primary sector*, *the food sector*, and *the non-metallic sector* (cf. Annex 2).

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Figure 4: Structure of cumulative water intensity in selected sectors (2010, in m³/
mil. HRK)
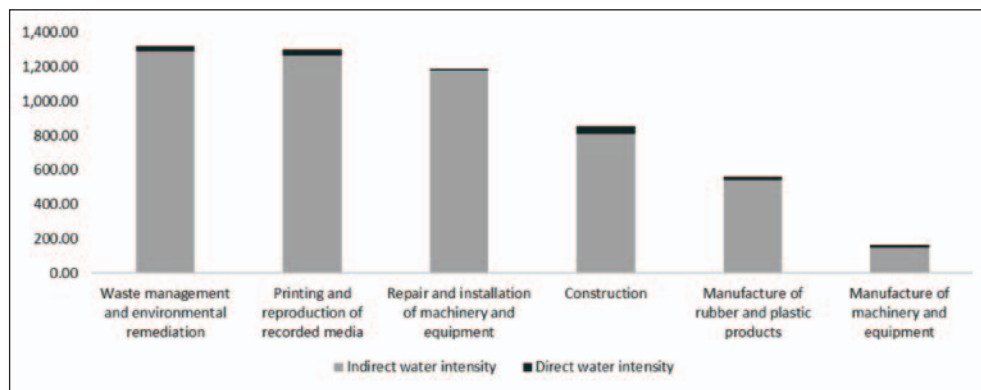
The proportion in which the sudden expansion of the production of sectors shown in Figure 4 may influence the rise in aggregate water demand is best reflected in the values of their water use multipliers, according to which, for each 1 m³ of water used directly (cf. Table 3):

– the *repair and installation of machinery and equipment sector* indirectly consumes 134.78 m³ of water,

– the *waste management and environmental remediation sector* indirectly consumes 48.88 m³ of water,

– the *printing and reproduction of recorded media sector* indirectly consumes 41.26 m³ of water,

– the *manufacture of rubber and plastic products sector* indirectly consumes 34.48 m³ of water,

– the *construction sector* indirectly consumes 20.21 m³ of water; and

– the *manufacture of machinery and equipment sector* indirectly consumes 10.24 m³ of water.

For example, if the value of indirect water use multiplier for *the repair and installation of machinery and equipment sector* is decomposed and interpreted from the aspect of water use in sectors supplying it with inputs, then it can be concluded that for each 1 m³ of water used directly in *the repair and installation of machinery and equipment sector*:

– *the oil- processing sector* must additionally consume 66.72 m³ of water,

– *the power sector* must additionally consume 48.82 m³ of water,

– *the chemical sector* must additionally consume 9.85 m³ of water,

– the remaining production sectors must additionally consume 9.39 m³ of water together.

Using the reverse approach, it is possible to decompose the direct water use of each sector according to the structure of its intermediate supply. For example, for each consumed 1 m³ of water in *the repair and installation of machinery and equipment sector*, *waste management and environmental remediation sector,* and *the construction sector*, *the oil-processing sector* must additionally consume 66.72 m³, 8.09 m³ and 6.10 m³ of water (cf. Annex 3).

4.2. Analysis of water footprint indicators

Since foreign trade is an indispensable part of the process of creating and distributing national output, the production sectors indirectly use the water resources of other countries through the consumption of imported inputs, but at the same time they use domestic water resources for their export production. Therefore, the so-called virtual water flows that are integrated in foreign trade between the Republic of Croatia and the rest of the world should also be taken into account for the overall assessment of water quantities needed to meet domestic demand. By linking estimated virtual water flows with data on direct and indirect water use, it is possible to calculate water footprints for all observed sectors in the Croatian economy (cf. Table 4).

Table 4: Water footprint of production sectors in the Croatian economy in 2010

Sector labels	Domestic water footprint (m³)	Net imported water footprint (m³)	Total water footprint (m³)
1	10,699,024.94	1,209,404.10	11,908,429.04
2	1,669,542.34	1,855,370.41	3,524,912.76
3	26,897,222.06	3,211,867.46	30,109,089.52
4	3,016,694.13	1,188,719.03	4,205,413.16
5	157,540.73	-81,758.52	75,782.22
6	3,359,820.83	1,806,558.15	5,166,378.98
7	101,637.23	971.15	102,608.39
8	87,684,841.04	-3,601,090.76	84,083,750.28
9	53,437,949.52	41,106,394.74	94,544,344.27
10	449,149.33	205,748.52	654,897.85
11	75,304.61	62,402.95	137,707.57
12	7,226,877.77	990,959.20	8,217,836.97
13	1,210,203.65	912,281.48	2,122,485.13

Sector labels	Domestic water footprint (m³)	Net imported water footprint (m³)	Total water footprint (m³)
14	1,245,632.06	632,158.53	1,877,790.59
15	129,357.07	96,296.29	225,653.36
16	657,405.30	153,997.40	811,402.70
17	222,035.93	82,344.93	304,380.86
18	42,816.71	-13,011.09	29,805.62
19	111,214,126.12	20,710,671.98	131,924,798.10
20	1,528,292.81	-2,154.94	1,526,137.87
21	97,244.29	-38,312.70	58,931.59
22	1,891,008.36	-37,864.63	1,853,143.73
23	15,129,551.16	1,174,389.84	16,303,940.99
24	29,284,914.81	-1,647,455.41	27,637,459.40
Total	357,428,192.80	69,978,888.13	427,407,080.93

Source: Author's calculation

According to the results of the model, the total water footprint of the Croatian economy in 2010 amounted to 427.7 million m³ of water, out of which 357.4 million m³ refers to the consumption of domestic water resources and 69.98 million m³ to the net imported quantity of virtual waters. The water footprint of imported inputs consumed in domestic production amounted to 207.3 million m³ of water, while 137.4 million m³ of water was used for exported production in the Croatian economy.

Looking at each sector individually, it can be concluded that the largest domestic water footprint are the ones from *the power sector* (111.2 million m³), *the oil-processing sector* (87.7 million m³), and *the chemical sector* (53.4 million m³). They are followed by *the food sector* (26.9 million m³), *the catering sector* (15.1 million m³), *the primary sector* (10.7 million m³) and *non-metallic sector* (7.2 million m³). All other sectors together account for only 13.3% of the total national production water footprint (47.6 million m³). However, direct water use mostly contributes to the domestic water footprint of *the power sector*, *the oil-processing sector*, *the chemical sector* and *the non-metallic sector*, while the majority of the domestic water footprint of the *food sector*, *the catering sector,* and *the primary sector* refer to indirect water use (cf. Tables 3 and 4).

Assuming the equal intensity of water use in the production of domestic and foreign goods and services, Figure 5 shows the distribution of total net imported/exported water footprint by key sectors of the Croatian economy. The sectors above the horizontal line are net importers of virtual waters, and the sectors below the horizontal line are net exporters of virtual waters.

Figure 5: Net imported/exported water footprint per sectors in 2010 (m³)
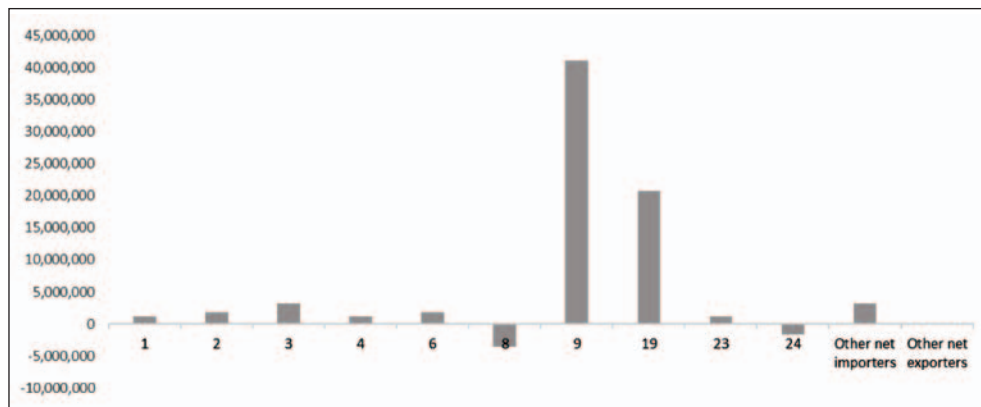
Source: Prepared by the author

According to data for 2010, the most important net importers of virtual waters are *the chemical sector* (41.1 million m³) and *the power sector* (20.7 million m³). The distribution of estimated net imported/exported water footprints shown above reflects the underdeveloped domestic value chains supporting the production of industrial, energy, and agricultural sectors.

Therefore, a significant part of their intermediate consumption relates to the use of imported inputs, i.e. indirect consumption of foreign water resources.[24] On the other hand, relatively small quantities of exported virtual waters can be explained by the underdevelopment of water intensive export sectors in the Croatian economy, which is why the services sector dominates the structure of total exports of the Republic of Croatia.[25]

The following Figure 6 shows the structure of the total water footprint of the Croatian economy.

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[23] In 2010, the share of imports in the total value of Croatian production amounted to 17% (cf. Annex 1).

[25] In 2010, *the other service activities* sector participated in the total exports of the Croatian economy with a share of 44.2% (cf. Annex 1).

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Figure 6: Structure of the total water footprint of the Croatian economy by key production sectors in 2010
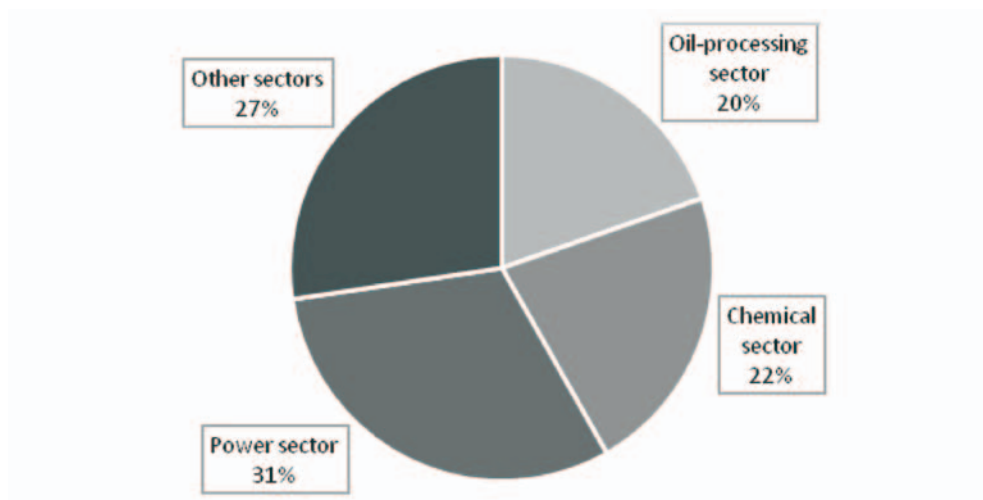
Source: Prepared by the author

According to the structure of the estimated total water footprint, it is evident that the largest water footprints are in *the power sector* (131.9 million m³), *the chemical sector* (94.5 million m³), and *the oil-processing sector* (84.1 million m³), which together account for as much as 72.7% of the total water footprint of the Croatian economy.

4.3. Analysis of pull and push effects of water use in the Croatian economy

In order to gain a complete understanding of the impact of each sector on the initiating of water use flows in the Croatian economy, the relative strength of their intermediary *forward* and *backward linkages* has been analysed in this part of the paper. Accordingly, the following table shows *pull* and *push indices of* water use in the Croatian economy.

Table 5: Pull and push indices of water use in the Croatian economy in 2010

Sector labels	Pull indices	Push indices	Sector labels	Pull indices	Push indices
1	0.84	0.50	13	0.20	0.29
2	0.13	2.96	14	0.18	0.11
3	0.85	0.47	15	0.08	0.09
4	0.52	0.17	16	0.16	0.08
5	0.41	0.23	17	0.23	0.10
6	0.71	0.80	18	0.61	0.43
7	0.66	0.04	19	6.27	6.15
8	3.95	5.02	20	0.69	0.42
9	3.60	3.85	21	0.67	0.27
10	0.26	0.16	22	0.44	0.04
11	0.29	0.37	23	0.70	0.29
12	1.17	0.91	24	0.38	0.22

Source: Author's calculation

According to the model results, *the oil-processing*, *chemical,* and *power sector* have the highest values of *pull* and *push indices* of water use. Since the values of both indices for these sectors are greater than 1, it can be concluded that these sectors play a key role in the overall process of water use in the Croatian economy. In other words, the unit change in the final demand for their output causes an above-average change in water use in the Croatian economy, but also a unit change in the total final demand in the Croatian economy causes an above-average change in water use in these sectors. Out of other observed sectors, only the *non-metallic sector* has a value *of pull index* greater than 1, which means that this sector has a significant strength *of the backward linkage*, i.e. it generates above-average total water use in the Croatian economy when purchasing and consuming intermediate inputs. On the other hand, *the push index* of water use exceeding 1 was also recorded in *the mining and quarrying sector*, indicating that this sector has above-average sensitivity of direct water use to the unit change of final demand in the Croatian economy.[26]

5. Results discussion

The results obtained by the model show that *the power, oil-processing,* and *chemical sector* are the most important sources of direct pressures on water resources in the Croatian economy. Since most of their production serves to satisfy intermediate

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[26] Although *the mining and quarrying sector* has relatively small direct and indirect water use, it is excessively sensitive to *the push effects of* water use, because as much as 98% of its output is intended for intermediate uses (cf. Annex 1).

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consumption of other sectors, the final demand in the rest of the economy has strong multiplicative effects on water use in these industrial sectors. Also, these sectors also have above-average strength of forward and backward linkages in terms of water use, which is why chains of production and distribution of their output have a relatively high level of cumulative water intensity. In addition, the results of water footprint indicators indicate that intermediate needs for water intensive inputs in the Croatian economy are largely met through imports. Taking into account the natural resources – preconditions of the Republic of Croatia for the production of precisely such products, it is quite evident that there are significant potentials in the Croatian economy for substitution of a part of imports with domestic production, but also for increasing exports through stimulation of the development of water-intensive activities. This applies in particular to *the power, agricultural,* and *food sector* activities. However, summing up new findings on the nature of direct and indirect water use flows in the Croatian economy, it is realistic to expect that the increase in production in these sectors will significantly affect the overall water use in the Republic of Croatia. Therefore, in order to achieve optimal harmonisation of interests of conservation and protection of national water resources and development interests of the Croatian economy, it is particularly necessary to take into account the multiplicative effects of cross-sectoral dependencies on water use when conducting activities of planning, management, and protection of Croatian water resources.

6. Conclusions

In order to comprehensively understand the impact of cross-sectoral dependencies on the total economic use of water in the Republic of Croatia, the water extended input-output model of the Croatian economy has been developed in this paper. Based on this model, three levels of input-output analysis were conducted. The indicators of direct, indirect, and cumulative water intensity of production sectors in the Croatian economy, including multipliers of their water use, were calculated and analysed first. Subsequently, domestic, net imported, and total water footprints of the Croatian economy and its production sectors were also calculated and analysed. Finally, the pull and push effects of final demand on economic water use flows in the Republic of Croatia were calculated and analysed as well. According to the results of the analysis, it can be concluded that the Croatian economy has a highly homogeneous structure of direct water use, which is mostly concentrated in several basic industrial sectors. Since a significant part of the output of these sectors is integrated into value chains of national production, the production activities of other sectors have a significant multiplicative impact on the flows of direct and indirect water use in the Croatian economy. Consequently, it can be concluded that the level of total economic water use in the Republic of Croatia is dominantly conditioned by intermediate processes of production and consumption

of outputs of *the power*, *chemical,* and *oil-processing sector*. Also, the analysis of water footprint indicators showed that the Republic of Croatia achieves a surplus in the international exchange of virtual waters, which in view of the relatively high abundance of water resources in the territory of the Republic of Croatia indicates the underdevelopment and structural non-adjustment of water-intensive production capacities of the Croatian economy in relation to the intermediate demand of domestic producers.

Considering the guidelines for future input-output research of the impact of the Croatian economy on water resources, the model presented in this paper can also be used for quantification and analysis of direct, indirect, and cumulative wastewater flows in the Croatian economy, as well as for assessment of the corresponding sectoral wastewater footprints. However, due to the existence of regional disparities in the availability of water resources in the territory of the Republic of Croatia, but also due to inequalities in structural characteristics and the development of regional economies, it is not possible to determine, based on this model, how the flows of the production and consumption of goods and services within and between Croatian regions affect national water resources. Therefore, one of the future research challenges should be related to the construction and empirical application of a multi-regional hybrid input-output model of water use and water pollution in the Croatian economy.

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Vodom proširena input-output analiza hrvatskog gospodarstva[1]

Saša Čegar[2]

Sažetak

Osnovni cilj ovog rada je identificirati najznačajnije izravne i neizravne izvore potrošnje vode u hrvatskom gospodarstvu te na osnovu toga ukazati na ključne pokretače potrošnje vode u procesu hrvatske nacionalne proizvodnje. U svrhu toga, u radu je konstruiran i empirijski primijenjen vodom prošireni input-output model na temelju kojeg su kvantificirani i analizirani pokazatelji izravne, neizravne i kumulativne vodne intenzivnosti proizvodnih sektora u hrvatskom gospodarstvu, uključujući njihove kumulativne i neizravne multiplikatore potrošnje vode. Pomoću spomenutog modela u radu su također procijenjeni i analizirani domaći, neto uvezeni i ukupni vodeni otisci proizvodnih sektora u hrvatskom gospodarstvu, kao i relativna snaga pull i push efekata njihove potrošnje vode. Za potrebe konstrukcije modela korištena je posljednje objavljena input-output tablica hrvatskog gospodarstva za 2010. godinu te referentni podaci hrvatske službene vodne statistike. Rezultati modela ukazuju da su izravni i neizravni tokovi potrošnje vode u hrvatskom gospodarstvu najvećim dijelom determinirani intermedijarnim procesima stvaranja i raspodjele outputa elektro-energetskog, kemijskog i naftno-prerađivačkog sektora. Također, modelom je utvrđeno da ovi sektori dominiraju u strukturi ukupnog vodenog otiska hrvatskog gospodarstva, pri čemu Republika Hrvatska, ukupno gledajući, ostvaruje suficit u međunarodnoj razmjeni virtualnih voda. S obzirom na novo dobivene spoznaje o neizravnim i kumulativnim tokovima potrošnje vode u hrvatskom gospodarstvu, preporuka je autora da se prilikom provođenja budućih aktivnosti planiranja, upravljanja i zaštite hrvatskih vodnih resursa moraju uzeti u obzir i multiplikativni učinci međusektorskih zavisnosti u procesima nacionalne proizvodnje na ukupnu potrošnju vode.

Key words: *hrvatsko gospodarstvo, proširena input-output analiza, neizravna intenzivnost vode, kumulativna intenzivnost vode, vodeni otisci, veze prema unaprijed i prema unazad*

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Appendices

Annex 1: Extended input-output table of the Republic of Croatia (24 x 24, in mil. HRK) with data on direct water use (in mil. m³)

Sector labels	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Final demand (f)	Export (x)	Total output (X)
1	4,358.68	0.12	6,562.56	164.27	325.87	148.68	46.55	0.03	161.08	123.24	122.40	5.78	2.15	0.31	1.23	28.65	141.23	2.18	14.29	0.91	24.03	43.37	697.28	2,053.25	12,555.53	1.88	27,583.64
2	11.32	3,105.10	1,350.34	0.91	20.76	20.78	18.63	7,406.10	97.85	23.07	24.89	242.09	58.24	6.81	14.34	3.72	25.16	540.37	1,536.03	35.17	39.92	964.18	993.19	3,265.17	380.84	0.37	20,184.97
3	888.36	0.06	972.56	153.86	15.41	16.96	3.80	0.07	129.37	34.87	18.82	2.79	0.60	0.30	0.20	0.34	35.76	0.37	0.18	5.78	36.43	22.14	29.92	885.16	35,982.02	4.95	41,504.20
4	2.84	2.27	13.53	726.69	2.16	6.04	8.52	0.15	1.26	1.01	11.11	44.75	3.64	3.15	3.47	9.89	88.47	6.38	15.20	1.83	7.97	34.10	29.92	535.51	12,096.77	2.07	13,641.61
5	1.73	3.30	249.59	301.98	427.00	12.51	11.51	5.67	13.78	2.16	19.44	48.89	43.70	24.12	12.22	26.39	90.64	15.18	15.20	2.38	3.96	160.14	9.95	252.42	2,019.65	2.01	3,773.49
6	4.33	4.49	738.27	99.98	54.25	372.25	276.18	3.96	280.91	54.95	43.71	65.24	34.55	36.64	12.79	27.13	34.52	17.88	3.86	5.15	77.17	55.77	308.44	1,780.57	1,819.33	0.87	6,212.34
7	0.00	0.16	19.23	3.48	0.77	33.93	60.45	0.24	3.02	1.62	3.52	1.63	1.53	1.38	0.71	3.97	1.33	1.61	1.68	0.40	0.71	0.87	1.71	104.00	3,101.78	0.01	3,349.73
8	468.99	104.14	355.86	24.46	9.35	8.16	9.50	239.83	33.67	3.90	5.88	65.48	47.47	23.00	7.19	8.71	8.92	519.10	2,425.31	32.68	88.92	875.04	372.74	3,946.97	9,663.46	5.89	19,348.74
9	1,987.85	20.19	969.40	764.66	72.21	139.85	263.44	42.57	1,904.49	217.70	287.88	234.10	129.17	196.18	29.56	28.17	141.15	62.32	5.13	21.99	496.84	238.00	258.46	1,208.83	6,114.41	4.37	15,834.56
10	10.60	0.00	259.70	0.00	1.67	0.00	0.70	0.00	17.10	416.62	2.63	0.08	0.04	0.00	0.01	0.00	2.04	0.00	1.23	0.25	1.38	4.03	9.02	2,972.15	4,302.54	1.77	7,981.78
11	35.50	34.69	998.01	169.22	45.00	39.72	358.49	9.88	120.01	104.18	455.81	604.66	107.92	217.44	88.82	279.45	96.97	131.66	6.66	35.97	47.18	529.85	147.30	1,197.38	939.60	0.83	6,801.41
12	30.99	15.06	248.32	34.49	21.58	0.43	2.33	5.84	22.75	23.91	6.63	214.40	58.26	91.79	20.31	53.71	17.59	47.93	10.79	82.28	16.03	3,555.26	123.28	765.57	1,799.93	1.61	7,269.45
13	112.57	29.36	561.82	144.91	91.41	10.77	240.93	84.16	188.56	44.75	239.63	189.22	2,132.86	822.76	399.44	922.39	387.08	405.27	21.51	67.40	460.56	2,362.10	493.60	3,429.70	4,201.77	3.57	18,044.52
14	4.89	2.23	37.82	9.73	6.01	1.09	17.94	1.26	4.06	0.99	8.18	41.11	67.21	1,620.98	97.38	390.40	65.75	480.67	51.01	25.73	9.45	517.03	28.56	1,357.86	15,361.21	5.00	20,208.54
15	19.75	7.15	165.49	39.25	9.51	8.56	16.05	13.60	16.76	13.03	13.10	29.41	82.51	167.47	286.30	549.49	15.68	142.39	51.01	9.51	10.20	410.11	309.81	1,502.58	7,500.19	1.73	11,347.01
16	8.30	0.86	2.70	14.83	0.44	10.62	0.07	0.06	0.13	0.00	0.36	1.06	38.39	73.28	100.41	1,342.62	2.54	175.24	0.35	5.19	122.27	132.44	4.51	1,454.33	12,541.32	5.64	16,032.34
17	3.24	0.41	31.67	75.92	27.99	1.79	4.63	0.73	9.16	6.23	3.15	50.28	23.83	65.86	2.95	21.02	151.18	5.98	1.77	3.07	3.97	11.53	42.74	1,636.55	4,838.94	1.91	7,024.58
18	689.46	14.57	285.93	33.01	17.35	33.94	26.95	36.29	80.57	23.60	15.61	45.01	143.99	172.74	75.38	125.66	18.39	325.37	234.80	111.83	59.27	214.55	312.31	2,918.66	2,337.40	2.33	8,352.64
19	257.36	26.68	601.69	129.62	40.39	117.09	64.05	41.34	280.28	49.00	34.77	181.42	99.42	68.00	22.60	35.50	32.29	257.71	1,050.17	91.42	133.49	511.72	139.52	6,880.36	1,599.14	0.26	13,634.70
20	8.89	0.38	25.64	8.27	1.00	0.62	0.91	0.43	9.18	2.20	0.95	1.88	1.60	1.32	0.38	4.19	2.25	1.36	3.57	77.09	30.81	39.06	373.72	830.10	1,668.40	0.00	3,094.18
21	12.49	3.71	67.17	15.92	14.12	89.79	81.30	1.64	7.99	8.11	56.07	30.99	68.54	12.15	4.32	14.35	6.87	34.28	131.17	22.96	248.70	117.05	202.34	1,343.22	3,226.73	1.67	5,822.00
22	18.19	5.46	102.34	20.76	8.94	4.94	6.76	7.24	18.17	6.43	5.48	28.99	18.69	13.75	6.00	8.20	6.51	20.80	25.76	73.99	53.04	2,614.50	139.52	2,223.61	43,011.89	0.87	48,449.96
23	47.88	0.38	27.18	3.90	1.05	2.29	0.66	0.54	3.18	1.64	0.94	2.37	3.37	2.53	1.67	5.14	1.79	3.13	4.03	3.82	13.84	50.53	231.71	3,425.22	28,605.83	0.00	32,444.63
24	3,116.68	756.87	6,873.82	1,458.46	442.23	626.09	678.39	1,701.17	1,180.86	600.55	514.65	1,088.90	1,617.41	1,672.27	868.37	2,060.56	668.26	1,220.61	1,682.33	572.57	905.38	15,492.03	4,675.57	73,435.90	199,747.22	32.69	323,756.93
Import (m)	3.19	14.00	8.79	6.26	1.25	2.91	0.02	5.09	9.70	4.28	4.03	2.25	10.38	11.51	7.99	7.68	3.61	0.62	2.09	0.00	0.18	0.02	2.60	15.39			
Total input (X)	27,583.64	20,184.97	41,504.20	13,641.61	3,773.49	6,212.34	3,349.72	19,348.73	15,834.56	7,981.78	6,801.41	7,269.45	18,044.52	20,208.54	11,347.01	16,032.34	7,024.58	8,352.64	13,634.70	3,094.18	5,822.00	48,449.96	32,444.63	323,756.93			
Water inputs (w, in mil. m³)	12.67	2.30	31.05	3.65	0.48	4.60	0.10	143.79	92.26	0.65	0.11	10.17	1.91	1.80	0.17	1.12	0.33	0.07	133.41	1.62	0.15	1.95	15.41	35.01			

Source: Author's processing

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Annex 2: Cross-sectoral virtual water flows matrix (W)

Sector labels	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	91.39	0.33	91.50	10.98	55.68	15.55	12.94	0.71	8.30	10.46	12.18	3.57	1.12	1.04	0.83	2.48	13.78	1.91	1.80	2.17	5.38	3.39	19.82	5.83
2	2.89	21.31	6.86	1.27	2.46	1.86	3.16	52.93	2.25	1.19	1.39	6.88	1.45	0.87	0.78	1.03	1.45	14.35	27.59	4.73	3.83	6.24	7.13	3.88
3	30.98	0.22	24.22	10.89	7.57	3.91	3.90	0.49	8.07	4.76	3.77	1.88	0.66	0.63	0.47	0.90	5.62	1.13	0.96	2.73	6.99	2.23	56.62	4.11
4	0.17	0.07	0.29	15.18	0.37	0.40	1.03	0.09	0.12	0.12	0.58	2.00	0.16	0.16	0.17	0.34	3.74	0.41	0.14	0.42	0.59	0.65	0.43	0.68
5	0.12	0.04	1.00	3.47	16.48	0.37	0.72	0.08	0.20	0.09	0.51	1.16	0.44	0.26	0.21	0.36	2.03	0.40	0.24	0.26	0.25	0.72	0.20	0.22
6	3.36	0.57	17.03	8.72	14.89	49.27	70.66	1.04	16.93	7.10	7.24	10.00	2.81	2.71	1.77	3.02	5.79	3.83	1.69	3.67	14.26	4.50	10.37	6.51
7	0.00	0.00	0.02	0.01	0.01	0.18	0.59	0.00	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
8	225.69	57.67	170.64	66.76	97.94	77.05	125.98	136.85	75.82	39.44	45.70	155.61	59.73	42.70	30.64	47.60	51.43	583.12	1504.60	200.13	213.92	245.30	194.79	181.57
9	593.13	12.05	285.61	426.67	227.49	199.26	630.85	25.59	821.76	215.85	330.98	273.46	69.10	86.89	30.79	40.04	176.79	86.11	27.18	86.43	624.17	89.12	109.20	57.01
10	0.24	0.05	0.75	0.16	0.23	0.14	0.31	0.11	0.22	4.55	0.15	0.20	0.12	0.11	0.09	0.17	0.16	0.22	0.19	0.25	0.25	0.40	0.26	1.05
11	0.09	0.04	0.48	0.27	0.28	0.16	1.92	0.04	0.17	0.26	1.17	1.49	0.14	0.23	0.16	0.37	0.28	0.35	0.05	0.30	0.22	0.37	0.16	0.12
12	4.13	1.65	11.56	5.73	11.49	1.50	4.37	1.78	3.57	5.59	2.87	45.04	6.42	8.39	3.74	7.25	5.46	11.52	3.27	44.41	8.00	115.00	8.95	6.47
13	1.46	0.35	2.70	2.10	4.12	0.93	10.59	0.90	2.04	1.15	5.06	4.42	14.74	5.85	4.79	8.46	7.39	7.41	1.04	4.01	11.05	7.65	2.80	2.23
14	0.34	0.05	0.36	0.23	0.39	0.18	0.86	0.11	0.16	0.12	0.25	0.80	0.56	7.94	1.00	2.81	1.08	6.07	0.64	1.29	0.52	1.48	0.35	0.69
15	0.05	0.01	0.10	0.07	0.07	0.04	0.12	0.03	0.03	0.04	0.05	0.10	0.10	0.16	0.40	0.59	0.06	0.32	0.04	0.10	0.08	0.19	0.18	0.11
16	0.17	0.03	0.16	0.18	0.13	0.25	0.24	0.06	0.07	0.06	0.09	0.14	0.27	0.39	0.76	6.53	0.06	1.82	0.04	0.34	1.83	0.45	0.16	0.50
17	0.07	0.02	0.12	0.35	0.47	0.17	0.17	0.04	0.07	0.08	0.07	0.42	0.11	0.11	0.05	0.14	1.10	0.13	0.07	0.14	0.12	0.17	0.14	0.33
18	0.31	0.01	0.15	0.06	0.11	0.09	0.14	0.04	0.08	0.05	0.05	0.10	0.10	0.11	0.08	0.11	0.06	0.40	0.20	0.38	0.15	0.11	0.14	0.13
19	211.71	33.28	274.93	179.80	217.36	274.12	358.90	67.33	260.42	115.21	114.43	360.76	112.54	85.93	59.33	93.13	111.65	426.68	891.37	430.37	364.33	274.64	436.30	325.03
20	0.60	0.11	0.84	0.66	0.55	0.38	0.81	0.23	0.57	0.37	0.34	0.57	0.30	0.26	0.21	0.49	0.45	0.54	0.53	13.90	3.45	1.23	6.67	1.97
21	0.06	0.02	0.12	0.08	0.17	0.46	0.82	0.03	0.06	0.06	0.28	0.20	0.15	0.05	0.04	0.07	0.07	0.18	0.32	0.28	1.25	0.17	0.24	0.18
22	0.12	0.03	0.22	0.20	0.20	0.06	0.23	0.07	0.10	0.08	0.09	0.27	0.10	0.08	0.06	0.10	0.09	0.21	0.17	1.16	0.51	2.47	0.29	0.41
23	2.14	0.33	1.98	1.11	1.40	1.10	1.97	0.76	0.82	0.76	0.80	1.46	0.87	0.78	0.69	1.28	0.99	1.60	1.32	2.20	2.62	3.07	4.77	6.78
24	23.48	6.68	31.09	19.59	23.89	18.15	37.41	15.66	14.44	13.29	14.37	26.65	15.95	14.89	12.79	23.01	17.28	29.24	24.25	32.64	29.29	53.23	26.73	35.68

Source: Author's calculation

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Annex 3: Matrix of technical coefficients of cumulative water use (Q)

Sector labels	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	0.20	0.00	0.12	0.04	0.43	0.02	0.42	0.00	0.00	0.13	0.77	0.00	0.01	0.01	0.06	0.04	0.29	0.22	0.00	0.00	0.20	0.08	0.04	0.05
2	0.01	0.19	0.01	0.00	0.02	0.00	0.10	0.01	0.00	0.01	0.09	0.00	0.01	0.01	0.05	0.01	0.03	1.64	0.00	0.01	0.14	0.16	0.02	0.04
3	0.07	0.00	0.03	0.04	0.06	0.01	0.13	0.00	0.00	0.06	0.24	0.00	0.01	0.01	0.03	0.01	0.12	0.13	0.00	0.01	0.26	0.06	0.12	0.04
4	0.00	0.00	0.00	0.06	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.08	0.05	0.00	0.00	0.02	0.02	0.00	0.01
5	0.00	0.00	0.00	0.01	0.13	0.00	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.01	0.04	0.05	0.00	0.00	0.01	0.02	0.00	0.00
6	0.01	0.00	0.02	0.03	0.12	0.07	2.30	0.00	0.00	0.09	0.46	0.01	0.03	0.03	0.12	0.04	0.12	0.44	0.00	0.01	0.54	0.11	0.02	0.06
7	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.49	0.51	0.23	0.25	0.76	0.10	4.10	0.02	0.01	0.49	2.90	0.11	0.56	0.48	2.09	0.68	1.09	66.72	0.15	0.38	8.09	6.10	0.41	1.68
9	1.29	0.11	0.38	1.60	1.77	0.27	20.52	0.00	0.14	2.67	21.04	0.20	0.65	0.98	2.10	0.57	3.74	9.85	0.00	0.16	23.60	2.22	0.23	0.53
10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.01
11	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.01	0.01	0.01	0.04	0.00	0.00	0.01	0.01	0.00	0.00
12	0.01	0.01	0.02	0.02	0.09	0.00	0.14	0.00	0.00	0.07	0.18	0.03	0.06	0.09	0.26	0.10	0.12	1.32	0.00	0.08	0.30	2.86	0.02	0.06
13	0.00	0.00	0.00	0.01	0.03	0.00	0.34	0.00	0.00	0.01	0.32	0.00	0.14	0.07	0.33	0.12	0.16	0.85	0.00	0.01	0.42	0.19	0.01	0.02
14	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.02	0.00	0.01	0.09	0.07	0.04	0.02	0.70	0.00	0.00	0.02	0.04	0.00	0.01
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.05	0.09	0.00	0.21	0.00	0.00	0.07	0.01	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.01	0.00	0.00	0.00
19	0.46	0.29	0.37	0.67	1.69	0.37	11.67	0.01	0.04	1.43	7.27	0.26	1.06	0.97	4.06	1.33	2.36	48.82	0.09	0.82	13.77	6.83	0.92	3.01
20	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.01	0.06	0.00	0.03	0.13	0.03	0.01	0.02
21	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.05	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.06	0.00	0.00
23	0.00	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.00	0.01	0.05	0.00	0.01	0.01	0.05	0.02	0.02	0.18	0.00	0.00	0.10	0.08	0.01	0.06
24	0.05	0.06	0.04	0.07	0.19	0.02	1.22	0.00	0.00	0.16	0.91	0.02	0.15	0.17	0.87	0.33	0.37	3.35	0.00	0.06	1.11	1.32	0.06	0.33

Source: Author's calculation

Globalization and economic growth of Eurozone economies[*]

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Abstract

Globalization is a process of world economic integration which leads to the global economy without borders. The paper estimates the impact of globalization on economic growth in the case of European Monetary Union countries (EMU). Authors used three components of globalization – economic, social, and political globalization. Pooled Mean Group estimator (PMG) was used to estimate the long-run and short-run relationship between globalization and economic growth. The results showed that in the short-run, economic and social globalization has a positive impact on economic growth, while political globalization has a negative effect on the economic growth of EMU countries. In the long-run, economic globalization has a statistically significant positive impact on the economic growth of EMU countries, while social and political globalization has a negative effect on the economic growth of EMU countries. Authors recommend, for each country, case by case approach in accepting the globalization process. The approach depends on the country's development stage, social, and political background. Thus, the approach for developing and least developed countries could be an evolutionary way, while for the developed ones a faster way of acceptances of globalization, for developed countries.

Key words: *economic, political and social globalization, economic growth, monetary union, case by case approach*

JEL classification: *L62, L63, L68*

1. Introduction

Globalization is a term used very often and in different contexts. There is still no consensus about the globalization and its definition. Thus, different authors give different meanings of globalization. According to Waters (1995), globalization is social processes in which the geographical limitations on social and cultural events disappear, and in which people increasingly become aware of it. For Gilpin (2001) globalization represents the integration of the world economy, while Avinash (2000) defines globalization as the integration of national economies leading to the notion of a global economy without borders. Accordingly, globalization is a multi-dimensional process; it has not only an economic component but includes political, social, and many other issues. Globalization, as the process of integration of the world market, provides the possibility of economic growth. The increase in economic activities that goes beyond national borders leads to the rise in international trade and a rise in foreign direct investment (FDI), to rising capital market flows. Globalization encourages a stronger international division of labor and efficient allocation of savings, increasing labor productivity, and can affect citizens' living standards (Dimitrijević, 2016). Globalization has some negative influences on national economies, too. One of the main is increasing wealth inequality between countries.

The most important feature of the globalization process is the interdependence among the economies of the national states with the world economy. Countries around the world are linked to a multi-dimensional system of economic, social, and political relations. Depending on the significance and level of complexity of these connections, a particular national economy suffers positive and negative effects of general trends in the world economy. Therefore, regional integration, association and development process has accelerated the establishment and development of the globalization process. The basis for the creation and development of the globalization process is the free trade zone, the customs union, the economic union, the highest degree of economic cooperation, and then the political and cultural association. It is precisely in that sense essential to examine the impact of globalization on the economic growth of the European Monetary Union (EMU). The research problem is manifested in the vague effect of globalization on the economic growth of the European Monetary Union, primarily due to the lack of research dealing with this issue at EMU level, but also at the EU level. The aim of the paper was to determine the long-term and short-term impact of globalization components (economic, social, and political globalization) on economic growth within EMU countries.

Three hypotheses were tested in the paper. The first hypothesis of this paper is that economic globalization has a positive impact on economic growth in EMU countries. The second hypothesis is that social globalization has a positive impact

on economic growth in EMU countries. The third hypothesis is that political globalization has a positive impact on economic growth in EMU countries. All of these hypotheses were tested for the short and long run. Therefore, there are additional hypotheses for the short and long run. As a result of testing hypotheses, the authors estimated the impact of all three components of globalization on the economic growth of EMU countries. This is one of the first papers which deals with the impact of globalization on the economic growth of this sample of countries, and that is the main contribution of the paper.

According to the aim and hypotheses of the research, the paper is structured as follows. Besides Introduction and Concluding remarks, there are four sections. Section two gives an overview of existing literature about the effects of globalization on economic growth. Section three represents methodology which has been used to estimate the impact of globalization on the economic growth of EMU countries. Section four shows empirical data and analysis, while section five shows results and discussion.

2. Literature review

In recent years, the issue of globalization effects has become a matter of interest among numerous researchers, but there is no consensus on the impact of globalization on economic growth. Dreher (2006) introduced a new index for measuring globalization called KOF. This index includes the analysis of three dimensions of globalization: (1) *economic globalization*, characterized as flows of goods, capital, and services, as well as the information and perception accompanying the market exchange; (2) *political globalization,* characterized by the diffusion of government policies and (3) *social globalization*, which is expressed as the dissemination of ideas, information, images, and people (ETH-Swiss Economic Institute, 2019). The constitution of the globalization index assumes that each of these variables is transformed into an index on a scale from one to a hundred, where a hundred is the maximum value for a specific variable which means the highest global integration level of some society. A detailed description of all dimensions of the KOF Globalization Index is given in Appendix (Appendix: Table 3). Dreher (2006) used the KOF index to study the impact of globalization on the economic growth of 123 countries from 1970 to 2000 using unbalanced panel data. The author concluded that there was a positive impact of the economic and social globalization on economic growth, but that the political globalization had no impact on economic growth. After Dreher introduced the KOF index of globalization, extensive research based on KOF has been conducted.

Afzal (2007) examined the impact of globalization on the economic growth of Pakistan from 1960 to 2006 using the error correction model for data analysis. As a

proxy of the globalization, Afzal (2007) used financial integration and a trade gap and concluded that there is a long-term relationship between these variables. Shaikh and Shah (2008) also studied the effects of globalization on the economic growth of Pakistan and found that globalization has a positive impact on the economic growth of this country.

Bergh and Karlsson (2010) also examined the impact of globalization on economic growth from 1970 to 1995 and from 1970 to 2005, including 29 OECD countries. The KOF Globalization Index was used as an independent variable. They concluded that there was no statistically significant impact of this variable on the economic growth of the OECD countries. Chang and Lee (2010) have also studied the impact of globalization on the economic growth of OECD countries, but their results are opposed to the results obtained by Bergh and Karlsson (2010). They found a weak impact of globalization on economic growth in the short run. The authors found a strong effect of the overall KOF Globalization Index (especially economic and social globalization) on economic growth in the long run.

Villaverde and Maza (2011) studied the effects of globalization on economic growth using the overall KOF Globalization Index, the economic, social and political globalization as explanatory variables. They used GMM method to analyze data for 101 countries and concluded that the global KOF Globalization Index, economic, social, and political dimensions are positively related to economic growth. Rao and Vadlamannati (2011) used the KOF Globalization Index as an explanatory variable to test the impact of globalization on the economic growth of the 21 African countries from 1970 to 2005. They found a statistically significant positive effect of globalization on economic growth. Rao et al. (2011) examined the impact of globalization on the economic growth of Malaysia, Thailand, India, and the Philippines. They found a positive effect of globalization on the economic growth of these countries.

Polasek and Sellner (2011) investigated the impact of globalization on the European Union's regional economic growth in 2006 using the model called Spatial Chow-Lin Procedure. They found the positive effects of globalization on the economic growth of the region. This is the only research that investigates the impact of globalization on the economic growth of the EU as an entity.

Mutascu and Fleischer (2011) investigated the impact of globalization on Romania's economic growth from 1972 to 2006. The Unrestricted Vector Autoregressive Model (Unrestricted VAR) was used for data analysis, and the results showed that globalization in the medium and long term positively affected Romanian economic growth. Açıkgöz and Mert (2011) investigated the impact of globalization on Turkey's economic growth from 1970 to 2008, analyzing the impact of political, economic, and social globalization. Autoregressive distributed lag model (ARDL) was used for data analysis. The results have shown that there is an impact of social and political

globalization on economic growth, while there is no impact of economic globalization on Turkey's economic growth. Leitão (2012) analyzed the impact of globalization on the economic growth of the United States from 1995 to 2008. Using panel data analysis, the author found that globalization had a positive impact on the economic growth of the United States. Ray (2012) examined the impact of globalization on India's economic growth using the Granger causality test. The results showed that there is a two-way causality between economic growth and globalization.

Ali and Imai (2015) examined the impact of economic globalization on the economic growth of 41 African countries from 1970 to 2009. In addition, they questioned how the economic crisis affected economic growth. They used a panel analysis with the fixed-effects model and the GMM method for data analysis. Globalization was used as an endogenous variable. They concluded that economic globalization has a positive impact on economic growth. Furthermore, Umaru (2013) analyzed the impact of globalization on Nigeria's economic growth between 1962 and 2009, applying the Annual Average Growth Rate (AAGR) method. Umaru et al. (2013) found that globalization had a negative impact on the fuel, manufacturing industry, and stable mineral sectors, while globalization had a positive impact on agriculture, transport, and communication sectors. Samimi and Jenatabadi (2014) examined the impact of economic globalization on the economic growth of the countries of the Organization of Islamic Cooperation, testing whether this impact varies depending on the level of the country's income. Using the GMM method for data analysis, it has been found that there is a statistically significant impact of economic globalization on the economic growth of analyzed countries. They also found that the impact of economic globalization varies depending on the country's income level, primarily due to the development of the financial system and the education of the workforce.

Ying et al. (2014) dealt with the impact of political, economic, and social globalization on the economic growth of the ASEAN countries between 1970 and 2008 using the Folly Modified Ordinary Least Square (FMOLS) method. They found that economic globalization has a positive impact on economic growth, while social globalization has a negative impact on economic growth. Also, they found that there is no statistically significant influence of political globalization on economic growth. Suci et al. (2015) also analyzed the impact of globalization on the economic growth of Cambodia, Indonesia, Malaysia, Thailand, Philippines, and Vietnam (ASEAN) using panel data analysis. The overall KOF Globalization Index, political, social, and economic globalization were used as explanatory variables. They concluded that the overall KOF Globalization Index has a statistically significant positive impact on the economic growth of the observed countries, as well as economic and political globalization. They also found that there is no statistically significant impact of social globalization on economic growth. The results of Ying et al. (2014) and Suci et al. (2015) studies differ, although both

studies were done for the ASEAN countries. Both studies have identified the positive impact of economic globalization on economic growth, while the results vary for the effects of social and political globalization.

Using the panel data analysis and fixed effects model, and Granger causality test, Kılıç (2015) examined the impact of economic, political, and social globalization on the economic growth of 74 developing countries between 1981 and 2011. The results of the panel analysis showed that there is a statistically significant positive impact of economics and political globalization on the economic growth of the analyzed developing countries, while the statistically significant negative effects of social globalization were found. The results of the Granger causality test have shown that there is a two-way causality between political globalization and economic growth and economic globalization and economic growth, while there is only a one-way causality between social globalization and economic growth.

Doğan and Can (2016) investigated the impact of globalization on the economic growth of South Korea from 1970 to 2012 using the Engel-Granger cointegration test. The overall KOF Globalization Index, social, and economic globalization are used as explanatory variables. The results of the research have shown that there is a statistically significant positive impact of KOF index, economic, and social globalization on the economic growth of South Korea. Reeshan and Hassan (2017) examined the effect of globalization, its social, political, and economic dimensions on economic growth in 86 developing countries in 2015, applying multiple regression. They have found that overall globalization (political, social, and economic globalization) has a negative and statistically non-significant impact on economic growth.

Based on all of the above, it can be concluded that there is a significant number of empirical research findings that confirm the impact of globalization on economic growth. The results of the research mentioned above on the effects of globalization on economic growth are different. However, in each study, a positive impact of at least one dimension of globalization on economic growth has been identified. The impact of economic globalization on economic growth is mainly positive, while this could not be the proper conclusion for the other two elements of the KOF index (social and political globalization). Results of research depend on different factors such as the research methodology, the research period, the sample and others.

3. Methodology

The aim of this study was to determine the effects of economic, political, and social globalization on the economic growth of Eurozone economies. Therefore, we analyzed annual data for 19 Eurozone economies (Austria, Belgium, Cyprus,

Germany, Spain, Estonia, Finland, France, Greece, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Portugal, Slovakia, Slovenia) from 1970 to 2016. We focused on the estimation of the effects of the economic, social, and political dimension of globalization on economic growth, which has a good theoretical and empirical background (Kılıç, 2015; Ying et al., 2014; Mutascu and Fleischer, 2011; Reeshan and Hassan, 2017). Kilic (2015) and Ying et al. (2014) used only economic, social and political globalization as a measure of globalization and explanatory variables. Therefore, based on previous empirical researches, especially those done by Kılıç (2015) and Ying et al. (2014), a model was developed to estimate the impact of globalization on economic growth in the EMU countries. Authors used all three components of KOF, economic, social, and political globalization. The following equation set the model:

$$GDP = \int(KOFE, KOFS, KOFP) \tag{1}$$

$$GDP = b_0 + b_1 KOFE_{it} + + b_2 KOFS_{it} + b_3 KOFP_{it} + e_{it}\,, \tag{2}$$
$$i = 1, ..., 19;\ t = 1970, 2016$$

Where *GDP* is GDP growth rate in *i* EMU country in *t* period, $KOFE_{it}$ is the economic dimension of the KOF Globalization Index in *i* EMU country in *t* period, $KOFS_{it}$ is the social dimension of the KOF Globalization Index in *i* EMU country in *t* period, and $KOFP_{it}$ is the political dimension of the KOF Globalization Index in *i* EMU country in *t* period, e_{it} error term of *i* country in *t* period.

To investigate the impact of globalization on the economic growth of Eurozone economies, we first used descriptive statistics. After descriptive statistics, we used cross-section dependence test (Pesaran CD test) because the ignorance of the cross-section dependency leads to substantial bias in estimations. The stationarity of a time series implies that the time series moves along a recognizable path over time; that is, its properties remain unchanged over time (Mladenović, 2010). In time series, stationarity plays one of the very important roles, so it is necessary to test the existence of unit root. There are several unit-root tests in the literature examining the stationarity of time series. Still, the second generation of unit root test (CIPS cross-section Im, Pesaran, and Shin) was used to determine the order of integration of variables and to get unbiased estimations (Pesaran, 2007).

Panel analysis was used for econometric data analysis. Panel data represents data at multiple time points (in our case years) for multiple observation units (in our case, the countries). The nature of panel data, that is, both spatial and temporal dimensions, justifies their use in our research. Furthermore, previous researchers (Dreher, 2006; Leitão, 2012; Ali and Imai, 2015; Suci et al., 2015; Kılıç, 2015) also used panel data analysis, which can justify the use of panel analysis in our research. We distinguish between static and dynamic panel models. If the present

value of a variable is influenced by its previous values, then we are talking about dynamic panel models. In dynamic panel models, the dependent variable shifts one or more periods backwards depending on its characteristics (lag dependent variable).

Auto-Regressive Distributed Lag (ARDL) approach was used for data analysis. To test whether the economic, political, and social globalization has a long-run and short-run impact on the economic growth within EMU the Pooled Mean Group (PMG) estimator by Pesaran et al. (1999) was used. The model uses the panel extension of the single equation autoregressive distributed lag (ARDL) model includes lagged dependent variable in the model and can also include lag for the independent variables (Krajišnik et al., 2019). Dynamic Fixed Effect (DFE) estimator also was tested. Hausman test was used to determine which estimator is more appropriate for accessing the long-run and short-run relationship between globalization and economic growth.

The following equation will be estimated:

$$DGDP_{it} = \alpha + \sum_{j=1}^{k} \beta_{j2} DGDP_{i,t-j} + \sum_{j=0}^{k} \delta_{j2} DKOFE_{i,t-j} +$$
$$+ \sum_{j=0}^{k} \theta_{j2} DKOFS_{i,t-j} + \sum_{j=0}^{k} \rho_{j2} DKOFP_{i,t-j} + \gamma ECT_{i,t-j} + \varepsilon_{it} \qquad (3)$$

Where β_{j2}, δ_{j2}, θ_{j2}, ρ_{j2} are coefficients, ε_{it} is white noise term, γ is the coefficient of the ECT (error-correction term). The coefficient γ explains the long-term relationship between the variables presented in equation (4).

$$ECT_{i,t-j} = GDP_{it} - \alpha - \sum_{j=1}^{k} \beta_{j1} GDP_{i,t-j} - \sum_{j=0}^{k} \delta_{j1} KOFE_{i,t-j} -$$
$$- \sum_{j=0}^{k} \theta_{j1} KOFS_{i,t-j} - \sum_{j=0}^{k} \rho_{j1} KOFP_{i,t-j} \qquad (4)$$

where β_{j1}, δ_{j1}, θ_{j1}, ρ_{j1} are coefficients.

4. Empirical data and analysis

Annual series from ETH – Swiss Economic institute were used to measure economic, social, and political globalization of 19 Eurozone economies. Annual GDP growth rate series from the World Bank were used to measure the economic growth of Eurozone economies. Data and sources of data which were used in research are presented in Table 1.

Table 1: Sources of data

Variable	Measure	Source
GDP	GDP growth rate (%)	World Bank
KOFE	The economic dimension of globalization	ETH – Swiss Economic institute
KOFS	The social dimension of globalization	ETH – Swiss Economic institute
KOFP	The political dimension of globalization	ETH – Swiss Economic institute

Source: Authors'

Descriptive statistics of the observed variables are shown in Table 2. The average economic growth of EMU measured through GDP growth rate is 3.08%, while the maximum GDP growth rate in the EMU countries was in Ireland in 2015 (25.56%), and minimum GDP growth rate was in Lithuania in 2009 (-14.81%) (Table 2). Lithuania has increasingly opened economically, socially, and politically since 1990 and after 2009. Still, total GDP and GDP per capita gains were relatively small due to the low baseline level, while Ireland is one of the most globalized economies and total GDP and GDP per capita gains due to globalization are high (Weiß et al., 2019). According to Masteikienea and Venckuvieneb (2015), Lithuania faces the harshest competition from global manufacturing competitors partially due to specific industry structure of the country. GDP growth rate in EMU for individual countries from 1970 to 2016 is given in Appendix (Figure 1).

Table 2: Descriptive statistics

	GDP	KOFE	KOFS	KOFP
Mean	3.08	63.31	75.18	79.55
Median	2.96	72.03	76.24	83.79
Maximum	25.56	93.47	92.11	98.71
Minimum	14.81	29.69	51.82	22.84
Standard deviation	3.59	14.43	8.64	17.17
Number of observations	757	757	757	757

Source: Authors' calculations in EViews 10

The average economic globalization index in the EMU is 63.31, while the maximum economic globalization index was in Luxembourg in 2004 (93.47) and minimum economic globalization index was in Greece in 1970 (29.69). The average social globalization index in the EMU is 75.18. The maximum social globalization index was in Luxembourg in 2016 (92.11), while the minimum social globalization index was in Portugal in 1970 (51.82). It may be concluded that among the EMU countries, Luxembourg had the maximum value of economic and

social globalization index. The average political globalization index in the EMU is 79.55. The maximum political globalization index was in France in 2009 (98.71), while the minimum political globalization index was in Estonia in 1991 (22.84) (Table 2). Figure 1 shows the average economic, social, and political globalization by Eurozone country.

Figure 1: The average economic, social, and political globalization by Eurozone country, (1970-2016)
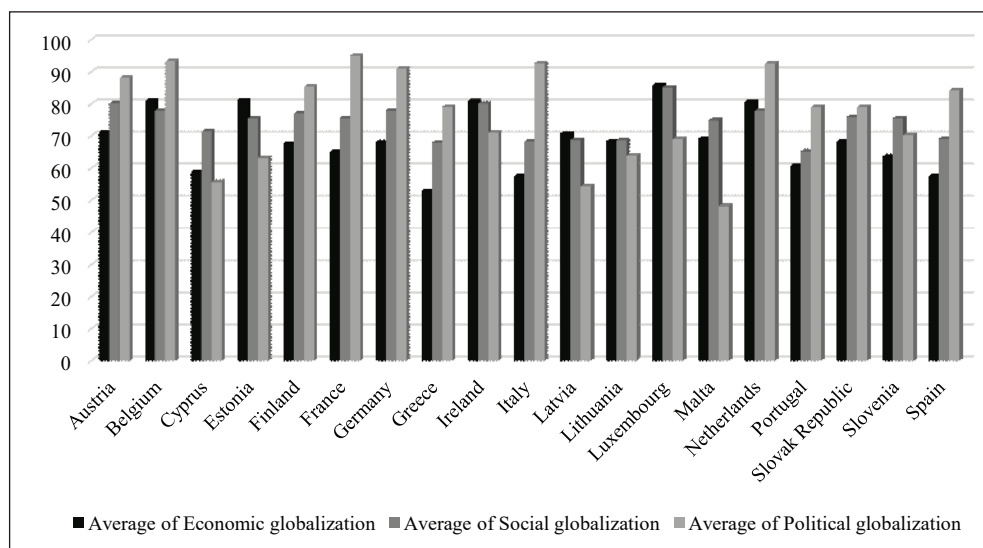
Source: Authors' calculations

Cross-section dependence test (Pesaran CD test) was used to analysethe null hypothesis that there is no cross-section dependence (correlation) in the time-series (Pesaran, 2004). It is important to test for the cross-sectional dependence in a panel analysis because the ignorance of the cross-section dependency leads to substantial bias in estimations. The results showed that there is a cross-section dependence in time series (Table 3). The results of cross-section dependence test (Pesaran CD test) showed that change of economic growth, economic, social, or political dimension of globalization that occurred in any of the observed EMU countries affected other countries as well.

Table 3: Results of cross-section dependence test

Variable	t-statistic	p-value
GDP	41.04	0.00*
KOFE	70.32	0.00*
KOFS	75.96	0.00*
KOFP	66.95	0.00*

* indicate rejection of the null hypothesis at a 1% level of significance

Source: Authors' calculations in EViews 10

Since the results of Pesaran CD test showed that there is a cross-section dependence in all-time series, the second generation of unit root test (CIPS cross-section Im, Pesaran, and Shin) was used to determine the order of integration of variables and to get unbiased estimations (Pesaran, 2007). Results of the panel unit root test showed that the series are not integrated in the same order. Some series are stationary at the level I(0), while other series are stationary at the first difference I(1). GDP is stationary at the level I(0), while KOFE, KOFP, and KOFS are stationary at first difference. The results of the panel unit root test are shown in Table 4. Data for individual countries (at the level and first difference) for all variables are given in Appendix (Appendix: Figure 1-8).

Table 4: Results of unit root test

Variable	Intercept	Intercept and trend
GDP	-10.19*	-10.03*
KOFE	-0.44	3.37
D(KOFE)	-13.06*	-12.45*
KOFS	2.69	0.95
D(KOFS)	-14.42*	-14.01*
KOFP	-2.66*	-2.32*
D(KOFP)	-11.69*	-10.60*

* significant at 1% level

Source: Authors' calculations in EViews 10

Kao's test of cointegration was used to test the null hypothesis that there is no cointegration among variables (Kao & Chiang, 2000). The results of Kao's test showed that there is cointegration among variables (t=-10.94, p<0.01) at 1% significance level. Hausman test was used to determine whether the Pooled Mean Group estimator or Dynamic fixed effects model should be used for estimation.

The results of the Hausman test showed that Pooled Mean group estimator is more appropriate for accessing the long-run and short-run relationship between globalization and economic growth ($\chi_{(3)}$ = 0.56, p = 0.91). The Pooled Mean group estimations were obtained by estimating an ARDL (1, 1, 1, 1) for all countries. The results of the Dynamic fixed effects model are presented in the Appendix (Table 4).

Table 5 shows the results of PMG estimates.

Table 5: PMG Results

Variable	Coefficient	Std. Error	t-statistics	p-value
Long Run Equation				
KOFE	0.09	0.03	2.99	0.00
KOFS	-0.15	0.04	-3.55	0.00
KOFP	-0.14	0.03	-3.98	0.00
Short Run Equation				
Cointeq1	-0.68	0.05	-13.85	0.00
D(KOFE)	0.42	0.14	2.91	0.00
D(KOFS)	0.69	0.17	4.17	0.00
D(KOFP)	-0.23	0.09	-2.51	0.01
C	12.18	1.07	11.37	0.00

Source: Authors' calculations in EViews 10

Pooled mean group model results showed that there is a long-run and short-run relationship between globalization and economic growth. In the long-run, economic, social, and political globalization have a statistically significant impact on economic growth within EMU (Table 5). Furthermore, economic globalization has a statistically significant positive impact on the economic growth of EMU, while social and political globalization has a statistically significant negative impact on the economic growth of EMU in the long run. The error correction term is negative and statistically significant, and shows that the speed of adjustment towards equilibrium is 68% annually (Table 5). It means that the system will be again in equilibrium for more than a year.

Short-run coefficients are also statistically significant and show that economic, political, and social globalization have a statistically significant impact on the economic growth of EMU countries. Equally to long-run, in the short-run, political globalization has a negative impact on economic growth and economic globalization has a positive statistically significant impact on the economic growth of EMU countries. However, social globalization has a positive and statistically significant impact on the economic growth of EMU countries in the short-run,

while in the long-run, it has a negative impact on the economic growth of EMU countries (Table 5).

Short-run coefficients for individual countries were also examined. The results are shown in Table 6. The results for the individual countries of EMU showed that the error correction term is negative and statistically significant at 1% level in every country of EMU. According to results, the highest error correction term values are in Austria and Belgium (-0.99), Germany (-0.95) and Italy (-0.93) which means that these countries return to the equilibrium more quickly than other EMU countries, under the influence of economic, social, and political globalization. The lowest error correction term is in the case of Malta (-0.33), Lithuania (-0.33), and Spain (-0.36) meaning that these countries return to the equilibrium slower than other EMU countries. It takes them about three years to return to equilibrium and correct disequilibrium created by the influence of economic, social, and political globalization.

Table 6: Short-run coefficients for individual countries

Country	Cointeq1	D(KOFE)	D(KOFS)	D(KOFP)	C
Austria	-0.99*	0.17**	0.88**	0.12**	19.22
Belgium	-0.99*	0.51*	0.58***	0.01	18.69
Cyprus	-0.71*	0.03	0.96**	-0.07***	11.94
Germany	-0.95*	0.20**	0.18	0.18*	18.63
Spain	-0.36*	0.12**	0.28	-0.08**	6.59
Estonia	-0.64*	1.41	1.99	-1.14	10.25
Finland	-0.67*	0.20**	0.81	0.41*	12.55
France	-0.62*	0.03	0.41**	-0.43*	12.49
Greece	-0.54*	0.24**	0.37	0.01	9.05
Ireland	-0.59*	0.24	1.92***	-0.19	10.57
Italy	-0.93*	0.04	0.36***	-0.18	17.67
Lithuania	-0.33*	2.43*	2.57*	-1.43**	2.63
Luxembourg	-0.78*	0.12	0.28	-0.01	13.85
Latvia	-0.49*	1.14**	0.62	0.01	6.62
Malta	-0.33*	-0.04	-0.22	-0.27	5.88
Netherlands	-0.62*	0.36*	-0.12	-0.10***	11.65
Portugal	-0.76*	-0.03	0.42**	-0.26*	13.17
Slovakia	-0.76*	0.07	0.61	-0.07	14.66
Slovenia	-0.87*	0.69*	0.28	-0.10	15.19

* statistically significant at 1% level; ** statistically significant at 5% level; *** statistically significant at 10% level

Source: Authors' calculation in EViews 10

Furthermore, if we observe short-run coefficients for individual countries of EMU, it may be concluded that economic globalization has a positive impact on the economic growth of all EMU countries, except Malta and Portugal where negative, but the statistically non-significant impact of economic globalization on economic growth were found. The strongest positive and statistically significant impact of economic globalization in short-run is in Lithuania (2.43), while the lowest positive and statistically significant impact of economic globalization in short-run is in Spain (0.12) (Table 6). Table 6 also showed the short-run coefficient for social globalization impact on economic growth for individual countries. The results showed that social globalization has a positive and statistically significant impact on economic growth in Austria, Cyprus, France, Lithuania (the strongest positive impact; 2.57) and Portugal, that is in line with results obtained for the panel data. The negative and statistically non-significant impact of social globalization on economic growth in the short run is in Malta and Netherlands. The positive and statistically significant impact of political globalization is in Austria (0.12), Germany (0.18), and Finland (0.41). The negative and statistically significant impact of political globalization on economic growth is in Spain, France, Lithuania, and Portugal, while the strongest negative impact of political globalization on economic growth is in Lithuania (-1.43) that is in line with results obtained for the panel data (Table 6).

Pairwise Dumitrescu-Hurlin (2012) test panel was used to determine whether there is a causal relationship between variables (Table 7).

Table 7: Dumitrescu Hurlin Panel Causality Test

Null hypothesis	W-stat.	Zbar-stat.	p-value
KOFE does not homogeneously cause GDP	3.35	2.18	0.03
GDP does not homogeneously cause KOFE	1.96	-0.37	0.71
KOFS does not homogeneously cause GDP	4.99	5.21	0.00
GDP does not homogeneously cause KOFS	1.79	-0.67	0.50
KOFP does not homogeneously cause GDP	5.09	5.38	0.00
GDP does not homogeneously cause KOFP	1.87	-0.54	0.59

Source: Authors' calculation in EViews 10

The results showed that there is one-way causality running from economic globalization to economic growth, one-way causality running from social globalization to economic growth, and one-way causality running from political globalization to the economic growth in the EMU. There was no evidence of bidirectional causality between these variables. The results for one-way causality running from social globalization to economic growth are in line with the results obtained by Kılıç (2015).

5. Results and discussion

Although the term globalization is one of the most commonly used terms in the contemporary theoretical and empirical literature, it is a term that is extremely difficult to define, as well as the effects it has on economic growth. Globalization is a process whose consequences go far beyond the economic sphere and is now the subject of various multidisciplinary research. Accordingly, Dreher (2006) defined the KOF Index of Globalization, which includes three dimensions: social, economic and political. The study uses these dimensions of globalization as explanatory variables to examine their effects on the economic growth of Eurozone economies.

The results of the analysis show that globalization has significant effects on the economic growth of Eurozone economies in the long-run and the short-run. Economic globalization has a positive and statistically significant impact on the economic growth of Eurozone economies in the long-run, while social and political globalization has a negative effect on economic growth in the long-run. In that case, we can accept hypothesis one (H_1) and reject two (H_2) and three (H_3) hypotheses for the long-run period. The obtained results in the long run, for the impact of economic globalization on economic growth, are in line with results presented by Dreher (2006), Kılıç (2015), Villaverde and Maza (2011), while the results obtained for the impact of political globalization on economic growth are opposed to results obtained by Kılıç (2015). The results obtained for the effect of social globalization on economic growth are in line with results presented by Kılıç (2015) and opposed to results obtained by Dreher (2006) who found a positive impact of social globalization.

Economic and social globalization has a positive and statistically significant impact on the economic growth of Eurozone economies in the short-run, while political globalization has a negative effect on economic growth in the long-run. The obtained results for the effect of social globalization on economic growth in the short-run are opposed to the results obtained in the long-run. In that case, we can accept hypotheses one and two (H_1 and H_2) and reject hypothesis three (H_3) in the short-run period. Economic globalization captures the effect of variables such as of trade, FDI flows and stocks, so the positive effect of economic globalization on economic growth is expected. One of explanation for opposite results of social globalization in short and long period could be that in short-run countries have benefited from new ideas, information and people, but in long-run period ideas, information, and people leave these countries.

Political globalization is reflected in the rise of international institutions and associations that are united around common interests, such as the United Nations, the OECD, the World Trade Organization, International Monetary Fund, etc. It includes embassies in the country, membership in International organizations, and participation in UN Security Council Mission. The results showed a negative impact of political globalization on economic growth in the short-run and the long-

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run. The obtained results may be due to the scope of the obligations associated with international agreements and organizations (Kılıçarslan and Dumrul, 2018).

The error correction term showed that the system would be again in equilibrium for more than a year. If individual countries are observed, the error correction term is statistically significant and negative for all countries, but Malta, Lithuania and Spain return to the equilibrium slower than other EMU countries. These countries need about three years to correct disequilibrium created by the influence of economic, social, and political globalization. According to Weiß et al. (2019), Spain has integrated globally to a lesser extent than other countries since 1990, so that may be the reason for the obtained results, and lower gains from the globalization. The reasons for these results for Malta may be a high geopolitical risk, small domestic market, lack of natural resources, and policy uncertainty (Simonescu, 2016).

Contributions of the research could be in the next things. First of all, this research is the first of this type for EMU countries. Second, there is a positive impact of economic globalization on economic growth, which means that globalization is significant for economic growth, especially for developed countries such as EMU counties. This statement could be controversial for developing and least developed countries. Next thing is the negative impact of political globalization on economic growth, which means that political influence from abroad could negatively affect economic growth. Nowadays there are a lot of international political obligations which every country has. Those obligations can restrict the domestic decision-making process in every field, especially economic policy. The fourth thing is the estimation of the controversial impact of social globalization on economic growth in the short and long-run period. In the short-run, countries receive new ideas, information from abroad, but in long-run, they lose ideas, information, and people who are looking for a new opportunity in other countries.

Authors could recommend policymakers to be careful with driving globalization process in their countries, especially with a social component. The solution could be the case by case approach, where each country needs to have its way of acceptaning the globalization process. The approach depends on the country's development stage, social, and political background. One approach could be an evolutionary way for developing and least developed countries, while the other approach could be a faster way of the acceptance of the globalization process for developed countries.

6. Conclusions

The paper examined the impact of globalization (economic, political, and social) on the economic growth of 19 EMU countries and causality relationship between the variables using ARDL approach and pairwise Dumitrescu-Hurlin test from 1970 to 2016.

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The results showed that in the short-run, economic and social globalization had a positive statistically significant impact on the economic growth of EMU countries, while political globalization has a negative impact on the economic growth of these countries. In the long-run, economic globalization had a statistically significant positive impact on the economic growth of EMU countries, while social and political globalization had a statistically significant negative impact on the economic growth of EMU countries. Finally, the results of pairwise Dumitrescu-Hurlin test showed one-way causality running from economic, social, and political globalization (separately) to the economic growth in the EMU countries.

Since the economic globalization includes trade, foreign direct investments, import barriers and taxes on international trade, the higher positive effects of the economic globalization on the economic growth of Eurozone economies can be achieved by reducing tax on international trade or import barriers, and by attracting more foreign direct investments. Governments should also change policies to social globalization as to have positive effects on economic growth, both in the long-run and in the short-run.

The research is related to the EMU countries which are developed. Therefore,, some further research should be related to the developing or least developed countries. In that case, researchers could compare the impact of globalization on these three types of countries and can test the results of the research. Of course, recommendations for further research could be including a wider sample of countries with different economic, social and economic background and a longer period of research. For EMU countries some new types of research could be focused on estimation impact of globalization on currency policy, potential fiscal integration, common industrial policy, etc. New extensive research into this area could result in findings that might challengethe results presented in the paper.

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Globalizacija i ekonomski rast ekonomija Eurozone

Marija Radulović[1], Milan Kostić[2]

Sažetak

Globalizacija je proces svjetske ekonomske integracije koji vodi do globalne ekonomije bez granica. U radu se procjenjuje utjecaj globalizacije na gospodarski rast u slučaju zemalja Europske monetarne unije (EMU). Autori su koristili tri komponente globalizacije – ekonomsku, socijalnu i političku globalizaciju. Pooled Mean Group estimator (PMG) korišten je za procjenu dugoročne i kratkoročne veze između globalizacije i ekonomskog rasta. Rezultati su pokazali da u kratkom roku ekonomska i socijalna globalizacija ima pozitivan utjecaj na gospodarski rast, dok politička globalizacija negativno utječe na ekonomski rast zemalja EMU. Ekonomska globalizacija dugoročno ima statistički značajan pozitivan utjecaj na ekonomski rast zemalja EMU, dok društvena i politička globalizacija negativno utječe na ekonomski rast zemalja EMU. Autori preporučuju, za svaku zemlju, pojedinačni pristup prilikom prihvaćanja globalizacijskog procesa. Pristup ovisi o fazi razvoja zemlje, socijalnoj i političkoj pozadini. Jedan bi pristup mogao biti evolucijski za zemlje u razvoju i najmanje razvijene zemlje. Drugi pristup bi mogao biti brži način prihvaćanja globalizacije za razvijene zemlje.

Ključne riječi: *ekonomska, politička i društvena globalizacija, ekonomski rast, monetarna unija, pojedinačni pristup*

JEL klasifikacija: *L62, L63, L68*

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Appendices
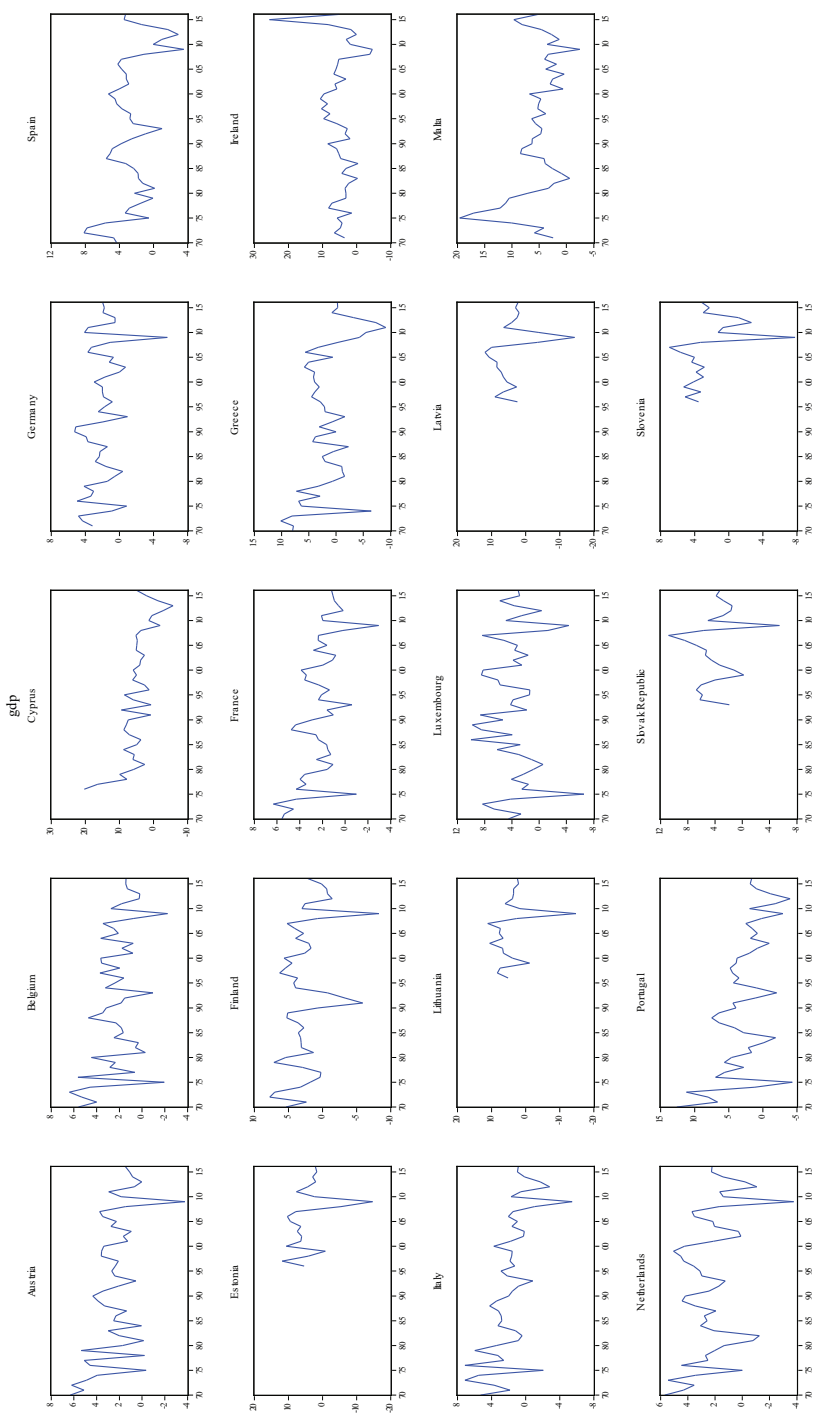
Figure 1: GDP growth rate in EMU for individual countries, 1970-2016

Source: Authors' calculation in EViews 10

Figure 2: GDP growth rate in EMU for individual countries, 1st difference, 1970-2016
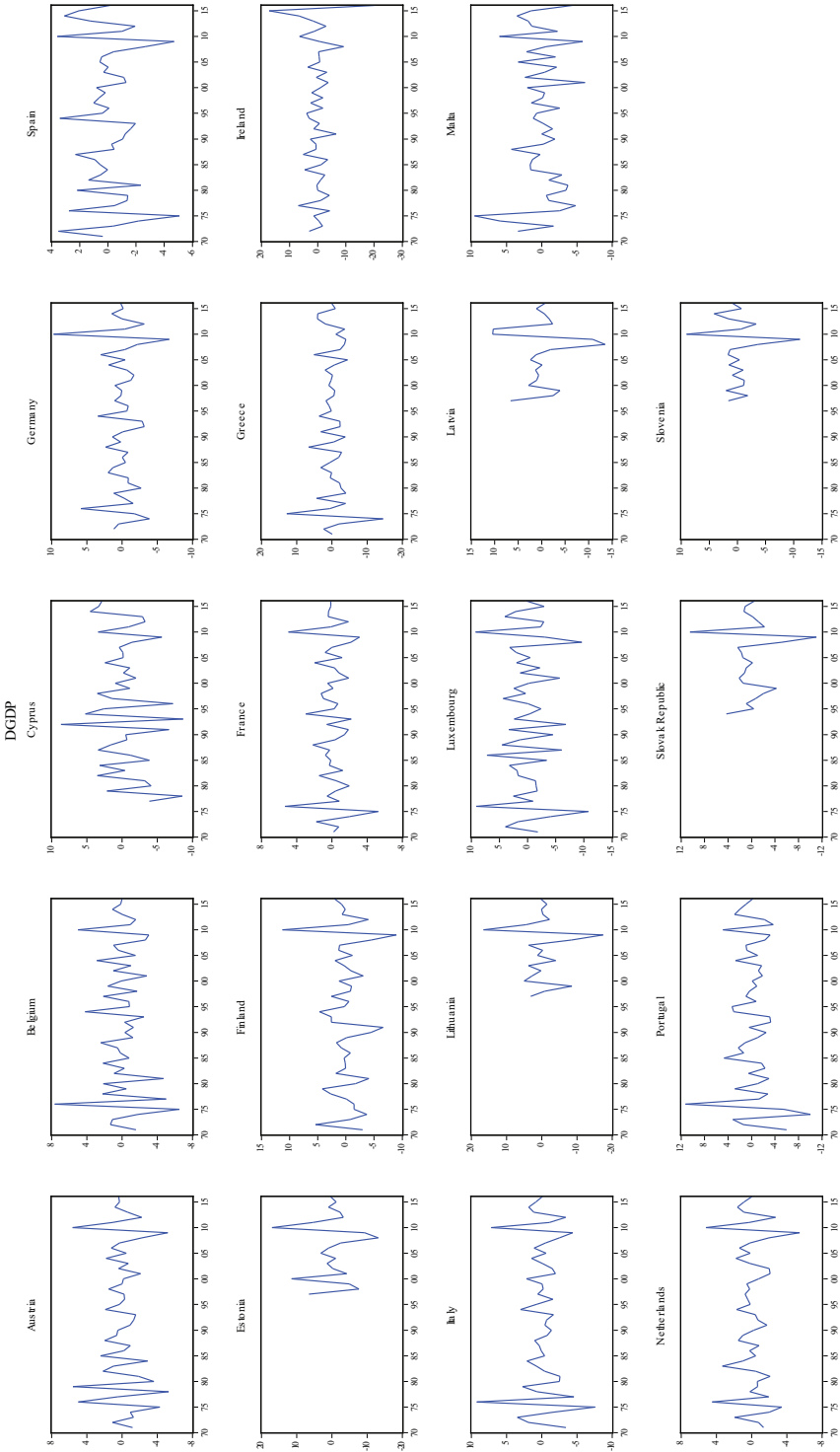
Source: Authors' calculation in EViews 10

Figure 3: Economic globalization in EMU for individual countries, 1970-2016
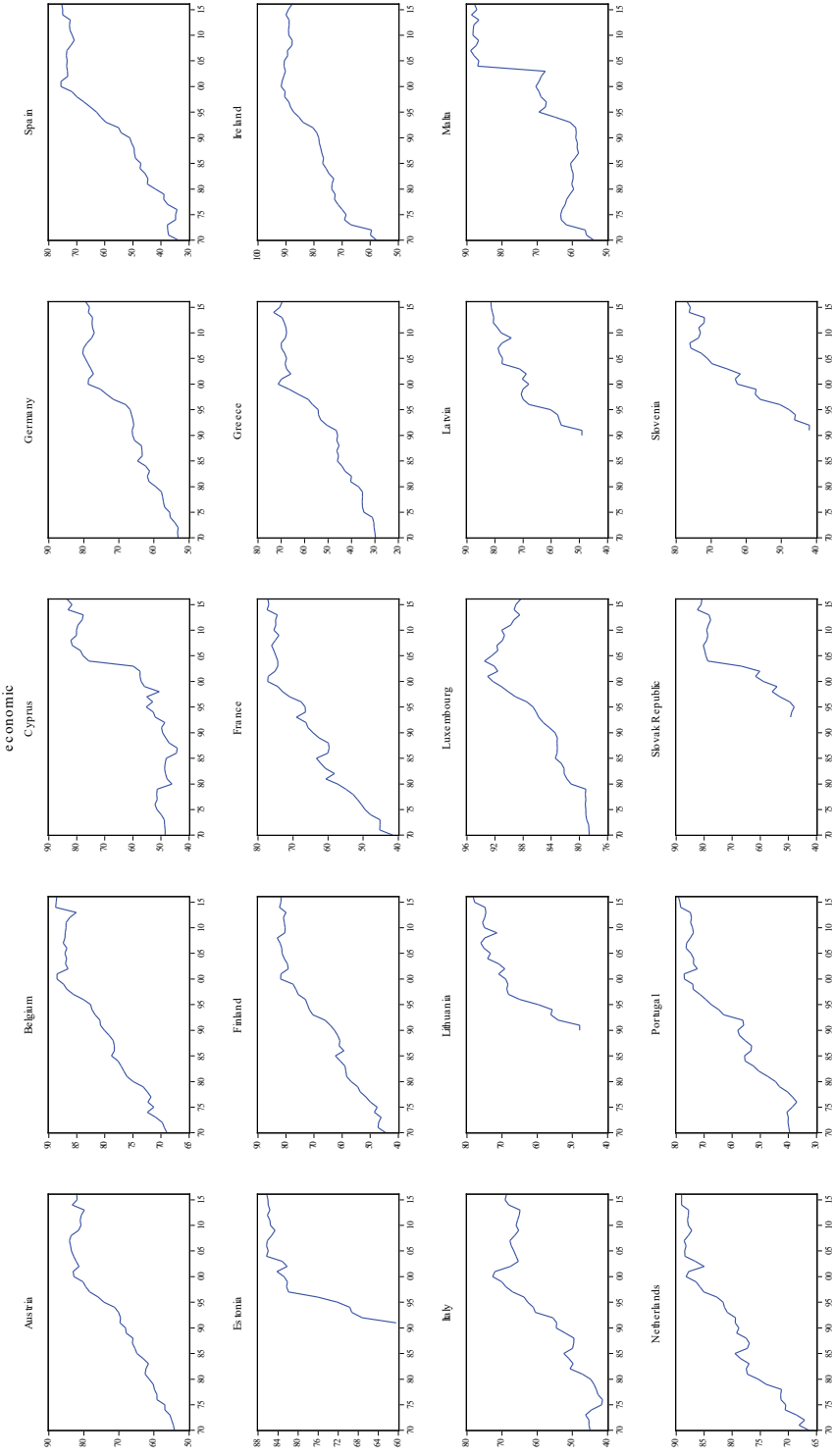
Source: Authors' calculation in EViews 10

Figure 4: Economic globalization in EMU for individual countries, 1st difference, 1970-2016

Source: Authors' calculation in EViews 10

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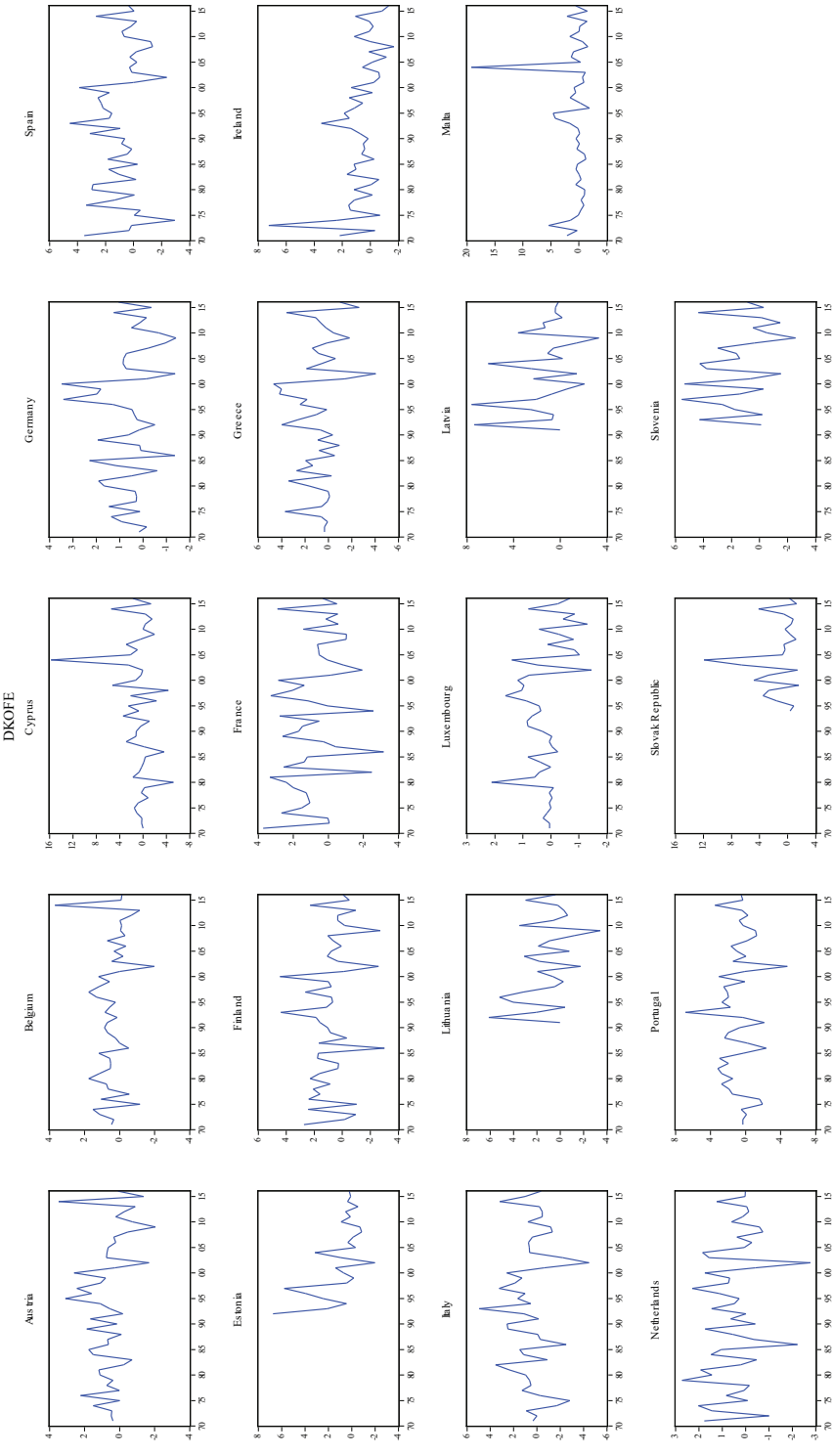
Figure 5: Social globalization in EMU for individual countries, 1970–2016
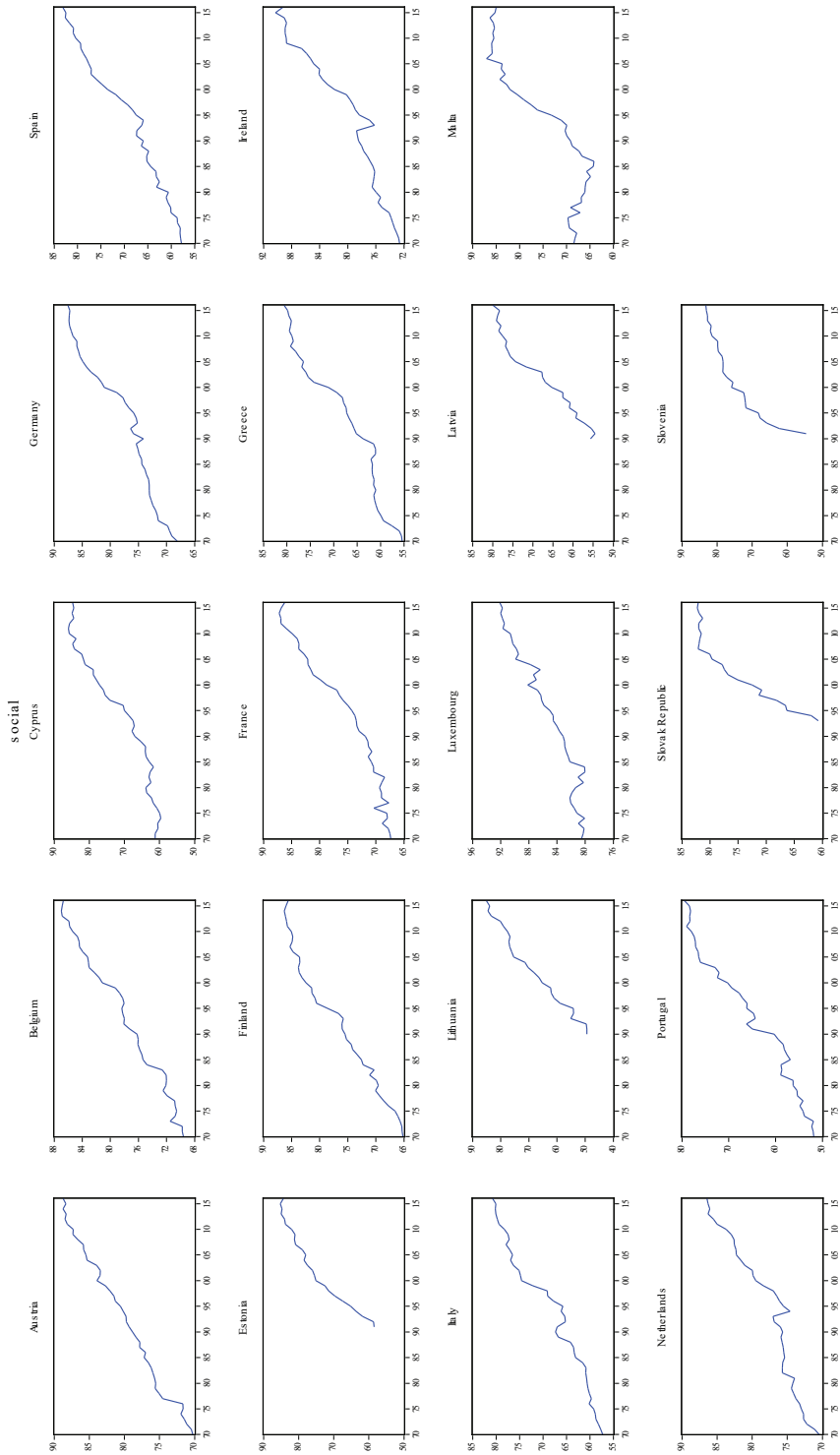
Figure 6: Social globalization in EMU for individual countries, 1st difference, 1970-2016

Source: Authors' calculation in EViews 10

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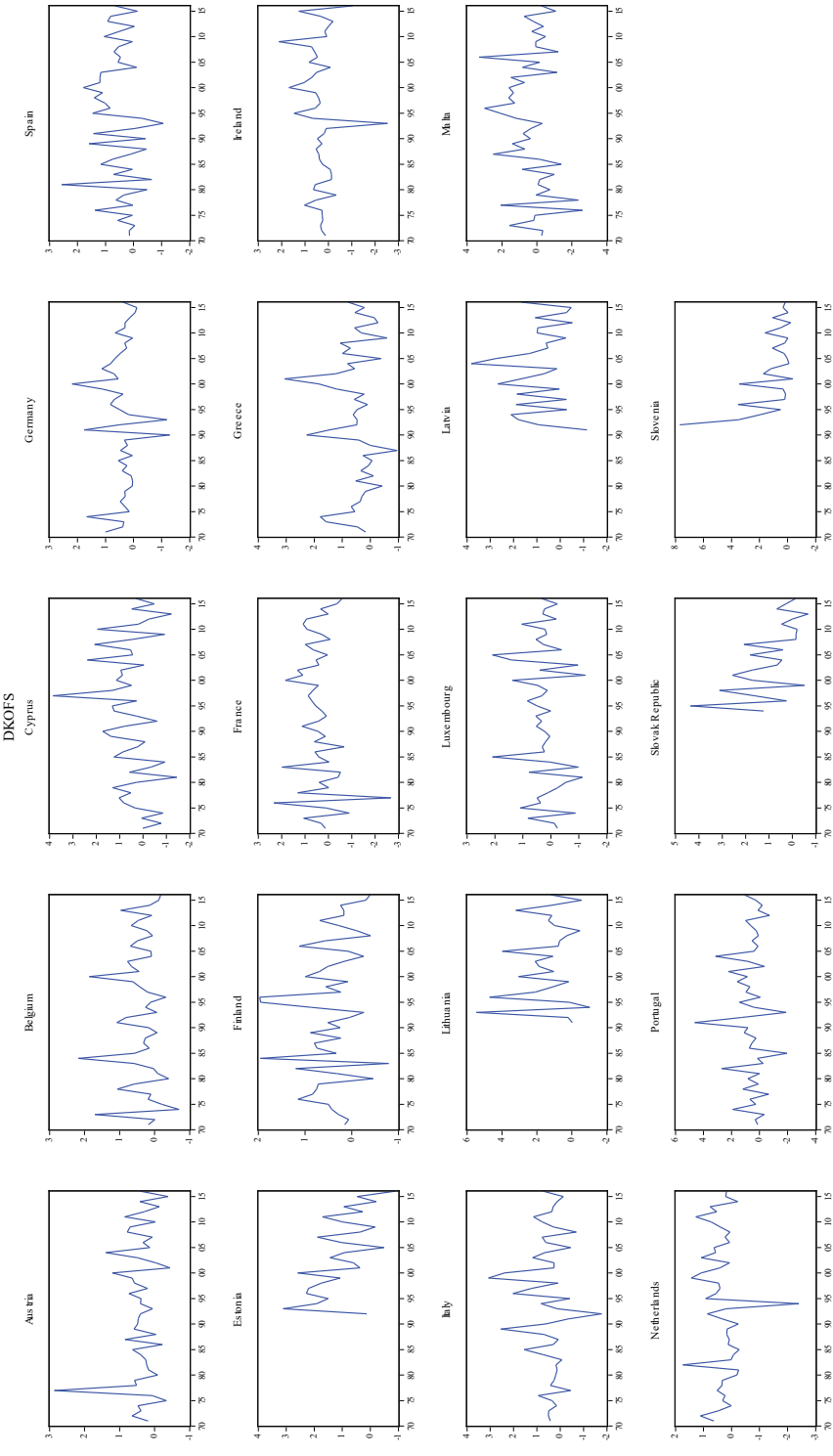
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Figure 7: Political globalization in EMU for individual countries, 1970-2016
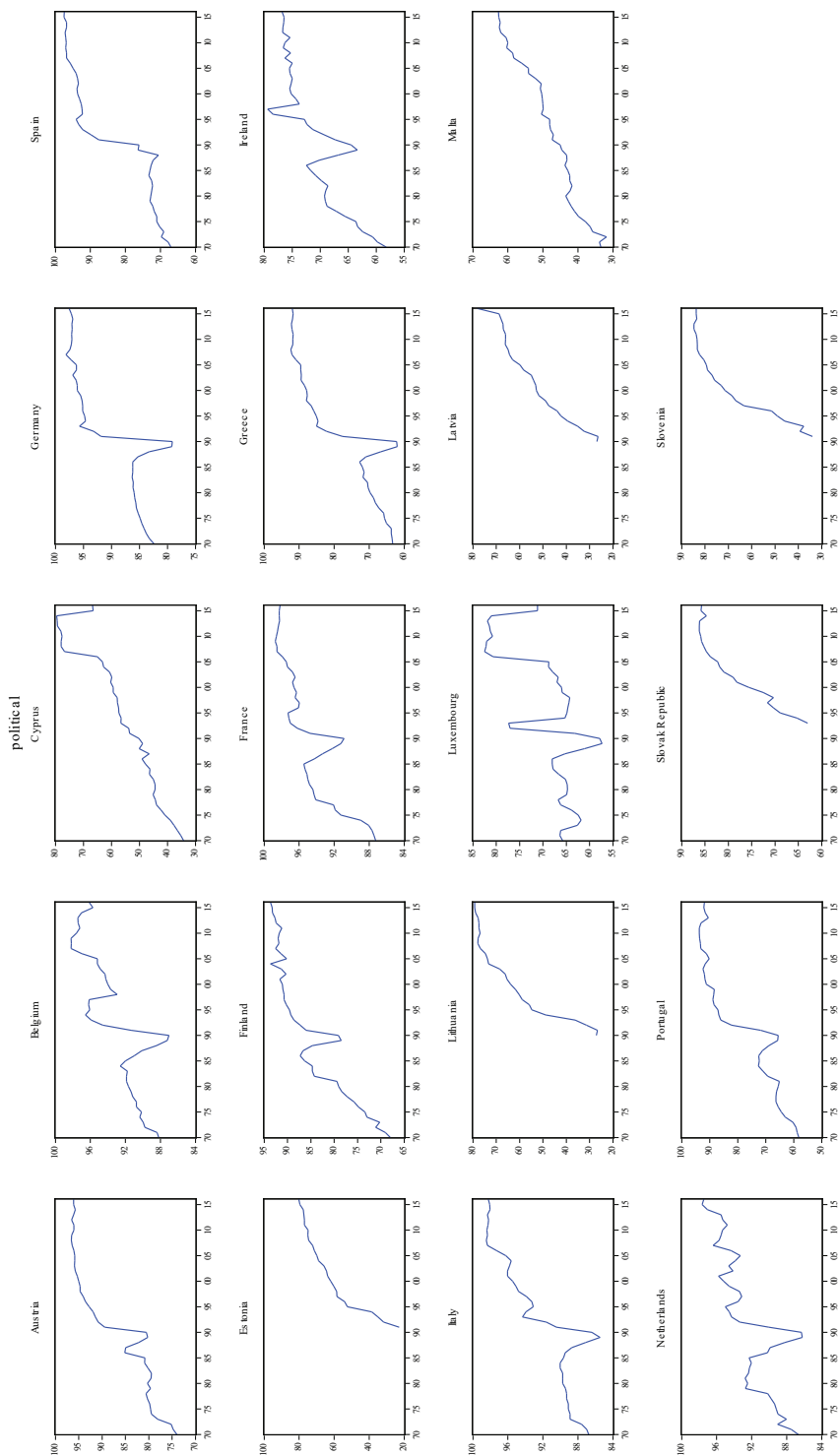
Source: Authors' calculation in EViews 10

Figure 8: Political globalization in EMU for individual countries, 1st difference, 1970-2016

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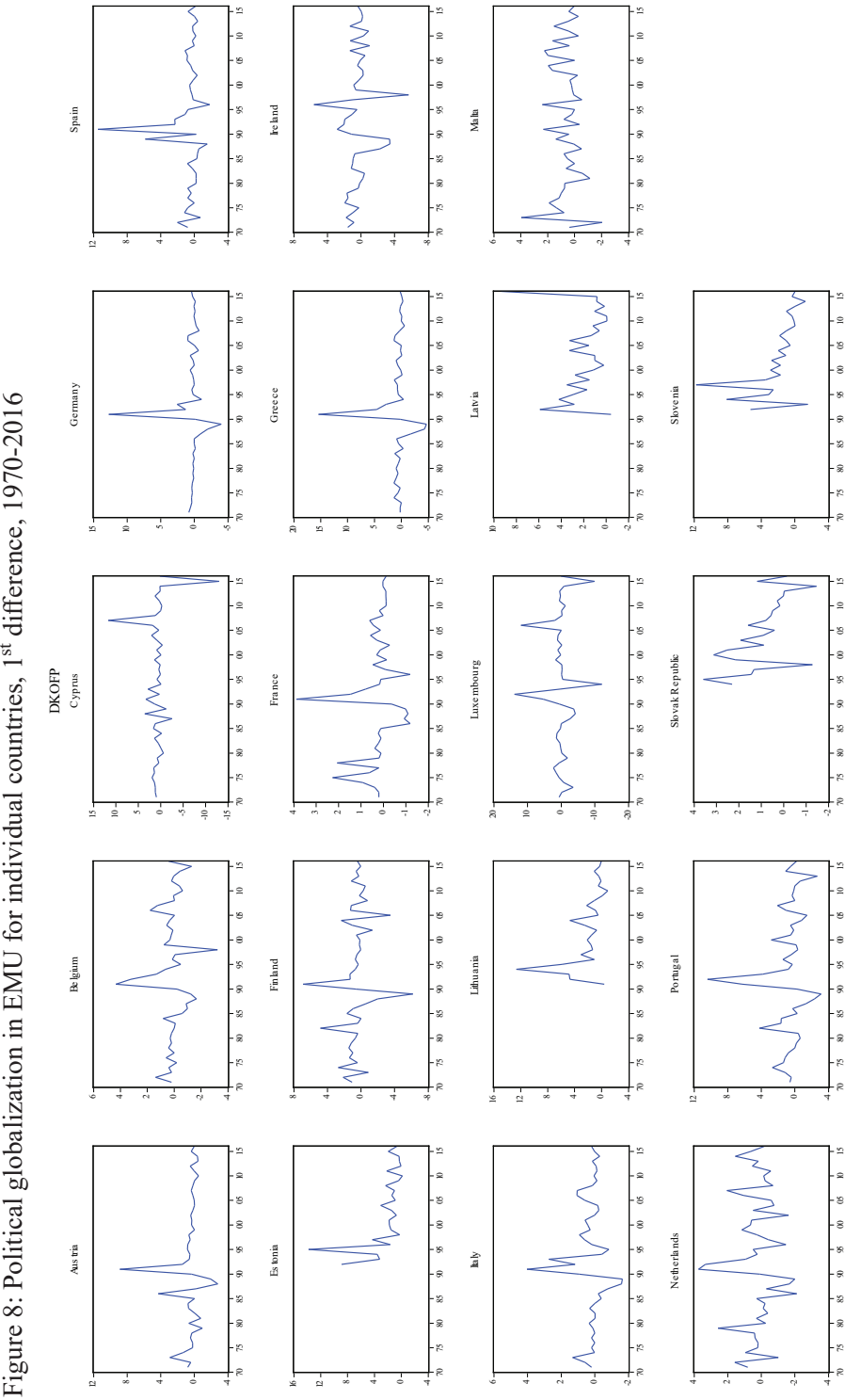
Table 1: Descriptive statistics for GDP for individual countries, 1970-2016

Country	Mean	Minimum	Maximum
Austria	2.42	-3.76	6.32
Belgium	2.24	-2.25	6.38
Cyprus	4.85	-5.80	20.27
Germany	2.00	-5.62	5.26
Spain	2.62	-3.57	8.15
Estonia	4.15	-14.72	11.80
Finland	2.52	-8.27	7.74
France	2.26	-2.94	6.31
Greece	1.82	-9.13	10.16
Ireland	5.00	-4.63	25.56
Italy	1.82	-5.48	7.13
Lithuania	4.33	-14.81	11.09
Luxembourg	3.75	-6.57	9.98
Latvia	4.13	-14.40	11.89
Malta	5.32	-2.46	19.56
Netherlands	2.35	-3.77	5.69
Portugal	2.72	-4.35	12.61
Slovakia	4.06	-5.42	10.80
Slovenia	2.60	-7.80	6.94

Source: Authors' calculation in EViews 10

Table 2: Descriptive statistics for economic globalization for individual countries, 1970-2016

Country	Mean	Minimum	Maximum
Austria	71.21	54.11	84.05
Belgium	80.93	68.97	88.77
Cyprus	58.88	44.22	83.42
Germany	68.10	53.13	80.31
Spain	57.52	33.74	75.58
Estonia	81.10	60.43	86.27
Finland	67.61	44.46	83.12
France	65.06	41.54	77.36
Greece	52.88	29.70	73.31
Ireland	80.86	57.70	91.66
Italy	57.42	41.41	72.68
Lithuania	68.41	47.89	78.18
Luxembourg	85.73	78.58	93.47
Latvia	70.82	49.05	81.44
Malta	69.30	53.86	88.91
Netherlands	80.66	66.34	89.01
Portugal	60.88	36.95	79.19
Slovakia	68.32	47.94	82.41
Slovenia	64.34	41.95	80.84

Source: Authors' calculation in EViews 10

Table 3: KOF Globalization Index and Its Dimensions

Indices and variables	Weights
1. Economic globalization	37%
1.1. Actual Flows	50%
Trade (% of GDP)	18%
FDI flows (% of GDP)	21%
FDI stocks (% of GDP)	22%
Portfolio Investment (% of GDP)	19%
Income paid to foreign nationals (% of GDP)	20%
1.2. Restrictions	50%
Hidden import barriers	24%
Mean tariff rate	28%
Taxes on International trade (% of current revenue)	27%
Capital account restrictions	20%
2. Social globalization	39%
2.1. Data on personal contact	30%
Telephone traffic (% of GDP)	13%
Transfers (% of GDP)	6%
International tourism (% of the total population)	28%
Foreign population (% of the total population)	26%
International letters (per capita)	28%
2.2. Data on information flows	35%
Internet users (per 1000 people)	25%
Television (per 1000 people)	25%
Trade-in newspapers (% of GDP)	21%
Radio (per 1000 people)	29%
2.3. Data on cultural proximity	35%
Number of McDonald's restaurants (per capita)	40%
Number of Ikea stores (per capita)	41%
Trade-in books (% of GDP)	19%
3. Political globalization	25%
Embassies in the country	35%
Membership in International organizations	36%
Participation in UN Security Council Mission	29%

Source: Pekarskiene, I. & Susniene, R. (2011), p. 62.

Table 4: Dynamic fixed effects model results

Variable	Coefficient	Std. Error	t-statistics	p-value
Long Run Equation				
KOFE	0.16	0.04	3.90	0.00
KOFS	-0.20	0.06	-3.21	0.00
KOFP	-0.18	0.05	-3.72	0.00
Short Run Equation				
Cointeq1	-0.65	0.03	-19.24	0.00
D(KOFE)	0.14	0.06	2.41	0.02
D(KOFS)	0.59	0.13	4.57	0.00
D(KOFP)	-0.05	0.06	-0.90	0.37
C	13.08	1.74	7.52	0.00

Source: Authors' calculations in Stata 14

Integrity of the benchmark price for price testing of US municipal bonds[*]

Srečko Devjak[1]

Abstract

External financial market data institutions (vendors) may provide different prices for the same US municipal bond due to differences among market participants in perception about its market value. The valuation control function will include only selected vendors in the calculation of the consensus price, which enters as a benchmark price in the price testing process. Selection of vendors is largely driven by the valuation control function's consideration of their valuation capabilities and their market coverage. Empirical analysis in this paper shows that additional pricing service may bring additional pricing information to the final consensus price, which may significantly alter the benchmark price and final price testing results. The approach described in this paper is in interest of any financial institution with US municipal bonds in the trading portfolio. Contribution of this paper to valuation of US municipal bonds is high because remaining literature does not explain alternative approach to measurement of additional pricing information in the benchmark price.

Key words: *investment banking, US municipal bonds, valuation risk management, market efficiency, calculation of a benchmark price*

JEL classification: *G12, G14, G24, G32, C81*

1. Introduction

A municipal bond is a fixed or a floating rate bond issued by a state (as part of a federal country), city or other local government, or their agencies and subdivisions. They fall in two categories, general obligations and revenue bonds. Because interest on most of these securities is exempt from taxation at the federal level

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and sometimes at state and local levels, they are also called tax exempt bonds. Municipal bonds can further be classified into two clusters, high-grade and high-yield municipal bonds. High-yield refers to non-investment grade or unrated municipal bonds, whereas high-grade refers to investment grade municipal bonds.

Financial institutions value their trading portfolios in front office and book obtained valuation results in the general ledger. To ensure that the general ledger reflects only fair value of trading portfolios, an independent valuation control function values the same trading portfolios again and calculates valuation adjustments, which are also booked in the general ledger. As a result, the general ledger will reflect trading portfolios at fair value.

The valuation process is composed of sub-processes, which are classified into two groups, price testing processes and processes for calculation of valuation adjustments. Since price of a municipal bonds by itself already reflects fair value of this asset on the market at which market participants are willing to do a transaction, the valuation control function does not further adjust this price with valuation adjustments. Hence, the only adjustment that comes out of the valuation process of a municipal bond, is the price testing adjustment or pricing adjustment.

The valuation control function values trading portfolio of municipal bonds on a CUSIP level. CUSIP is an acronym that refers to Committee on Uniform Security Identification Procedures and is a nine-digit numeric or nine-character alphanumeric code, which is used to identify securities, including municipal bonds. The valuation control function values municipal bonds at least at month-end and sends valuation results to financial control function, which books valuation results in the general ledger. In ideal scenario, the valuation control function values trading portfolio on a daily basis, which provides a better control and overview over fair value of the trading portfolio over time for the senior management.

To complete the valuation process, the valuation control function needs three inputs, end-of-day portfolio structure, front office prices and external prices for municipal bonds in the trading portfolio. The valuation control function obtains portfolio structure from the product control function, which ensures population completeness of a trading portfolio in focus of valuation. Requirement for population completeness is met if end-of-day portfolio structure contains all CUSIPs and if accurate notional values are assigned to these CUSIPs. The product control function is not only responsible to ensure population completeness of a trading portfolio in focus for valuation, it is also responsible to ensure accurate front office prices for each CUSIP. The valuation control function on the other hand is responsible for importing complete and accurate external prices for each CUSIP.

In this paper we study information completeness of the final consensus price, which enters as a benchmark price in the price testing process of US municipal bonds. Specifically, we explore amount of additional information, which enters in the

final consensus price with additional pricing service. Calculation of the consensus price, which enters in the price testing process, is responsibility of the valuation control function because valuation control function is also responsible for correct calculation of the pricing adjustments. Too little pricing services in the consensus price make consensus price unreliable because the consensus price in this case does not holistically reflect opinion of the market about the fair market price of the municipal bond. Such consensus price is then also less appropriate to enter in the price testing process as a benchmark price, against which the valuation control function compares front office prices of municipal bonds in order to calculate pricing adjustments that move portfolio value in the general ledger from front office value to fair value, which is in interest of the management, shareholders and ultimately of regulators.

Every additional pricing service in the consensus price improves reliability of the consensus price and makes it more appropriate as the benchmark price. However, every additional pricing service brings additional cost to the owner of a trading portfolio in line with the price list of vendor, which provides additional pricing service in focus. The question is, how many pricing services should enter in calculation of the consensus price so that the final consensus price will qualify itself as an appropriate benchmark price for the price testing process. Our hypothesis is that the valuation control function should consider additional pricing service in the consensus price as long as additional pricing service significantly alters the final consensus price. Our hypothesis also is that the amount of additional information from additional pricing service is significant, if the post-threshold pricing adjustment based on the consensus price with additional pricing service is significantly different from the post-threshold pricing adjustment based on the consensus price without additional pricing service.

Selection of vendors and pricing services is thus an optimization problem, where owners of trading portfolios collect given amount of pricing information from vendors for a minimal cost. Investment banks as portfolio owners will consider a number of the most reputable vendors to obtain relevant pricing services for calculation of the final consensus price. However, selected number of reputable vendors and pricing services may not be sufficient to achieve information completeness of the final consensus price, that should enter into the price testing process. This is a practical problem of the valuation control function, which needs a sound solution to justify the post-threshold pricing adjustments and linked records in the general ledger. This paper contributes to economic science with an answer on a question, which pricing services should the valuation control function consider to include in the final consensus price and how many pricing services should the valuation control function ultimately include in the calculation of the final consensus price. We will provide an answer to this question by proving or not proving our working hypothesis, which we explained earlier.

The rest of this paper is organized as follows. Section two contains review of literature, which deals with valuation of municipal bonds. Section three explains the model, which we will use to work with the data and to find an answer to the research questions. Section four explains empirical data, which we will use in this research. The results are interpreted in section five. Section six explains conclusions.

2. Literature review

Pricing of municipal bonds has been previously researched by many authors and from various aspects. Authors have researched pricing of plain vanilla municipal bonds as well as valuation of municipal bonds with embedded options. Result of their work is usually a methodology, which is improved in comparison to existing methodologies. Risk aversion is an important preference of investors at selection of investments, therefore Kriz (2004) tested the presence of risk aversion on the municipal bond market and found a significant level of risk aversion at trading with municipal bonds, which drives the pricing of municipal bonds. He tested for the presence of risk aversion on the municipal bond market through comparison of yields from a risk-neutral bonds and yields from municipal bonds. Partridge and Medda (2020) have studied another sentiment of investors, this is their inclination towards nature preservation. Specifically, they have investigated the performance of US green municipal bonds in comparison with general municipal bonds. To achieve research results, they selected two metrics to assess performance of US green municipal bonds. The first metric was the green municipal bond index and the second metric was the difference in yields between green municipal bonds and their conventional counterparts. Research has shown that pricing of municipal bonds on the secondary market is sensitive to embedded green component in municipal bonds. Empirical results have shown that an index comprised of green municipal bonds outperforms the closest equivalent S&P index from 2014 to 2018. Moreover, there is a statistically significant green premium present in the secondary muni bond market of 5 basis points by 2018.

Some authors research pricing of municipal bonds based on comparison with corporate bonds. In this way, Fama (1977) explains that US municipal bonds have relatively higher yield in comparison to corporate and governmental bonds because municipal default risk exceeds the default risk of corporate and governmental bonds. Defaults on municipal bonds in the history have raised concern about the credit risk of municipal bonds. Between 1977 and 1998, 1.765 out of a total of 253.850 issues of municipal bonds defaulted, with a face value of $24,9 billion out of a total of $375,5 billion (see Litvack and Rizzo, 2000). Wang et al. (2008) hence conclude that the probability of default may not be trivial and is of potentially greater concern for low-rated uninsured municipals.

Wang et al. (2008) also showed that prices of municipal bonds are strongly driven by liquidity, default and personal taxes. A similar research has been done by Lin et al. (2009). They have studied an effect of liquidity risk on relative yields of municipal and taxable bonds. For this reason, they have employed a reduced-form model with liquidity intensity and taxes to price tax-exempt bonds. Results show that a substantial portion of the yield spread between municipal and taxable bonds is attributable to the liquidity premium. Schwert (2017) examines the pricing of municipal bonds with three distinct, complementary approaches to decompose municipal bond spreads into default and liquidity components. The first approach estimates the liquidity component using transaction data, the second measures the default component with credit default swap data, and the third is a quasi-natural experiment that estimates changes in default risk around pre-refunding events. Results show that default risk accounts for 74% to 84% of the average spread after adjusting for tax-exempt status. The price of default risk is high given the rare incidence of municipal default and implies a high risk premium.

IHS Markit (Markit from here onwards) as a market data provider reviewed trade and quote activity on approximately 570,000 unique municipal bonds from January 2015 through March 2016. This analysis concludes that municipal bond liquidity was stable during the period and the market was relatively efficient with intermittent periods when liquidity did taper off due to seasonal factors. A direct relationship exists between the number of unique quotes and bonds that trade on a given day or month, with the correlation almost perfectly linear during a monthly period. The number of dealers quoting a bond on a given day is correlated with the likelihood of trading. Data indicates that increasing the depth from one to four dealers increases the probability of trading from 19% to 66%, based on 2015 data. There were 250 trading days in 2015 and not a single municipal bond traded every day (Markit, 2016).

Downing and Zhang (2004) found a positive relation between the number of transactions and a bond's price volatility. They also found a negative relation between average deal size and price volatility. Kalotay (2017) describes a live yield curve in the illiquid muni market, which is derived from ask prices of selected bonds across maturity spectrum.

Raman and Leidner (2018) provide a nonparametric model to estimate US municipal bond yields, which ensures that the functional relationship between the input and output variable is determined by the data rather than any a priori assumptions. The Bayesian nature of the model offers a framework to account for uncertainty in the estimates. This statistical model calculates pricing estimates based on trade transactions. Empirical analysis of the model shows that model estimates are in line with hand priced evaluations for a large number of bonds.

Chun et al. (2019) suggest an intensity-based model for pricing of municipal bonds, which simultaneously uses the credit default swap premiums of the insurers as well

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as insured and uninsured municipal bond transactions. Decomposition of municipal yield reveals a dominant role of the liquidity component as well as interactions between liquidity and default similar to those modeled by Chen et al. (2018) for corporate bonds.

Based on available literature we can see that there is no simple answer to the question, what should the price of a municipal bond be. For municipal bonds, both during primary and secondary market trading, various factors drive the price of a municipal bond. Every market participant will assign a unique price to each factor that drives the price of a municipal bond, which as a results determines final price for a municipal bond. Because every market participant has its own perception about risks associated with a municipal bond, different market participants assign different prices to the same municipal bond.

Research from Markit (2016) explains that there is no way to assess the genesis of each quote, as they are a culmination of a dealer's own inventory and trade axes from a principal perspective, as well as sell orders and client axes from an agent basis. One thing that is sure is that these quotes do not come from a vacuum and each one is sent to spur a conversation on the quoted bond or a similar bond, and these are the conversations that lead to trades.

If we are looking at bonds that are quoted and traded in the same timeframe, then we cannot assume that the dealer quoting the bond actually traded it. However, the data does indicate that the price transparency provided by the quote appears to facilitate the trade to some degree. However, market makers are an integral part of a functioning municipal bond market and the quotes they send out every day to their clients provide a gauge for several aspects of liquidity. A dealer needs to be careful about the quantity and quality of distributed quotes, as trading partners don't like to see bids too far below the market or offers well above the market. In the contrary, those same trading partners will often try to hold the trader to execute quotes, regardless of whether the levels were intentional or accidental (Markit, 2016).

Rosa (2014) has studied the impact of conventional and unconventional monetary policy on US municipal bonds. Results of his research show that monetary policy news have economically important and highly significant effects on municipal bond prices. However, prices of municipal bonds respond to monetary policy news substantially less that prices of comparable Treasury notes. This conclusion demonstrates market inefficiency because Treasury notes are risk free papers and thus react with a bigger magnitude than riskier municipal bonds. The same topic further researched Peng et al. (2014). They were researching pricing of municipal bond in stress environment. Specifically, they were comparing the yields on municipal bonds and comparable corporate bonds and found out, that municipal bonds of lower investment grade ratings after financial crisis pay a significantly higher risk premium than their corporate counterparts in light of the traditional

yield spread between these two asset classes, which has negative implications for the municipal bond market. This is an important contribution to pricing of municipal bonds because banking regulation requires from banks to perform stress testing, which has an impact not only on pricing of municipal bonds, but ultimately also on capital requirements for market risk and total capital of the bank. Understanding of pricing of municipal bonds in stress is also important because it enables understanding of valuation results for trading portfolio of municipal bonds and because it establishes platform for development of necessary quantitative adjustments in the valuation process of municipal bonds, which is in focus of this paper. Volatility of valuation results is namely driven by volatility of underlying prices, which enter in the valuation process. As a result, it is impossible to provide appropriate explanation of valuation results on one hand and on the other hand, selection of adequate quantitative techniques within the valuation process, for any product sector, including municipal bonds.

Pricing of municipal bonds has been further researched by Mozes (2015). Specifically, he studied interest rate sensitivity of municipal bonds. He measured relative cost of municipal bonds with the difference between municipal bond yields and Treasury bond yields. Two conclusions follow from his research. The first one, the less expensive municipal bonds are relative to Treasury bonds, the lower the interest rate sensitivity of municipal bonds. And the second one, the cheaper municipal bonds are relative to Treasury bonds, the higher the return on municipal bonds, which applies after controlling for the level of municipal bond yields. Interest rate sensitivity has been studied by Kalotay and Buursma (2019). Their focus in this paper was interest rate sensitivity and effective duration for tax-exempt municipal bonds. Research shows that for tax-exempt municipal bonds, effective duration may differ from the sum of key rate durations, where key rate durations are obtained by shifting individual key rates. Research explains, that the reason for this is that the prices of discount municipal bonds are tax affected, and the applicable tax rate depends on the size of the discount.

Liu (2018) thinks about pricing of municipal bonds on the primary market, which determines the starting point for the pricing of municipal bonds on the secondary market. His study provides an estimate of the heterogeneous average treatment effect. After correcting for the endogeneity bias of sale method and its interaction effect, on average competitive sale still significantly lowers the interest rate, but the interest cost advantage decreases as issuer experience increases.

Pricing of embedded call options in municipal bonds has also been studied by many authors. Kalotay and Howard (2014) have researched the value of embedded tax options in municipal bonds. Their research has shown that under realistic assumptions, the tax option embedded in a long-term municipal bond has a value of several basis points. They proved this hypothesis based on comparison of bond prices under optimal tax management and under the unmanaged buy-and-hold base

case. Embedded options in municipal bonds have also been studied by Gurwitz et al. (1992). They show that embedded option in municipal bonds has a different value for investors and for issuers on the municipal market. Specifically, ability to evaluate after tax cash flows and the effect of a potential advance refunding on the value of a municipal bond in the secondary market are not relevant capabilities of the valuation model from the perspective of issuers. Taxation of municipal bonds have studied Yerkes at al. (2016). Their paper analyzes an extensive sample of tax-exempt and taxable municipal bonds and studies how municipal bonds behave without federal tax exemption. The authors find that taxable municipal bonds are issued at higher yields in high state tax jurisdictions and that they are less likely to be issued in these areas and more likely to be issued in those that tax in-state issues.

Pricing is the starting point of the valuation process to calculate pricing adjustments, and literature review above demonstrates that it has been researched extensively. However, authors so far have not researched much valuation models to calculate pricing adjustments for municipal bonds. As a result, available literature offers very little researches of valuation models and very little improved approaches for calculation of pricing adjustments, which are ultimately booked in the general ledger of the portfolio holder. We can find limited contribution to price testing of municipal bonds in Lai and Zhang (2013). They used a large sample of US municipal bond data from 2001 to 2010 and studied the time variation of the value of municipal bond insurance, estimated with differentials in yields between insured and uninsured municipal bonds at issue. Their research shows that the supply of bonds and the level of market interest rates to have significant positive impacts on the time-varying value of bond insurance. Their research further shows asymmetric response of yield differentials to rises and declines of market interest rates. Research also shows that the value of municipal bond insurance is not a function of business cycles, but rather a function of habitat preference of municipal bonds issues. Methodological approach in this paper compares yields of insured and uninsured municipal bonds, where yields of uninsured municipal bonds serve as benchmark yields. Comparison of yields is typical for price testing. However, this paper does not discuss the number of different pricing sources to calculate the yields of insured and uninsured municipal bonds, which enter into the research. This paper also does not discuss methodological approach and does not offer an improved methodological approach, which would contribute to development of price testing for municipal bonds.

We were able to find one more paper in the exiting economic literature, which discusses elements of the price testing process for municipal bonds. This is research from Stock (1982). He empirically analyzed municipal bond portfolio structure and performance. On the back of this research, he was able to conclude that the prime determinants of price volatility are maturity and risk-premium. This paper studied municipal bonds not on individual level, but on the portfolio level, which is the

ultimate purpose of the price testing process. However, also this paper does not put in focus the number of pricing services to determine performance of the municipal bond portfolio nor discusses existing price testing techniques to calculate pricing adjustments for municipal bonds.

As a result, we conclude that available literature does not discuss the number of pricing services to calculate the benchmark price for municipal bonds nor discusses existing price testing techniques to calculate pricing adjustments for municipal bonds.

3. Methodology

Price testing process starts with calculation of the pre-threshold pricing adjustment. Assume w is the pre-threshold pricing adjustment for a municipal bond, n is the current notional value, p_i is the internal or front office price and p_b is the benchmark or consensus price for the same municipal bond. Then the pre-threshold pricing adjustment w for a municipal bond is defined with the following equation:

$$w = n \cdot \frac{p_i - p_b}{100} \tag{1}$$

Price testing thresholds are implemented to distinguish between price variances due to market noise or vendor price quality and actual valuation disparity between front office and consensus levels. They are defined based on product sector attributes and prevailing market conditions (liquidity, risk leverage, price clarity, etc.), including bid-offer levels. Assume x is the post-threshold pricing adjustment for a municipal bond and t is the pricing threshold, then the post-threshold pricing adjustment x for a municipal bond is defined with the following equation:

$$x = \begin{cases} n \cdot \dfrac{|p_i - p_b| - t}{100} \cdot \dfrac{p_i - p_b}{|p_i - p_b|} ; n \cdot \dfrac{(|p_i - p_b| - t)}{100} > 0 \\ \\ 0 ; n \cdot \dfrac{(|p_i - p_b| - t)}{100} \leq 0 \end{cases} \tag{2}$$

On the portfolio level with m CUSIPs in the portfolio is post-threshold pricing adjustment x_p so:

$$x_p = \sum_{j=1}^{m} \left[n_j \cdot \frac{|p_{ij} - p_{bj}| - t_j}{100} \cdot \frac{p_{ij} - p_{bj}}{|p_{ij} - p_{bj}|} \right] ; n_j \cdot \frac{|p_{ij} - p_{bj}| - t_j}{100} > 0 \tag{3}$$

The valuation control function does not need to include additional pricing service in the calculation of the final consensus price if this additional pricing service does not bring additional pricing information. To find out if Bloomberg brings

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additional pricing information to the benchmark price or not, we will use NY3PM bid prices and for each CUSIP and calculate two different benchmark prices. The first benchmark price $p_b(2V)$ will include two vendors, Markit and IDC. The second benchmark price $p_b(3V)$ will include three vendors, Markit, IDC and Bloomberg. Each benchmark price will be calculated as a median. Both medians will be in the following relationship for each CUSIP j:

$$p_{bj}(3V) = p_{bj}(2V) + \varepsilon_j \tag{4}$$

where ε_j represents a deviation from the benchmark price, which is calculated based on two vendors only. To measure average quantity of additional pricing information on the portfolio level, which enters into the benchmark price with additional pricing service, we will calculate mean absolute deviation of ε_j, where $j \in \{1, 2, \ldots, m\}$ and m is the number of CUSIPs in the portfolio.

This mean absolute deviation δ_p is defined as follows:

$$\delta_p = \frac{1}{m}\sum_{j=1}^{m}|\varepsilon_j| = \frac{1}{m}\sum_{j=1}^{m}\left|p_{bj}(3V) - p_{bj}(2V)\right| = \frac{1}{m}\sum_{j=1}^{m}\left|\varphi_j(3V) - \varphi_j(2V)\right| \tag{5}$$

Assume that the valuation control function considers all relevant vendors as equally important price contributors, then the control valuation function will calculate the benchmark or consensus price to enter the price testing process as the median price. In case of final set of ascendingly ordered numbers $X = \{x_1, x_2, \ldots, x_n\}$, the median φ is defined as follows:

$$\varphi = \begin{cases} x_{\frac{n+1}{2}}; & n \text{ is an odd number} \\ \dfrac{x_{\frac{n}{2}} + x_{\frac{n+2}{2}}}{2}; & n \text{ is an even number} \end{cases} \tag{6}$$

We know that a post-threshold pricing adjustment with benchmark price as a median from two vendors $x_p(2V)$ and for portfolio with m CUSIPs is:

$$x_p(2V) = \sum_{j=1}^{m}\left[n_j \cdot \frac{\left|p_{ij} - p_{bj}(2V)\right| - t_j}{100} \cdot \frac{p_{ij} - p_{bj}(2V)}{\left|p_{ij} - p_{bj}(2V)\right|} \right];$$

$$n_j \cdot \frac{\left|p_{ij} - p_{bj}(2V)\right| - t_j}{100} > 0 \tag{7}$$

We also know that $p_{bj}(2V) = p_{bj}(3V) - \varepsilon_j$.

For $j \in \{1, 2, \ldots, m\}$ and $n_j \cdot \frac{\left|p_{ij} - (p_{bj}(3V) - \varepsilon_j)\right| - t_j}{100} > 0$ therefore holds:

$$x_p(2V) = \sum_{j=1}^{m} \left[n_j \cdot \frac{\left| p_{ij} - \left(p_{bj}(3V) - \varepsilon_j \right) \right| - t_j}{100} \cdot \frac{p_{ij} - \left(p_{bj}(3V) - \varepsilon_j \right)}{\left| p_{ij} - \left(p_{bj}(3V) - \varepsilon_j \right) \right|} \right]$$

$$x_p(2V) = \sum_{j=1}^{m} \left[n_j \cdot \frac{\left| \left(p_{ij} - p_{bj}(3V) \right) + \varepsilon_j \right| - t_j}{100} \cdot \frac{\left(p_{ij} - p_{bj}(3V) \right) + \varepsilon_j}{\left| \left(p_{ij} - p_{bj}(3V) \right) + \varepsilon_j \right|} \right]$$

(8)

Post-threshold pricing adjustment with benchmark price as a median from three vendors $x_p(3V)$ and for portfolio with m CUSIPs is:

$$x_p(3V) = \sum_{j=1}^{m} \left[n_j \cdot \frac{\left| p_{ij} - p_{bj}(3V) \right| - t_j}{100} \cdot \frac{p_{ij} - p_{bj}(3V)}{\left| p_{ij} - p_{bj}(3V) \right|} \right];$$

$$n_j \cdot \frac{\left| p_{ij} - p_{bj}(3V) \right| - t_j}{100} > 0$$

(9)

Impact of additional pricing information from additional vendor on the post-threshold pricing adjustment is equal to a difference between post-threshold pricing adjustments from three and two vendors:

$$\Delta = x_p(3V) - x_p(2V)$$

(10)

For $j \in \{1, 2, \ldots, m\}$ and $n_j \cdot \frac{|p_{ij} - p_{bj}| - t_j}{100} > 0$ holds:

$$\Delta = x_p(3V) - x_p(2V)$$

(11)

$$\Delta = \sum_{j=1}^{m} \left[n_j \cdot \frac{\left| p_{ij} - p_{bj}(3V) \right| - t_j}{100} \cdot \frac{p_{ij} - p_{bj}(3V)}{\left| p_{ij} - p_{bj}(3V) \right|} \right] -$$

$$- \sum_{j=1}^{m} \left[n_j \cdot \frac{\left| \left(p_{ij} - p_{bj}(3V) \right) + \varepsilon_j \right| - t_j}{100} \cdot \frac{\left(p_{ij} - p_{bj}(3V) \right) + \varepsilon_j}{\left| \left(p_{ij} - p_{bj}(3V) \right) + \varepsilon_j \right|} \right]$$

(12)

$$\Delta = \frac{1}{100} \sum_{j=1}^{m} \left[\frac{n_j \cdot \left(\left| p_{ij} - p_{bj}(3V) \right| - t_j \right) \cdot \left(p_{ij} - p_{bj}(3V) \right)}{\left| p_{ij} - p_{bj}(3V) \right|} - \right.$$

$$\left. - \frac{n_j \cdot \left(\left| p_{ij} - p_{bj}(2V) \right| - t_j \right) \cdot \left(\left(p_{ij} - p_{bj}(3V) \right) + \varepsilon_j \right)}{\left| p_{ij} - p_{bj}(2V) \right|} \right]$$

(13)

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$$\Delta = \frac{1}{100}\sum_{j=1}^{m}\left[\frac{n_j \cdot \left(\left|p_{ij}-p_{bj}(3V)\right|-t_j\right)\cdot\left(p_{ij}-p_{bj}(3V)\right)\cdot\left|p_{ij}-p_{bj}(2V)\right|}{\left|p_{ij}-p_{bj}(3V)\right|\cdot\left|p_{ij}-p_{bj}(2V)\right|}-\right.$$

$$\left.-\frac{n_j\cdot\left(\left|p_{ij}-p_{bj}(2V)\right|-t_j\right)\cdot\left(\left(p_{ij}-p_{bj}(3V)\right)+\varepsilon_j\right)\cdot\left|p_{ij}-p_{bj}(3V)\right|}{\left|p_{ij}-p_{bj}(3V)\right|\cdot\left|p_{ij}-p_{bj}(2V)\right|}\right] \tag{14}$$

$$\Delta = \frac{1}{100}\sum_{j=1}^{m}\left[n_j\cdot\frac{\left(p_{ij}-p_{bj}(3V)\right)}{\left|p_{ij}-p_{bj}(3V)\right|\cdot *\left|p_{ij}-p_{bj}(2V)\right|}\cdot\right.$$

$$\cdot\left[\left(\left|p_{ij}-p_{bj}(3V)\right|-t_j\right)\cdot\left|p_{ij}-p_{bj}(2V)\right|-\left(\left|p_{ij}-p_{bj}(2V)\right|-t_j\right)\cdot\right. \tag{15}$$

$$\left.\left.\cdot\left|p_{ij}-p_{bj}(3V)\right|+\frac{\left(\left|p_{ij}-p_{bj}(2V)\right|-t_j\right)\cdot\left|p_{ij}-p_{bj}(3V)\right|\cdot\varepsilon_j}{\left(p_{ij}-p_{bj}(3V)\right)}\right]\right]$$

$$\Delta = \frac{1}{100}\sum_{j=1}^{m}\left[\frac{n_j}{\left|p_{ij}-p_{bj}(3V)\right|\cdot\left|p_{ij}-p_{bj}(2V)\right|}\cdot\right.$$

$$\cdot\left[\left(\left|p_{ij}-p_{bj}(3V)\right|-t_j\right)\cdot\left|p_{ij}-p_{bj}(2V)\right|\cdot\left(p_{ij}-p_{bj}(3V)\right)-\right. \tag{16}$$

$$\left.\left.-\left(\left|p_{ij}-p_{bj}(2V)\right|-t_j\right)\cdot\left|p_{ij}-p_{bj}(3V)\right|\cdot\left[\left(p_{ij}-p_{bj}(3V)\right)+\varepsilon_j\right]\right]\right]$$

4. Empirical data and analysis

Various external financial market data institutions (vendors) provide prices for US municipal bonds, which enter as external prices into the price testing process. They enter as benchmark of fair value for inventoried positions in the trading portfolio. The choice of vendors utilized as part of the price testing process is largely driven by the valuation control function's consideration of their valuation capabilities and their market coverage. The major leading institutions providing such evaluation services are Markit and IDC, both of whom are considered industry experts in providing muni bond analysis. Markit provides quotes for more than 1,1 million municipal bonds rated Aaa/AAA to Baa3/BBB- with both fixed and variable coupons. Pricing inputs include data from proprietary parsing technology and the Municipal Securities Rulemaking Board (MSRB) feed. Quotes incorporate also the

financial condition of each state and municipality, uses of proceeds and other issue level factors (Markit, 2016).

There are various pricing services that each vendor provides for the same product sector. Prices are first location specific to consolidate opinions of market value from local market participants. Vendors provide prices for all market orientations, which are bid, ask and mid prices. Finally, vendors may also provide prices at different cut-off times during a business day. Each vendor provides at least close price at the end of the business day, but it can also provide prices for other cut-off times during the business day.

Key requirement in the price testing process is that all pricing services utilized refer to the same cut-off time, which ensures that valuation results and corresponding pricing adjustments belong to one snapshot. The price testing process utilizes bid prices to calculate the amount of money front office would get if it would sell all portfolio at selected cut-off time. As a result, all external prices imported and used in the price testing process are also bid-side prices to ensure proper price comparison.

The financial control function will leverage those location specific prices from vendors, which match up with location of the portfolio. If portfolio resides in the US, the financial control function will use New York prices.

For municipal bonds, IDC provides prices for New York location only once per day. These are New York close prices, which reflect prices at 3pm New York time. Business acronym for these prices is NYCLOSE prices. Markit on the other hand provides two price snapshots each day for municipal bonds, these are New York 3pm (NY3PM) and New York 4pm (NY4PM) prices. Because snapshots from all vendors in the price testing process must match up and because IDC provides prices for municipal bonds only at 3pm New York time, the valuation control function will select NY3PM market prices.

Beside IDC and Markit, Bloomberg also provides prices each business day for US municipal bonds. The relevant Bloomberg pricing service that provides prices of US municipal bonds is Bloomberg Valuation Service (BVAL). BVAL is an end-of-day evaluated pricing service covering 2,5 million fixed income bonds and loans. It covers also thinly-traded and hard-to-price fixed income securities. All BVAL prices are independent, transparent and defendable, with the majority being model derived. Inputs include reported trades and contributed quotes contracted specifically with BVAL (Bloomberg L.P., 2016a).

Market coverage and pricing integrity of BVAL prices enable portfolio holder valuation of fixed income portfolios, but also ensures that entire organization of the portfolio holder, from front office to back office, has consistent access to the same pricing service (Bloomberg L.P., 2015).

Fixed income markets have evolved dramatically over the last few decades with the introduction of streaming quotes, electronic trading and more compliance and regulatory requirements. To help market participants keep up with this demanding environment, Bloomberg provides more pricing data, more often and with more transparency for government, supranational, agency and corporate (GSAC) bonds, municipal bonds and securitized products (Bloomberg Finance L.P., 2020).

BVAL uses pricing data from only the highest quality market contributors. These include TRACE, MSRB, exchanges and broker quotes. Collected data enter into a data review process, which filters, cleanses and verifies pricing data further for ongoing quality and consistency. Capital markets experts monitor the process of data collection and provide exceptional 24/5 global and around the clock customer service. Result enables Bloomberg to provide prices and valuations, which are highly accurate and defensible, so users can act upon it with confidence (Bloomberg Finance L.P., 2020).

Market of municipal bonds at Bloomberg oversees a team of experts for municipal bond with market experience. BVAL prices for municipal bonds consistently demonstrate the lowest degree of tracking error and the highest degree of transparency in the industry. For securities that are less liquid, among them are also US municipal bonds, BVAL derives a comparable relative price with an algorithm based on the most recent market data. Therefore, BVAL prices are reactive and closely reflect current market conditions (Bloomberg Finance L.P., 2020).

Bloomberg prices are supported by the BVAL score, a proprietary metric designed to give insight into the amount and consistency of market data used to produce the BVAL price. The metric utilizes Bloomberg's ability to access a wealth of market observations and the standard deviation of those observations. It is defined on a scale between 1-10. Direct market observations sourced from the Bloomberg Trading System, TRACE, MSRB, and other permissioned contributions get maximum score of 10. When direct observations on the target fixed income instrument are insufficient, observations on comparable fixed income instruments are leveraged to determine a relative price of the target fixed income instrument. Such fixed income instruments receive a BVAL score of 5 or lower and are priced using mostly data from comparable securities rather than direct observations on the target fixed income instrument (Bloomberg L.P., 2016b).

The BVAL score has been designed to identify securities with limited availability of pricing data, which is especially important in the price testing process at portfolio holder. Valuable characteristic of the BVAL score is also its consistency across asset classes in the universe of asset classes that Bloomberg covers. The BVAL score has namely been calibrated to be consistent across all asset classes depending on the data used to produce the BVAL score (Bloomberg L.P., 2015).

The BVAL score is not a statement of accuracy, relative quality or an indicator of confidence in the BVAL price. Bloomberg as a vendor is confident in the quality of BVAL prices and believes that they are defensible. Further, the BVAL score is also not a liquidity indicator even though it is possible that securities with higher BVAL scores have more market makers providing prices. If a user is able to access those market makers, he may find more liquidity for those securities with higher BVAL scores as opposed to ones that have lower BVAL scores. As a result, BVAL score enhances the valuation process, for which valuation control function of the portfolio owner is responsible for (Bloomberg L.P., 2015).

BVAL pricing data are available on the Bloomberg Terminal or as an enterprise data feed via Bloomberg Data License. On the Bloomberg Terminal, BVAL pricing service is integrated into Bloomberg's Asset & Investment Manager (AIM), Trade Order Management Solutions (TOMS), Portfolio Management System (PORT) and regulatory and accounting products (Bloomberg Finance L.P., 2020).

Bloomberg provides two snapshots per day for US municipal bonds, these are New York 3pm and 4pm prices. Because Bloomberg also provides pricing services for US municipal bonds, the question appears if the valuation control function should also use this pricing service in the price testing process.

To answer the question, we will use a trading portfolio of US municipal bonds in the balance sheet of a financial institution in USA as of 29 March 2019. This portfolio contained high-grade as well as high-yield US municipal bonds with total market value as per front office or internal prices of 1,55bn USD. There were 279 unique CUSIPs in the portfolio.

For each CUSIP in the portfolio, we collected NY3PM bid prices on 29 March 2019 from all three vendors in focus, which are Markit, IDC and Bloomberg. After importing the prices from vendors, we reviewed imported prices. Review has shown that all three vendors provided a price for each CUSIP in the portfolio, which demonstrates that each vendor holds sufficient market coverage. Sufficient market coverage in return enables the vendor to quote prices for locations, market orientations and time snapshots. According to this criteria, we cannot identify a vendor, who would provide less reliable prices as other vendors. As a result, we can consider all three vendors as equally important.

5. Results and discussion

We measured an average quantity of additional pricing information on the portfolio level, which enters into the consensus price with additional pricing service, with mean absolute deviation. Mean absolute deviation of the difference between consensus price with three vendors and consensus price with two vendors was $\delta_p =$

0,22683 index points. As a result, we can conclude that additional pricing service does bring additional pricing information to the final consensus or benchmark price. We can further conclude that the valuation control function should consider this additional pricing service as a relevant vendor for calculation of the consensus price, which enters as a benchmark price into the price testing process. To conclude if the valuation control function should also use this pricing service in the price testing process on a regular basis, we should calculate statistical significance of this difference, which supersedes the purpose of this paper.

To calibrate the impact of additional pricing information on final price testing results, we calculated a difference between post-threshold pricing adjustment, where the benchmark price contained three vendors, and post-threshold pricing adjustment, where the benchmark price contained two vendors. Calculation has shown a difference of -595.363 USD. Post-threshold pricing adjustment with benchmark price from two vendors was 720.795 USD, therefore we can conclude that the additional pricing information significantly changes post-threshold pricing adjustment.

This is a difference between post-threshold pricing adjustments for one month-end in a year. If we would observe equal result each month, which is a reasonable assumption if these are price testing results in normal circumstances on financial markets, then we would be able to conclude that it is likely to see similar price volatility also in the next months as long as situation on financial markets does not change. As a result, estimated difference between post-threshold pricing adjustments at a yearly level is 12 · (-595.363 USD) = -7.144.356 USD, which is a significant amount and has a material impact on final profit and loss of the portfolio holder and ultimately on the market value of shareholder's equity.

From the shareholder's perspective is introduction of additional pricing service in the calculation of the benchmark price economically justified if it is estimated difference between post-threshold pricing adjustments at a yearly level higher than the yearly cost of additional pricing service. Because it is estimated difference between post-threshold pricing adjustments at a yearly level -7.144.356 USD and much higher than the yearly cost of additional pricing service, is therefore from perspective of shareholders economically justified to include this pricing service in the calculation of the benchmark price.

It is not only in interest of shareholders to reflect a trading portfolio of municipal bonds at fair value, this is also in interest of banking regulators. Valuation of a trading portfolio with municipal bonds at fair value enables correct calculation of capital charges for market risk from positions in the trading portfolio with municipal bonds. Moreover, it also enables correct calculation of capital adequacy of a bank. Capital adequacy is a key metric of banking solvency, which may be endangered in times of stress due to reduced prices of US municipal bonds on

financial markets. Incomplete inclusion of pricing services in the benchmark price may leave out important pricing information from another vendor and may lead to overpriced benchmark price, which enters in the price testing process, and it ultimately leads to overpriced total market value of the trading portfolio in comparison to actual situation on financial markets. In this case, capital of a bank may appear as adequate, which would not be the case if the benchmark price would contain all relevant pricing information from the market and consequently, all relevant pricing services from all vendors. As a result, the benchmark price without additional pricing service may require capital increase from the bank later than informationally holistic benchmark price with additional pricing service. Previous financial crisis has shown, that collection of capital in times of stress is more demanding than in normal times on financial markets. Hence it is better for the bank to collect capital before crisis, which may be in crisis not only too late, but also impossible.

To avoid incomplete reflection of pricing adjustments in the general ledger, the valuation control function should holistically identify vendors on the market that provide external prices for municipal bonds and assess amount of additional pricing information from each external price to the benchmark price. The valuation control function should keep adding additional pricing services to the benchmark price as long as contribution from additional pricing service to price testing results is significant. When contribution of additional pricing service to the benchmark or consensus price and ultimately to the pricing adjustment becomes insignificant, the valuation control function does not need to add this additional pricing service to the benchmark price.

6. Conclusion

In this paper we have explored impact of partial pricing information from additional pricing service in the benchmark price on post-threshold pricing adjustments. We have measured this impact with the difference between the post-threshold pricing adjustment with additional pricing service and post-threshold pricing adjustment without additional pricing service in the benchmark price. Our research shows that in case of very small number of pricing services in the benchmark price, additional pricing service brings material new information to calculation of the benchmark price, which enters into the price testing process of US municipal bonds. As a result, we have also shown that that introduction of additional pricing service in the calculation of the benchmark price is economically justified when the pricing adjustment with additional external price is materially different from the pricing adjustment without additional external price, which proves our working hypothesis. We see this result from our research as a new contribution to economic science. Measurement of additional pricing information is a responsibility of the valuation

control function at establishment of a portfolio and before the first calculation of the pricing adjustment. As we can see from results, consideration to include additional pricing service in calculation of the benchmark price is necessary and management of the valuation control function should implement it in the business process.

Approach and results in this paper have two limitations. The first one is shallowness of external price by CUSIP in the pricing service. Even if vendors provide price for a CUSIP, this price may be calculated on a shallow pool of market participants, which moves this price further away from market average and therefore makes it less useful for calculation of the benchmark price. Vendors may not explain, how many market participants they used to calculate external price for a CUSIP, in which case we can conclude about reliability of a pricing service. As we have explained, Bloomberg provides a proprietary metric as an indicator of the amount and consistency of market data used to produce the BVAL pricing service. This is the BVAL score, which accompanies and supports the BVAL price. Other vendors may have other metrics, which serve the same purpose. Even though Bloomberg calibrated this metric to be consistent across all asset classes depending on the data used to calculate the BVAL pricing service, the definition of the BVAL score may not be the same as definition of similar metrics at other vendors, which disables comparison of shallowness among pricing services from different vendors. Further, vendors typically do not provide granular data, which they used to calculate their metric of market shallowness. Availability of granular data of market coverage would allow to research the universe of market observations, which is available to each vendor and based on which each vendor calculates its metric of market shallowness. Shallowness of pricing services may result in an unlikely situation, where alteration of the benchmark price after inclusion of additional pricing service is driven by a shallow pool of market participants with limited opinion about fair value of an asset in focus and not by a reliable additional information about the market price. As a result, the difference between post-threshold pricing adjustment with additional pricing service and post-threshold pricing adjustment without additional pricing service may appear material, which in reality is not true and would be an incorrect conclusion about fair value of assets in the trading portfolio.

The second limitation is applicability of results from this research after inception of the trading portfolio. The results of this research are not sufficient to make a conclusion whether the significance of additional information from additional pricing service in the benchmark price is variable in time of normal circumstances on financial markets. Hence, results of this research are not able to advise whether the valuation control function should measure informational contribution of pricing services to the benchmark price within the lifetime of the portfolio. Also this question oversteps the purpose of this research and remains an open question to explore in the future.

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Integritet referentne cijene za testiranje cijena američkih općinskih obveznica

Srečko Devjak[1]

Sažetak

Vanjske institucije koje raspolažu podacima o financijskim tržištima (dobavljači) mogu za istu američku municipalnu obveznicu ponuditi različite cijene zbog razlika u percepciji njihove tržišne vrijednosti među sudionicima na tržištu. Funkcija kontrole procjene uključivat će samo odabrane dobavljače u izračun dogovorne cijene, koja ulazi kao referentna cijena u postupku testiranja cijena. Odabir dobavljača u velikoj je mjeri vođen razmatranjem funkcije kontrole procjene o njihovoj sposobnosti vrednovanja i njihove prisutnosti na tržištu. Empirijska analiza u ovom radu pokazuje da dodatna cjenovna usluga može dati dodatne informacije o tržišnim cijenama do finalne cijene postignute konsenzusom, što može značajno promijeniti referentnu cijenu i konačne rezultate cijenovnog testiranja. Pristup opisan u ovom radu koristan je za financijske institucije s američkim municipalnim obveznicama u trgovinskom portfelju. Doprinos ovog rada o vrednovanju američkih municipalnih obveznica je značajan budući da dosadašnja literatura ne objašnjava alternativni pristup mjerenju dodatnih cjenovnih informacija o referentnoj cijeni.

Ključne riječi: *investicijsko bankarstvo, američke municipalne obveznice, upravljanje rizikom procjene vrijednosti, tržišna učinkovitost, izračun referentne cijene*

JEL klasifikacija: *G12, G14, G24, G32, C81*

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Determinants of inward foreign direct investment: Comparison across different country groups[*][1]

Minakshee Das[2]

Abstract

This paper analyses the factors determining inward foreign direct investment, particularly the role of natural endowments and economic and political characteristics of the host country. It expands on the existing literature by focusing on four broad groups of countries: advanced , emerging-market, developing and transition economies, comprising of more than 100 countries in a panel data setting for the period 1996 – 2016. The paper also examines the scenario during the major economic crises – Asian crisis, Dotcom Bubble, Global Financial crisis and Sovereign Debt crisis. The results indicate that the determinants of inward foreign direct investment have changed over time and that the patterns are not uniform across the four country groups. Furthermore, the paper compares the determinants of two major country groups, namely – emerging-market and developing countries by conducting Chow test for equality of coefficients. It is seen that the economic growth and market size has a stronger positive influence on inward FDI flow to emerging-market than to developing economies. Also, emerging-market economies experienced a smaller flow of FDI during Global Financial crisis compared to developing economies. These results have important implications for the policy makers as they can help to identify the regional factors that attract capital inflows.

Key words: *foreign direct investment, multinational enterprises, determinants, panel data*

JEL classification: *F21, F23, O57*

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1. Introduction

Foreign direct investment (FDI) is an important aspect of globalization and a dominant component of economic development strategies of both home and host countries. Inward FDI have been rising rapidly since 1990. In the recent years, the emerging-market and developing economies have surpassed advanced economies in receiving capital inflows. This is a manifestation of the increasing receptive attitude towards inward FDI and the consequent changes undertaken by governments to institutions and incentives in order to facilitate these flows. Countries with insufficient domestic savings traditionally relied on foreign aid or foreign debt. But rapid accumulation of external borrowing can result in unsustainable debt dynamics with consequent negative effect on growth performance.

A major reason for the present positive attitude towards FDI is the certainty that these flows benefit both the home and host nations. Moreover, it also assures more stable source of external financing than portfolio investment. FDI flows are essentially non-debt-creating and have other direct and indirect advantages, such as transfer of advanced technology, managerial expertise, creation of job opportunities, spillover effects that involve ancillary supply chains, etc. from the host countries' point of view. These benefits have persuaded the host nations to reduce the barriers of inward FDI. However, these benefits are assessed by the host countries against costs, such as loss of managerial control and risk of losing sovereignty. Some nations still resist the idea of inward FDI and are sceptical about opening up certain sectors due to state security considerations. Taking all these factors into account, it is not surprising that understanding the forces attracting inward FDI is of considerable interest to both economists and policy makers. Not surprisingly, much attention has been given to empirically identifying the important determinants of inward FDI and the implication of the findings for policy formulation and implementation. The bulk of the empirical literature is focused on studies of a single country or a small set of countries.

This paper builds on and extends the existing literature by examining the determinants of FDI inflows over a longer time horizon and with broader country scope. It also contributes to the literature by analysing a wide set of determinants associated with FDI inflows into the four country groupings (advanced, emerging-market, developing and transition economies). In particular, the main contributions of this paper are that I compare the determinants of FDI inflows for the four broad groups of countries and also examine how the evolution of FDI flows to the different country groups that have been impacted by economic crises. The results indicate that the determinants of inward FDI have changed over time and that the patterns are not uniform across the four country groups. It also supports the general observation that some factors are indeed relevant determinants of inward FDI in almost all countries but to different extents, thereby suggesting that policies

to attract FDI into those areas should focus improving these country groups' determinants.

The remainder of the paper is organized as follows. Section 2 recalls the literature of theoretical and empirical studies that have examined various factors attracting capital inflows. Section 3 describes the data and the methodology. Section 4 reports the empirical results, and Section 5 concludes.

2. Literature review

The literature on determinants of inward FDI is extensive. Some notable surveys of the literature include – Blonigen (2005), Iršová and Havránek (2013), Tang, Yip, and Ozturk (2014), Donnelly (2014), Paul and Singh (2017) and Teixeira, Forte, and Assunção (2017). In this section, the theoretical considerations behind inward FDI are reviewed and the findings of selected recent empirical studies are summarized.

2.1. Theories of inward FDI

There are many theories, which explain why multinational enterprises (MNEs) are interested in investing abroad and why they choose one particular country over another for investment. MacDougall (1958) was one of the earliest researchers to analyse FDI flows within the framework of a model that assumed a perfectly competitive market structure. Later, Kemp (1964) proposed a two-country model, and stated that capital moves freely from a capital-abundant country to a capital-scarce country. As a result, the marginal productivity of capital tends to equalize between the two countries.

Hymer (1960) relaxed the assumption of a perfectly competitive market structure and developed a theory based on an imperfect market setting. This approach was subsequently followed by Lemfalussy (1961), Kindleberger (1969), Knickerbocker (1973), Caves (1974), Dunning (1974), and Vaitsos (1976). Hymer used the term "firm-specific" advantage to build his theory. His theory states that firms operating abroad have to confront a number of challenges, the biggest of which is to compete with domestic firms that possess a number of advantages in terms of culture, language, legal system, etc. Also, foreign firms should have some form of market power in order to gain profit from the international investment which compensates these local factors. In the reality of imperfect competition, firms are able to take advantage of their market power to reap profits by investing abroad. Some other researchers also supported this argument. For example, according to Graham & Krugman (1989), the main reason why European firms invest in the United States is because of technological advantage.

On the other hand, Robock & Simmond (1983) claimed that investing abroad is not the only way for firms to exploit firm-specific advantage as firms could manifest their advantages through exporting or licensing. The choice between FDI and licensing/exports is influenced by a host of factors, including local market conditions and size, local government policy, and the riskiness of investment, etc.

Though Hymer's (1960) theory was supported by many researchers, it fails to explain in which locations and when FDI takes place. Later, his theory was extended by Kindleberger (1969) on the basis of monopolistic market framework. Kindleberger claimed that the advantages enjoyed by MNEs could be valuable only when the market is imperfect. He also added that, as long as firms' monopoly profits are high, they are more inclined to invest abroad. Firms with advanced technology prefer to invest in a foreign country instead of sharing it with potential competitors in the foreign market.

Balassa (1966) hypothesized that investors are attracted to economies with large market size as it facilitates cost minimization and specialization of the factors of production. This hypothesis was confirmed in a study by Edward (1991) on FDI flows from OECD[3] countries to least developed countries (LDCs). He found that bigger the market size of a country, the larger was its share in the total FDI inflows of the world.

A prerequisite for exploitation of a firm's monopolistic advantages abroad is the support of the host country's policy. It may be that for the purpose of national interest, the host government does not permit free entry of foreign firms into the country. Several hypotheses fall under this imperfect market assumption, of which the location hypothesis and the eclectic theories are the two main models.

According to location hypothesis (first theory), location determinants of FDI play a vital role in attracting good number of funds. For instance, the locational advantage of labour with low wage rates (cheap labour) is an immobile factor of production. But evidence in support of this locational hypothesis is varied. Riedel (1975) found that lower wage rates is one the main factors that determines export-oriented FDI in Taiwan. Furthermore, Saunders (1983), Schneider & Frey (1985), and Culem (1988) found that a rise in labour cost discouraged capital inflows. In contrast, Hale and Xu (2016) claimed that a higher wage rate will not deter FDI inflows if the host country has a skilled labour force.

The second theory under the imperfect market assumption was developed by Dunning (1977, 1979 and 1988) that is known as the eclectic theory or the OLI theory. According to Dunning's theory, there are three main groups of determinants of inward FDI, namely: OLI, where O stands for ownership, L stands for location

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[3] OECD is Organisation for Economic Cooperation and Development

and I stand for internalization. Ownership advantage is based on Hymer's firm-specific advantages which address the question of why some firms but not others go abroad, and suggest that a successful MNE has some firm-specific advantages which allow it to overcome the costs of operating in a foreign country. It includes a firm's superiority over its competitors in terms of marketing practices or on the technological front. Location advantages focus on the question of where an MNE chooses to locate. It determines the country-specific advantages, which a firm gain when investing abroad. Finally, internalization advantages influence how a firm chooses to operate autonomously in the foreign country rather than licensing them to another party.

In addition to OLI, there are several other institutional factors which also play an important role in determining inward FDI (Agarwal,1980; Lizondo, 1991 and Moosa, 2002). For instance, political risk, good governance, natural resources, tax policy, trade barriers, etc. Wang and Swain (1995) found that political stability of host nations had a positive impact on FDI. Schneider and Frey (1985) concluded that without considering the governing factors of the host nations the analysis of inward FDI will be incomplete. Furthermore, Campos and Kinoshita (2003) states that a part of inward FDI can be motivated by the availability of natural resources of the host country.

Finally, four main motives of inward FDI are presented in Table 1, which are not only the embodiment of the theories mentioned above, but also the model (Equation (1) in Sub-section 3.2) to be further tested in the later section (Section 4, Empirical results).

Table 1: Main motives of inward FDI

Inward FDI motives	Description
Market-seeking FDI	Invest in a host country market in order to be closer to customers and to serve that market directly rather than through exporting (horizontal FDI). Market-seeking investors will rate the attractiveness of a host country mostly with respect to its market size and demand potential. They basically aim to serve the local and regional markets, by practicing tariff-jumping or export-substituting.
Efficiency-seeking FDI	Enterprises try to exploit economies of specialization and scope across the value chain, and will slice its production chain by allocating different prats (or tasks) to countries that allow low-cost production (vertical fragmentation), particularly where the cost of labor is taken into account.
Asset-seeking FDI	Aims to get access to advanced technologies, skills and other highly developed productive capabilities. Asset-seeking investors value locations depending on the quality of scientific, technological, and educational infrastructure they provide and on the availability of a rich pool of highly skilled labor.
Resource-seeking FDI	In order to exploit natural resources or agricultural production in the host country

Source: Dunning (1977)

2.2. Empirical studies of inward FDI

Since inward FDI helps in promoting growth and employment and facilitating a strong balance of payments position there has been a sharp rise in worldwide FDI since the 1980s (Carp, L., 2012; Inekwe, 2014 and Table 1, Section 1). This development has spawned a rapidly growing literature studying the drivers of inward FDI. As discussed in the previous sub-section (2.1) above, the existing literature is vast and reports a variety of theoretical models and frameworks that attempt to explain inward FDI and the location decision of MNEs.

Empirically, there are three main approaches used so far. Firstly, some studies use micro level data to get a deeper understanding of the factors driving inward FDI decisions of MNEs. In the second approach, bilateral inward FDI flows between countries is examined, inspired by the gravity-type model. And the third approach looks at the aggregate inward FDI flows into a country or a panel of countries. The various approaches reflect the availability of data and the research focus but also reflect the absence of a consensus as to how to model FDI flows.

The specifications in the empirical studies have included a variety of variables to test the hypotheses elaborated in the theoretical literature reviewed in Section 2.1. However, certain variables are common to most of the studies. These include (openness, market growth and potential, natural endowments, etc.). The inclusion of the other variables is guided by data availability and the main objectives of the paper. While most empirical studies included conventional variables, the inclusion of the less conventional ones differs between the various studies depending on the specific focus of the research.

The variables included in the empirical models and the results obtained by 25 recent studies shown in Table 2 (in Appendix).

Variables such as openness and proxies for market size and growth (level of GDP and GDP growth, respectively) are common to virtually all the studies. The results are consistent with a priori expectations and support the hypothesis that inward FDI are positively associated with these variables. However, other macroeconomic variables are more sparsely included in the studies. Among these, of note, is the finding on the real exchange rate (REER) variable. Only 7 out of the 25 studies reviewed in Table 2 include the REER variable, and the results are mixed. In 5 of the studies, the coefficient on the REER is negative but not statistically significant, while in 2 others the coefficient is positive and statistically significant.

However, for some variables like, firing cost, trade and public debt are considered in very few empirical studies. Despite the emphasis placed on the resource-seeking hypothesis, it is found that the natural endowment variable is entered in only 7 out of 25 studies. Out of those 7 studies, 5 appears with the expected positive and

statistically significant sign in. When the measures of human capital, labour force and research and development were entered in the regression equations, all of them were positively related to FDI inflows.

3. Methodology

The variables that are considered in this study are in line with the theoretical considerations behind inward FDI and with the variables that appear in most empirical studies. However, because the data on certain variables are not uniformly available across countries or are not available consistently across time, the list of variables is limited. Due to issues with data availability, this paper had to forego the inclusion of some potentially relevant variables. For instance, labour force with tertiary education, political stability, air transport, etc. While it would have been desirable to include human capital and doing business indicators, but then many observations would have been lost. For example, the inclusion of labour force with tertiary education and doing business results in the number of valid observations falling from 2200 to 450 and 1500 to 222 respectively.

Table 3 describes the list of variables used in the econometric estimation, their source and expected sign.

Table 3: Description of variables

Variable	Description	Expected sign	Source
Dependent variable			
IFDI	Inflow of FDI (% of GDP)		World Development Indicator of World Bank
Independent variables			
OPEN	Trade openness index=(exports+imports)/GDP	+	World Development Indicator of World Bank
$GDPG_{(t-1)}$	GDP per capita growth (annual %) lagged by 1 year	+/-	World Development Indicator of World Bank
GDPP	GDP, PPP (constant 2011 international $)	+	World Development Indicator of World Bank
$REER_{(t-1)}$	Real Effective Exchange Rate index (2010=100) lagged by 1 year.	+/- (?)	International Monetary Fund
GFCF	Gross fixed capital formation (% of GDP)	+	World Development Indicator of World Bank
ORES	Ores and metals exports (% of merchandise exports)	+	World Development Indicator of World Bank
INFRA	Fixed telephone subscription (per 100 person)	+	World Development Indicator of World Bank

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Variable	Description	Ex-pected sign	Source
GOV	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	+/-	World Governance Indicator of World Bank

Source: Authors' compilation

The descriptive statistics and correlation matrix is presented in the Appendix (Table A1 and Tables A2 respectively). The sample is grouped into 4 different country groups (listed in Appendix Table A3), namely – advanced, emerging-market, developing and transition economies. The country groupings follow the classification by UNCTAD. However, UNCTAD's classification includes many emerging-market economies simultaneously as developing economies. These cases of emerging-market economies have been removed from the developing country group.

3.1. Econometric specification

Several regression equations are estimated for the entire sample and for each country group. The basic specification consistent with theory and hypotheses espoused in literature is shown below.

$$IFDI = \alpha + \beta_1\ OPEN + \beta_2\ GDPG_{(t-1)} + \beta_3\ GDPP + \beta_4\ REER_{(t-1)} +$$
$$+ \beta_4\ GFCF + \beta_5\ ORES + \beta_5\ INFRA\ + \beta_6\ GOV + \mu \tag{1}$$

Subsequently the analysis add to the basic specification in two important ways. It includes dummies for the four country groups and time dummies for crises periods. Then, estimate several regression equations for the entire sample, each country group and then examine if there is significant difference in the coefficients on the explanatory variables between different country groups, particularly between emerging-market and developing economies by considering the dummies representing the major economic crises.

The regression equations are estimated by the Ordinary Least Square (OLS) method, as has been done by 21 out of 25 studies reviewed earlier in Table 2. The remaining 4 studies used empirical methodologies like- 2SLS (wo-stage least square), ADRL (autoregressive distributed lag), Extreme Bound Analysis and Tobit for analysing the determinants of FDI. Moreover, as a means of robustness

check this paper includes time fixed-effects (FE) in the main regressions, including the dummies representing economic crises. Additionally, to deal endogeneity problem and to allow for the possibility of causation, this paper applies system generalized method of moments (GMM) as proposed by Arellano & Bover (1995) and Blundell-Bond (1998) building on Arellano-Bond (1991). This is also done to check for possible dynamic effects in the regressions, i.e. to see whether inward FDI is correlated with past observations. Compared to the baseline regression, this means adding the lagged dependent variable on the right-hand side.

4. Empirical data and analysis

This section presents the empirical results, where the first section (4.1) gives an overall view of the determinants of FDI inflows for the entire sample. The second section (4.2) reports the determinants of FDI inflows by the major country groups, followed by a comparison of the determinants of FDI inflows between emerging-market and developing economies in section 4.3. The last section (4.4) does a robustness check of main results with other empirical methods.

4.1. Determinants of inward FDI for the entire sample

Table 4 shows the determinants of inward FDI for the entire sample of countries that includes – advanced, emerging-market, developing and transition economies. The specification includes the standard macroeconomic variables discussed in the literature survey and four time dummies representing the economic crises periods (Asian crisis, Dotcom Bubble, Global Financial crisis and Sovereign Debt crisis), in order to allow for variations in the dynamics of FDI inflows over time.

Table 4, column 1 shows that inward FDI are positively related to OPEN, ORES (natural resource intensity) and INFRA. These findings are in line with expectations and with the findings of the existing literature. However, contrary to expectations, coefficients on $GDPG_{(t-1)}$ i.e. lagged GDP growth, GDPP (the market size variable) and the $REER_{(t-1)}$ i.e. lagged REER are not statistically significant.

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Table 4: Determinants of inward FDI for entire sample
Dependent variable: IFDI (the ratio of IFDI flow to GDP)

	1	2
	Full-sample[1]	Full-sample[2]
OPEN	0.0942***	0.0963***
	(0.0161)	(0.0172)
GDPG$_{(t-1)}$	-0.0158	-0.0224
	(0.0544)	(0.0554)
GDPP	$1.29e^{-7}$	$1.03e^{-7}$
	$(2.62e^{-7})$	$(2.60e^{-7})$
REER$_{(t-1)}$	0.00017	0.000175
	(0.00022)	(0.000215)
GFCF	0.0551	0.0599
	(0.0433)	(0.0401)
ORES	0.0508***	0.0494***
	(0.00959)	(0.00983)
INFRA	0.0772***	0.0457**
	(0.0248)	(0.0205)
GOV	-0.37	-0.53
	(0.342)	(0.396)
Country groups		
Advanced		0.967
		(1.138)
Emerging-market		-2.264***
		(0.681)
Developing		-1.161*
		(0.691)
Economic crisis		
Asian crisis (1997-1998)	-0.576	-0.569
	(0.421)	(0.425)
Dotcom Bubble (2001)	-0.916*	-0.831*
	(0.487)	(0.475)
Global Financial crisis (2007-2008)	3.017*	3.042*
	(1.718)	(1.72)
Sovereign Debt crisis (2011-2012)	1.121	1.078
	(1.125)	(1.111)
Constant	-6.739***	-5.525***
	(1.514)	(1.508)
Observations	2,669	2,669
R-squared	0.121	0.124
F-ratio	30.53	25.04
	(0.000)	(0.000)

[1] Full-sample without any country group dummy; [2] Full-sample with omitted country group as the transition economies; Figures in parentheses are robust standard errors.; ***, **, * are significant respectively to $p<0.01$, $p<0.05$, $p<0.1$; e=10

These results have to be treated with a degree of caution because the responsiveness of inward FDI flows are likely to be different for different groups of countries. So, the estimates of consolidated sample, might not be representative for country heterogeneity. Therefore, in an alternative specification, dummies for advanced, emerging-market and developing countries (considering transition economies as the omitted category) are included. Results show that the coefficients on emerging-market and developing economies are negative and statistically significant (see Table 4, column 2), suggesting that other things remaining the same, inward FDI flows are smaller to these countries groups relative to advanced and transition economies. The coefficient on the emerging-market dummy is more negative than the coefficient on developing economies indicating relatively weaker inflows to emerging-market economies compared to developing economies.

Now looking at the economic crises, there was a negative inflow of FDI during the Dotcom Bubble (2001) crisis while in case of Global Financial crisis (2007-2008) it experienced an increase in capital inflows.

4.2. Investigating the determinants of inward FDI by major country groups

Now as the determinants of FDI inflows by major country groups (see Table 5) are looked upon, the results are more profound. It is clear that OPEN is positively significant for advanced, emerging-market and developing economies as these country groups might have adopted policies that favour foreign trade, encouraging domestic producers to export, increasing their profitability and attracting foreign investors. Additionally, the market-growth (GDPG) has a positive impact on emerging-market and transition economies, which is in line with many previous studies (Kinda, 2010; Carp, L., 2012 and Kumari & Sharma, 2017). These economies offer more opportunities for higher profits to the foreign investors as they are at their growing stage. Surprisingly, the market-size determinant (GDPP) is negatively related to developing economics but positively significant in case of advanced economies. In support of the negative relation between GDPP and developing economies, Holland & Pain (1998) and Asiedu (2002) too found that market-size as insignificant determinants of FDI inflows. Again, the developing economies has a negative significant relationship between inward FDI and real exchange rate (REER) indicating that it receives smaller amount of FDI with a more appreciated lagged exchange rate. In this situation, the investors choose to produce domestically rather than investing abroad. In contrast, the REER have a positive impact on transition economies which states that as the currency depreciates, the purchasing power of the investors in foreign currency terms is enhanced, increasing the inflow of FDI to the transition economies. The negative and insignificant effect of GFCF makes it clear that the privatization and ownership changes do not affect GFCF of emerging-market economies which is in line with the findings of Lipsey (2000) and Krkoska (2001). On the other hand, the GFCF of developing and transition economies has a positive impact on FDI inflows.

It is also evident that FDI inflows of emerging-market and developing economies is largely driven by natural resources (ORES). In short, my results are consistent with the resource-seeking strategy (Dunning & Lundan, 2008). With respect to infrastructure, fixed telephone subscription per 100 inhabitants helps to build up the confidence of foreign investors and increase FDI inflows for three main country groups- advanced, emerging-market and developing economies which is similar to the findings of several extant studies (Asiedu, 2006 and Xaypanya et al., 2015).

Table 5: Determinants of inward FDI by major country groups
Dependent variable: IFDI (the ratio of IFDI flow to GDP)

	1	2	3	4
	Advanced	Emerging-market	Developing	Transition
OPEN	0.213***	0.0386***	0.0546***	0.00673
	(0.0558)	(0.00479)	(0.00599)	(0.017)
GDPG$_{(t-1)}$	-0.402	0.126***	0.0215	0.129*
	(0.306)	(0.0377)	(0.0325)	(0.0661)
GDPP	$4.91e^{-13}$**	$8.86e^{-14}$	$-2.43e^{-12}$***	$-3.17e^{-13}$
	$(2.28e^{-13})$	$(7.14e^{-14})$	$(9.08e^{-13})$	$(4.70e^{-13})$
REER$_{(t-1)}$	0.000429	-0.000132	-0.000140*	0.000375**
	(0.000615)	(0.000128)	$(7.99e^{-5})$	(0.000188)
GFCF	0.049	-0.0393	0.138***	0.436***
	(0.192)	(0.0321)	(0.0303)	(0.144)
ORES	-0.0304	0.0866***	0.0445***	-0.0343
	(0.135)	(0.0163)	(0.0094)	(0.0311)
INFRA	0.218**	0.0494***	0.0953***	-0.146***
	(0.0909)	(0.0134)	(0.018)	(0.0494)
GOV	-0.354	-0.00962	-0.227	-0.717
	(0.928)	(0.206)	(0.291)	(0.708)
Economic crisis				
Asian crisis (1997-1998)	-0.00242	0.25	-0.463	-0.682
	(1.52)	(0.342)	(0.421)	(1.374)
Dotcom Bubble (2001)	-0.364	-0.306	-0.619	-0.796
	(1.642)	(0.535)	(0.457)	(1.745)
Global Financial crisis (2007-2008)	8.717	2.010**	1.888***	0.657
	(6.669)	(1.016)	(0.492)	(1.394)
Sovereign Debt crisis (2011-2012)	2.358	-0.650*	1.066*	0.649
	(3.545)	(0.333)	(0.585)	(0.75)
Constant	-24.24**	-0.43	-4.292***	-3.828
	(9.89)	(0.621)	(0.814)	(3.868)
Observations	697	648	1,234	231
R-squared	0.16	0.364	0.419	0.34
F-ratio				

Figures in parentheses are robust standard errors.; ***, **, * are significant respectively to $p<0.01$, $p<0.05$, $p<0.1$; e=10

Global financial crisis (2007-2008) which originated in the advanced economies and caused a pronounced slowdown in the global economy had a positive significant impact on emerging- market and developing economies. In other words, during the crisis both these country groups attracted FDI inflows. There might be two main reasons behind this attractiveness to investors. First, due to large exchange rate depreciation the domestic production costs of foreign firms is reduced making the crisis-affected region more attractive for export-oriented investment. Second, the sudden fall of asset prices offer attractive buying opportunities to the foreign investors. In case of the Sovereign Debt crisis (2011-2012), which started in the Eurozone and later intensified by the Greek crisis affected the emerging-market economies the most. Emerging-market and developing economies were statistically significant throughout that period where OPEN, ORES and INFRA were the main determinants in attracting capital inflows. However, the inward FDI of emerging-market economies were negative during that crisis period. The developing economies attracted foreign investors may be due to their liberal regime (due to crisis and falling of asset prices), encouraging "fire-sale" FDI (leading to mergers and acquisitions).

4.3. Comparison of determinants of inward FDI between emerging-market and developing economies

Now when the estimates for emerging-market and developing economies (Table 6, column 1) are looked, it is found that inward FDI flows are more attracted to open (OPEN) economies with huge stock of physical assets (GFCF), good telecommunication service (INFRA) and natural resources (ORES). However, level of GDP which is traditionally proxy for market size appear with an unexpected negative sign, but statistically significant at 10% level. But the size of the coefficient suggest that the impact is small. This finding could be interpreted that FDI flows go to destinations with less growth and lower level of GDP because the returns may be higher. Also, a negative significant relationship between inward FDI and real exchange rate (REER) is found, indicating that inward FDI are smaller in countries with a more appreciated lagged exchange rate. Feenstra (1998) also obtained a similar result and noted that this could be suggestive that host country appreciation reduces the wealth of foreign investors and will reduce investments. In addition, inward FDI which are governed by locational advantages that serves as a springboard for markets for exports to developing countries will be deterred by exchange rate appreciation in the host country because it makes exports more expensive.

It is of interest to determine whether there is a significant difference in the coefficients on the other explanatory variables between emerging-market and developing economies. It is performed in two alternative ways. First, the test for the equality of all the coefficients for emerging-market and developing

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economies by conducting Chow test for equality of coefficients (this is the test of homogeneity of the FDI equations for emerging-market and developing countries). The second method, estimates a regression equation for the combined sample of emerging-market and developing countries with the same explanatory variables but with the addition of a set of intercept and slope dummy variables representing the products of each of the independent variables and the dummy variable for emerging-market economies. In this specification, the focus is on the interaction terms to determine which of the particular variables are different between the two country groups.

For the Chow test the computed F-ratio is given by:

$$\frac{\{RSS_{EMER+DEVG} - (RSS_{EMER} + RSS_{DEVG})\}/K}{(RSS_{EMER} + RSS_{DEVG})/(N_{EMER} + N_{DEVG} - 2K)} \qquad (2)$$

where, K is the number of independent variables including the constant term, N is the number of observations and RSS is the residual sum of squares.

The Chow test yields an F-ratio of 10.353 (critical value: $F_{0.01} = 2.77$): the FDI equation for the two country groups are significantly different at the 1% level.

When the equation with interaction terms (see Table 6, column 4) is observed, it is found that the coefficients on corruption index (GOV) for emerging-market economies are not significantly different from comparable coefficients for developing country group. The coefficients on openness (OPEN), GFCF, natural endowments ORES and the time dummy representing Global Financial crisis (2007-2008) for emerging-market economies are statistically significant and negative compared to those for developing economies. In other words, for a given degree of openness, inward FDI is lower for emerging-market economies compared to developing countries, GFCF and ORES matters less for inward FDI flows to emerging-market economies compared to developing economies and other things remaining the same, emerging-market economies experienced a smaller flow of FDI during Global Financial crisis compared to developing economies.

Table 6: Contrasting determinants of inward FDI for emerging-market and developing economies
Dependent variable: IFDI (the ratio of IFDI flow to GDP)

	1	2	3	4
	Emerging-market & developing	Emerging-market	Developing	Interaction with emerging-market
OPEN	0.0458***	0.0386***	0.0546***	-0.0160***
	(0.00231)	(0.00305)	(0.00339)	(0.00479)
$GDPG_{(t-1)}$	0.043	0.126***	0.0215	0.104*
	(0.0279)	(0.04)	(0.0361)	(0.0579)
GDPP	$-3.04e^{-13}$ ***	$8.86e^{-14}$	$-2.43e^{-12}$**	$2.53e^{12}$***
	$(9.20e^{-14})$	$(9.87e^{-14})$	$(9.98e^{-13})$	$(9.40e^{-13})$
$REER_{(t-1)}$	-0.000158**	-0.000132	-0.000140*	$7.93e^{-6}$
	$(6.64e^{-5})$	(0.000103)	$(8.30e^{-5})$	(0.000144)
GFCF	0.122***	-0.0393	0.138***	-0.178***
	(0.0154)	(0.0329)	(0.0178)	(0.0422)
ORES	0.0638***	0.0494***	0.0953***	-0.0460*
	(0.0111)	(0.0149)	(0.0176)	(0.024)
INFRA	0.0560***	0.0866***	0.0445***	0.0421**
	(0.00715)	(0.0129)	(0.00857)	(0.0172)
GOV	-0.0576	-0.00962	-0.227	0.218
	(0.183)	(0.239)	(0.272)	(0.379)
Economic crisis				
Asian crisis (1997-1998)	-0.369	0.25	-0.463	0.774
	(0.381)	(0.524)	(0.5)	(0.313)
Dotcom Bubble (2001)	-0.413	-0.306	-0.619	0.982
	(0.475)	(0.681)	(0.607)	(0.123)
Global Financial crisis (2007-2008)	1.941***	2.010***	1.888***	-1.717**
	(0.357)	(0.509)	(0.455)	(0.735)
Sovereign Debt crisis (2011-2012)	0.542	-0.65	1.066**	0.749
	(0.359)	(0.522)	(0.457)	(0.427)
Constant	-3.390***	-0.43	-4.292***	-4.292***
	(0.461)	(0.786)	(0.571)	(0.534)
Observations	1,882	648	1,234	1,882
R-squared	0.37	0.364	0.419	0.41
F-ratio	91.66	30.25	73.32	51.61
	(0.000)	(0.000)	(0.000)	(0.000)
RSS	39161.5822	9051.85674	27646.3892	36697.4059

Figures in parentheses are standard errors.; ***, **, * are significant respectively to $p<0.01$, $p<0.05$, $p<0.1$; e=10

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In contrast, the regression result indicates the economic growth (GDPG) and market size (GDPP) have a stronger positive influence on inward FDI flow to emerging-market than to developing economies.

4.4. Robustness checks

Later on, FE and system GMM estimations are performed as a robustness check which also adds to the existing literature. For the system GMM to be valid, it is essential that its preconditions are met, as otherwise instrumental variable (IV) regression is actually preferable. With a view to testing whether GMM is actually more desirable then IV, this paper will need to see whether estimating a dynamic model is justified (i.e. is the lagged dependent variable significant) and whether heteroskedasticity is present. In this case, the GMM estimator is more efficient than the simple IV estimator. By contrast, if heteroskedasticity is not present, the GMM estimator is no worse asymptotically than the IV estimator. In case of homoscedasticity and if the lagged dependent variable is not significant then, simple IV regressions is used. However, for this approach, this paper will need to ensure that two assumptions are satisfied. First, relevant instruments would need to be distributed independently of the error process, and second, they would need to be sufficiently correlated with the included endogenous regressors.

The robustness check results are reported in Appendix B which validates the baseline findings.

5. Results and discussion

The results are in line with earlier studies of the literature. Inflows are positively influenced by openness, market growth and potential and are also attracted to destinations that are resource-rich having adequate infrastructure. In addition, the likelihood of inward FDI flows increases for countries with the depreciation of the real exchange rate.

Within this pattern of results that apply qualitatively for all country groups, it is observed that the sensitivity of inward FDI flows by various variables are different for advanced, emerging-market, developing and transition economies. Notably, the openness factor is stronger for developing than for emerging-market economies. Whereas, growth and potential of GDP are more significant for emerging-market economies. It is also notable that the sensitivity of inflows to quality of governance is not significantly different between emerging-market and developing economies. The results confirm the increasing importance of good INFRA for inward FDI flows to advanced economies whereas for emerging-market and developing economies the importance of this variable was strongest during the period of Global Financial crisis (2007-2008).

Such results highlight the prominence of governmental actions over improving the investment environment, in particular the importance of investing in infrastructure, improving the quality of institutions (by controlling corruption and enforcing contracts and property rights), and promoting policies to open/ liberalise the economy (by adopting export-oriented policies and eliminating/lowering taxes on corporate profits).

6. Conclusion

FDI flows have increased manifold in the last two decades. Increasingly these flows have shifted towards emerging-market and developing economies. In view of the potential beneficial effects of FDI for both the home and host countries, researchers have devoted considerable attention in analysing the determinants of inward FDI flows.

This paper sheds light on the determinants of inward FDI flows across a very large group of countries – advanced, emerging-market, developing and transition economies over a time period that spans the Asian crisis, Dotcom Bubble, Global Financial crisis and Sovereign Debt crisis. The focus is on the traditional variables such as- openness, market growth and size, competitiveness, capital and resource endowments, physical infrastructure and governance. However, lack of data on certain variables uniformly across countries have precluded from inclusion of wider range of explanatory variables.

The results of the estimation should be treated with caution as it is based on aggregate inward FDI flows and not on bilateral inward FDI flows (since suitable data on bilateral inward FDI flows is available only for a few developing countries and years). Further research could be devoted to examining the relevance of these factors at the bilateral and firm levels (that extends beyond the case of an individual country) and also examine the role played by various domestic regulatory and institutional bottlenecks that might attract inward FDI flows.

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Odrednice izravnih stranih ulaganja: Usporedba različitih skupina zemalja

Minakshee Das[1,2]

Sažetak

U ovom radu analiziraju se čimbenici koji određuju izravna strana ulaganja, posebice uloga prirodnih resursa, te gospodarskih i političkih karakteristika zemlje domaćina. Istraživanje se proširuje na postojeću literaturu usredotočujući se na četiri široke skupine zemalja: napredne, tržišta u nastajanju, zemlje u razvoju i tranzicijska gospodarstva, a panel podataka za razdoblje od 1996. do 2016. godine uključuje više od 100 zemalja. U radu se također istražuje scenarij tijekom velikih ekonomskih kriza – azijske krize, Dotcom Bubble, globalne financijske krize i krize državnog duga. Rezultati pokazuju da se s vremenom odrednice ulaznih izravnih stranih ulaganja mijenjaju i da obrasci nisu ujednačeni u četiri skupine zemalja. Nadalje, u radu se uspoređuju odrednice dviju glavnih skupine zemalja, a to su: tržište u nastajanju i zemlje u razvoju provođenjem Chow testa uz jednake koeficijente. Vidljivo je da gospodarski rast i veličina tržišta imaju snažniji pozitivni utjecaj na priljev izravnih stranih ulaganja na tržišta u nastajanju nego na gospodarstva u razvoju. Također, gospodarstva s tržištima u nastajanju su tijekom globalne financijske krize doživjela manji priljev izravnih stranih ulaganja u usporedbi s gospodarstvima u razvoju. Ovi rezultati imaju važne implikacije za donositelje politika jer mogu pomoći u prepoznavanju regionalnih čimbenika koji privlače priljev kapitala.

Ključne riječi: *izravna strana ulaganja, multinacionalne kompanije, odrednice, panel podaci*

JEL klasifikacija: *F21, F23, O57*

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Appendices

Table 2: Summary of results of selected empirical studies

		1	2	3	4	5
Authors		Dellis, Sondermann & Vansteenkiste	Stack, Ravishankar & Pentecost	Aziz	Shan, Lin, Li & Zeng	Kumari & Sharma
Year of publication		2017	2017	2017	2017	2017
Sample description						
Country coverage		Advanced economies	10 Eastern European countries	10 Arab countries	22 African countries	20 developing countries
Period coverage		2005–2014	1996–2007	1984–2012	2008–2014	1990–2012
Dependent variable[4]		FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP
Independent variables	No. of studies that have included					
FDI stock	1/25		+(sig)			
Openness	25/25	+(sig)	+(sig)	+(sig)	+ (sig)	+ (sig)
Market growth (proxied by GDP growth)	16/25		+(sig)	+(sig)		+ (sig)
Market Size (proxied by GDP PPP)	14/25	+(sig)		+(sig)	+ (sig)	
Gross Fixed Capital Formation			+(sig)	+ (sig)		
Inflation Rate	8/25			-(not-sig)	-(not-sig)	-(not-sig)
Real Interest Rate	10/25					
Real Exchange Rate	7/25			+(sig)		
Domestic Investment	10/25					
Labor Force	6/25					
Unemployment	5/25					-(not-sig)
Labor cost	5/25	-(not-sig)	+(sig)			+ (sig)
Firing cost	7/25					+ (sig)
Corporate Tax Rate	7/25	-(not-sig)	-(not-sig)			
Corruption	6/25		+(sig)			-(not-sig)
Natural endowments	7/25			-(not-sig)	+(sig)	
Human capital	11/25			+ (sig)		
Infrastructure	13/25		+(sig)	-(not-sig)	+(sig)	-(not-sig)
Political Stability	13/25	+(sig)	-(not-sig)	+(sig)	-(not-sig)	
Public Debt	8/25			+(sig)		+(sig)
R&D	4/25					
Methodology		OLS, System GMM, 2SLS[5]	OLS	OLS, System GMM	OLS	OLS
Fixed Effects (FE)		No	Yes	No	Yes	Yes
Random Effects (RE)		Yes	No	No	No	Yes

Note: The '+ (sig)' means the coefficient is positive and significant at the 10% level;
The '-(not-sig)' means the coefficient is negative and not statistically significant

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[4] All dependent variables (FDI/GDP) in Table 2 are in flows and not in stock

[5] 2SLS is two-stage least square

Authors		6	7	8	9	10
		Akther & Akter	Teixeiraa, Fortea & Assunçãoa	Ahmad, Ismail & Nordin	Kaliappana, Khamis & Ismail	Hunady & Ovriska
Year of publication		2016	2016	2015	2015	2014
Sample description						
Country coverage		Bangladesh	125 countries	Malaysia	ASEAN	EU-15
Period coverage		2005–2015	1995–2012	1980–2013	2000–2010	2004–2011
Dependent variable		FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP
Independent variables	No. of studies that have included					
FDI stock	1/25					
Openness	25/25	+(sig)	+(sig)	+(sig)	+(sig)	+(sig)
Market growth (proxied by GDP growth)	16/25		+ (sig)			+ (sig)
Market Size (proxied by GDP PPP)	14/25	+(sig)	-(not-sig)	+(sig)	+(sig)	
Gross Fixed Capital Formation			+(sig)			
Inflation Rate	8/25	+(sig)	-(not-sig)		-(not-sig)	-(not-sig)
Real Interest Rate	10/25	+(sig)				
Real Exchange Rate	7/25	+(sig)		+(sig)		
Domestic Investment	10/25	-(not-sig)				
Labor Force	6/25	+(sig)				
Unemployment	5/25		+(sig)			-(not-sig)
Labor cost	5/25					+(sig)
Firing cost	7/25					+(sig)
Corporate Tax Rate	7/25	-(not-sig)	+(sig)			
Corruption	6/25		(sig)			-(not-sig)
Natural endowments	7/25		+(sig)			
Human capital	11/25		+(sig)		+(sig)	
Infrastructure	13/25		-(not-sig)	-(non-sig)	+(sig)	-(not-sig)
Political Stability	13/25		-(not-sig)			
Public Debt	8/25					+(sig)
R&D	4/25					
Methodology		OLS	OLS	ADRL[6]	OLS	OLS
Fixed Effect (FE)		No	Yes	No	Yes	Yes
Random Effect (RE)		No	No	No	Yes	No

Note: The '+ (sig)' means the coefficient is positive and significant at the 10% level;
The '-(not-sig)' means the coefficient is negative and not statistically significant

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[6]   ADRL is autoregressive distributed lag

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		11	12	13	14	15
Authors		Tang, Yip & Ozturk	Tintin	Liu, Daly & Varua	Buchanan, Le & Rishi	Castiglione, Gorbunova, Infante & Smirnova
Year of publication		2014	2013	2013	2012	2012
Sample description						
Country coverage		Malaysia	CEEC	China	164 countries	Russia
Period coverage		1980–2008	1996–2009	2001–2009	1996–2006	1996–2006
Dependent variable		FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP
Independent variables	No. of studies that have included					
FDI stock	1/25					
Openness	25/25	+(sig)	+(sig)	-(not-sig)	+(sig)	+(sig)
Market growth (proxied by GDP growth)	16/25	+(sig)	+(sig)	+ (sig)	-(not-sig)	
Market Size (proxied by GDP PPP)	14/25		+(sig)			
Gross Fixed Capital Formation			+(sig)		+(sig)	
Inflation Rate	8/25	-(not-sig)				
Real Interest Rate	10/25		-(sig)	+(sig)		
Real Exchange Rate	7/25	+(sig)				
Domestic Investment	10/25	-(not-sig)	-(not-sig)		+(sig)	
Labor Force	6/25			+(sig)		+(sig)
Unemployment	5/25					
Labor cost	5/25		-(sig)	+(sig)		
Firing cost	7/25					
Corporate Tax Rate	7/25		-(not-sig)			
Corruption	6/25				+(sig)	
Natural endowments	7/25					+(sig)
Human capital	11/25					+(sig)
Infrastructure	13/25	-(not-sig)		-(not-sig)		+(sig)
Political Stability	13/25		+(sig)			-(not-sig)
Public Debt	8/25					
R&D	4/25	+(sig)	+(sig)			
Methodology		OLS, ADRL	OLS	OLS	OLS, IV	OLS, GMM
Fixed Effect (FE)		No	No	No	Yes	No
Random Effect (RE)		No	No	No	Yes	No

Note: The '+(sig)' means the coefficient is positive and significant at the 10% level;
The '-(not-sig)' means the coefficient is negative and not statistically significant

		16	17	18	19	20
Authors		Anwara & Nguyenb	Cuyvers, Soeng, Plasmans & Bulcke	Vijayakumar, Sridharan & Rao	Kinda	Demirhan & Masca
Year of publication		2011	2011	2010	2010	2008
Sample description						
Country coverage		Vietnam	Cambodia	BRICS	77 developing countries	38 developing countries
Period coverage		1990–2007	1995–2005	1975–2007	1996–2006	2000–2004
Dependent variable		FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP
Independent variables	No. of studies that have included					
FDI stock	1/25					
Openness	25/25	+(sig)	+(sig)	+(sig)	+(sig)	+(sig)
Market growth (proxied by GDP growth)	16/25	+(sig)	+(sig)	+(sig)		
Market Size (proxied by GDP PPP)	14/25		+(sig)		+(sig)	+(sig)
Gross Fixed Capital Formation			+ (sig)			+ (sig)
Inflation Rate	8/25			-(not-sig)		
Real Interest Rate	10/25					-(not-sig)
Real Exchange Rate	7/25	-(not-sig)	-(not-sig)	-(not-sig)		
Domestic Investment	10/25			+(sig)		
Labor Force	6/25					
Unemployment	5/25				-(not-sig)	
Labor cost	5/25			-(not-sig)		
Firing cost	7/25					+(sig)
Corporate Tax Rate	7/25	-(not-sig)				
Corruption	6/25			+(sig)		
Natural endowments	7/25	-(not-sig)			+(sig)	+(sig)
Human capital	11/25	+(sig)	+(sig)	+(sig)	+(sig)	
Infrastructure	13/25				+(sig)	
Political Stability	13/25		-(not-sig)	-(not-sig)	-(not-sig)	-(not-sig)
Public Debt	8/25		-(not-sig)	-(not-sig)		
R&D	4/25					+(sig)
Methodology		OLS	OLS	OLS	2SLS	OLS
Fixed Effect (FE)		No	No	Yes	Yes	No
Random Effect (RE)		Yes	No	Yes	No	No

Note: The '+(sig)' means the coefficient is positive and significant at the 10% level;
    The '-(not-sig)' means the coefficient is negative and not statistically significant

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Authors		21 Moosa & Cardak	22 Bevan & Estrin	23 Sun, Tong & Yu	24 Chenga, & Kwan	25 Kimura & Lee
Year of publication		2006	2004	2002	2000	1998
Sample description						
Country coverage		138 countries	EU	China	China	Korea
Period coverage		1994–2005	1991–2001	1986–1998	1985–1995	1981–1995
Dependent variable		FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP	FDI/GDP
Independent variables	No. of studies that have included					
FDI stock	1/25					
Openness	25/25	+(sig)	+(sig)	+(sig)	+(sig)	+(sig)
Market growth (proxied by GDP growth)	16/25		-(not-sig)	+(sig)	+(sig)	+(sig)
Market Size (proxied by GDP PPP)	14/25	-(not-sig)	+(sig)			+(sig)
Gross Fixed Capital Formation				+ (sig)		
Inflation Rate	8/25	+(sig)				
Real Interest Rate	10/25		+(sig)	-(not-sig)	+(sig)	
Real Exchange Rate	7/25		+(sig)		-(not-sig)	-(not-sig)
Domestic Investment	10/25			-(not-sig)		
Labor Force	6/25	+(sig)		+(sig)		
Unemployment	5/25				-(not-sig)	
Labor cost	5/25					
Firing cost	7/25					
Corporate Tax Rate	7/25	-(not-sig)				
Corruption	6/25					
Natural endowments	7/25					
Human capital	11/25	+(sig)		+(sig)	+(sig)	
Infrastructure	13/25		+(sig)			
Political Stability	13/25			+(sig)		-(not-sig)
Public Debt	8/25	-(not-sig)	-(not-sig)	-(not-sig)		-(not-sig)
R&D	4/25					+(sig)
Methodology		Extreme Bound Analysis	OLS	OLS, GLS	OLS, GMM	Tobit
Fixed Effect (FE)		No	No	Yes	No	No
Random effect (RE)		No	Yes	No	No	No

Note: The '+(sig)' means the coefficient is positive and significant at the 10% level; The '-(not-sig)' means the coefficient is negative and not statistically significant

Source: Authors' compilation

A. Description of the dataset

Table A1: Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
IFDI	8,711	3.385762	11.97421	-82.8921	466.5622
OPEN	13,200	53.45661	53.11015	0	531.7374
$GDPG_{(t-1)}$	10,063	2.086261	5.782488	-64.99726	141.6418
GDPP	5,978	$2.73e^{12}$	$8.56e^{12}$	$2.13e^{10}$	$1.08e^{14}$
$REER_{(t-1)}$	5,221	2465.133	1503.353	1	5038
GFCF	8,612	22.581	9.040297	-2.424358	219.0694
ORES	7,507	7.847904	14.16915	0	99.0677
INFRA	10,128	15.44875	18.32691	0	132.9533
GOV	3,914	0.4166123	28.23524	-2.574585	1765.154

Table A2: Correlation matrix

	IFDI	OPEN	$GDPG_{(t-1)}$	GDPP	$REER_{(t-1)}$	GFCF	INFRA	ORES	GOV
IFDI	1.000								
	(8711)								
OPEN	0.2714*	1.000							
	0.000								
	(8711)	(13200)							
$GDPG_{(t-1)}$	0.0940*	0.0982*	1.000						
	0.000	0.000							
	(8353)	(10063)	(10063)						
GDPP	-0.0462*	-0.1493*	0.0237	1.000					
	0.0005	0.000	0.0696						
	(5723)	(5978)	(5888)	(5978)					
$REER_{(t-1)}$	0.0141	0.0328*	0.0412*	-0.0336*	1.000				
	0.3269	0.0177	0.0033	0.0254					
	(4866)	(5221)	(5100)	(4423)	(5221)				
GFCF	0.1815*	0.3071*	0.3048*	0.0769*	0.0003	1.000			
	0.000	0.000	0.000	0.000	0.9858				
	(7630)	(8612)	(8332)	(5428)	(4572)	(8612)			
INFRA	0.1243*	0.1059*	0.0272*	0.1304*	0.0056	0.0581*	1.000		
	0.000	0.000	0.0111	0.000	0.6911	0.000			
	(8169)	(10128)	(8694)	(5901)	(4986)	(7779)	(10128)		
ORES	0.0077	-0.0364*	-0.0507*	-0.0831*	0.0061	-0.0643*	-0.1645*	1.000	
	0.5376	0.0016	0.000	0.000	0.7073	0.000	0.000		
	(6447)	(7507)	(6948)	(4497)	(3815)	(6465)	(6515)	(7507)	
GOV	0.0014	-0.0152	0.0145	0.0013	-0.0147	0.0646*	0.0133	-0.0132	1.000
	0.9343	0.3432	0.3738	0.9386	0.3791	0.0002	0.4093	0.4718	
	(3666)	(3914)	(3762)	(3721)	(3584)	(3410)	(3859)	(2984)	(3914)

Figures in parentheses are number of observation.; * are significant at $p<0.05$

Table A3: List of country groupings

Advanced economies		
1. America	Canada, United States	
2. Asia	Israel, Japan	
3. Europe	Austria, Belgium, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom	
4. Oceania	Australia, New Zealand	
Emerging-market economies		
1. Africa	Egypt, Nigeria & South Africa	
2. America	Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Venezuela	
3. Asia	China, Korea, India, Indonesia, Malaysia, Philippines, Singapore, Thailand	
4. Middle-East	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Turkey, United Arab Emirates	
5. Europe	Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Russian Federation	
Developing economies		
1. Africa	Eastern Africa	Burundi, Djibouti, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Somalia, Uganda, United Republic of, Tanzania, Zambia, Zimbabwe
	Middle Africa	Angola, Cameroon, Central African Republic, Chad, Congo, Dem. Rep. of the Congo, Gabon
	Northern Africa	Algeria, Libya, Morocco, Sudan, Tunisia
	South Africa	Botswana, Lesotho, Namibia
	Western Africa	Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Senegal, Sierra Leone & Togo
2. America	Caribbean	Antigua and Barbuda, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Trinidad and Tobago
	Central America	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua
3. Asia	Eastern	Mongolia
	Southern	Afghanistan, Bangladesh, Bhutan, Iran (Islamic Republic of), Maldives, Nepal, Pakistan, Sri Lanka
	South-Eastern	Cambodia, Lao People's Dem. Rep., Myanmar, Viet Nam
	Western Asia	Iraq, Jordan, Lebanon, Yemen
4. Oceania	Fiji, Guam, Kiribati, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu,	
Transition economies	Albania, Armenia, Azerbaijan, Bosnia & Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Montenegro, Moldova, Serbia, Tajikistan, Macedonia, Turkmenistan, Ukraine, Uzbekistan	

Sample include developed countries, emerging-market economies, developing countries and transition economies. Groupings follow the classification by UNCTAD. However, countries classified as emerging-market economies have been removed from developing country group if they also appear there.

B. Additional empirical results

Table B1: Determinants of inward FDI- full sample
              Dependent variable: IFDI (the ratio of IFDI flow to GDP)

	FE	System GMM
IFDI$_{(t-1)}$		0.440**
		(0.188)
OPEN	0.0397	0.132*
	(0.0253)	(0.0697)
GDPG$_{(t-1)}$	-0.0709	-0.176
	(0.0836)	(0.129)
GDPP	-1.18e^{-10}***	-1.46e^{-5}*
	(3.09e^{-7})	(1.48e^{-6})
REER$_{(t-1)}$	-4.70e^{-5}	-0.000754
	(0.000238)	(0.00588)
GFCF	0.221***	0.836
	(0.0686)	(0.815)
ORES	0.00138	-0.0019
	(0.0503)	(0.269)
INFRA	0.0449	0.00176
	(0.0325)	(0.276)
GOV	2.636	5.853
	(2.471)	(5.603)
Economic crisis		
Asian crisis (1997-1998)	-0.983	-0.908
	(0.745)	(1.605)
Dotcom Bubble (2001)	-0.716	-1.142
	(0.607)	(1.712)
Global Financial crisis (2007-2008)	3.270*	1.286
	(1.919)	(4.717)
Sovereign Debt crisis (2011-2012)	1.31	2.468
	(0.803)	(4.73)
Constant	-3.489	-15.2
	(2.597)	(25.3)
Observations	2,669	2,658
R-squared	0.021	
Number of countries	162	162

Figures in parentheses are robust standard errors.; ***, **. * are significant respectively to p<0.01, p<0.05, p<0.1; e=10

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Table B2: Determinants of inward FDI at the time of major economic crises – FE
Dependent variable: IFDI (the ratio of IFDI flow to GDP)

	Advanced	Emerging-market	Developing	Transition
OPEN	-0.0806	0.0234**	0.0547***	0.104*
	(0.102)	(0.0109)	(0.0188)	(0.0489)
GDPG$_{(t-1)}$	-0.645	0.0644**	0.011	0.0279
	(0.658)	(0.027)	(0.0451)	(0.0422)
GDPP	$2.36e^{-11}$	$2.36e^{-11}$	$2.36e^{-11}$	$2.36e^{-11}$
	$(1.86e^{-11})$	$(1.86e^{-11})$	$(1.86e^{-11})$	$(1.86e^{-11})$
REER$_{(t-1)}$	$2.86e^{-5}$	-0.000176	$-9.10e^{-5}$	0.000151
	(0.000957)	(0.000157)	$(8.25e^{-5})$	(0.000162)
GFCF	0.0417	0.0192	0.193***	0.548*
	(0.363)	(0.0514)	(0.0631)	(0.27)
ORES	0.0741	0.0423	-0.00579	-0.133
	(0.0677)	(0.0533)	(0.0549)	(0.129)
INFRA	-0.0256	0.184	0.0288	-0.0375
	(0.363)	(0.131)	(0.0219)	(0.0313)
GOV	12.05	0.808	-0.1	-0.0841
	(11.73)	(0.526)	(0.445)	(1.255)
Economic crisis				
Asian crisis (1997-1998)	-3.133	0.0675	-0.172	1.731
	(2.325)	(0.405)	(0.348)	(1.073)
Dotcom Bubble (2001)	-1.294	-0.0169	-0.463	0.668
	(1.801)	(0.355)	(0.309)	(1.312)
Global Financial crisis (2007-2008)	11.56	2.18	1.630***	-0.000392
	(9.065)	(1.463)	(0.43)	(1.678)
Sovereign Debt crisis (2011-2012)	5.950*	-0.605	0.987*	-0.564
	(3.407)	(0.417)	(0.524)	(0.594)
Constant	-3.611	-0.53	-4.933**	-14.71*
	(13.71)	(2.536)	(2.223)	(7.833)
Observations	697	648	1,234	231
R-squared	0.035	0.106	0.199	0.473
Number of countries	36	35	84	15

Figures in parentheses are robust standard errors.; ***, **. * are significant respectively to p<0.01, p<0.05, p<0.1; e=10

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Table B3: Determinants of inward FDI at the time of major economic crises-
System GMM
Dependent variable: IFDI (the ratio of IFDI flow to GDP)

	Advanced	Emerging-market	Developing	Transition
IFDI$_{(t-1)}$	0.499***	0.223*	-0.174*	0.523***
	(0.182)	(0.121)	(0.102)	(0.0998)
OPEN	0.178***	0.0307**	0.140***	0.0595**
	(0.0582)	(0.0144)	(0.0219)	(0.0227)
GDPG$_{(t-1)}$	-0.66	0.13	-0.0930*	-0.0212
	(0.867)	(0.101)	(0.0548)	(0.0419)
GDPP	2.36e^{-11}	2.36e^{-11}	2.36e^{-11}	2.36e^{-11}
	(1.86e^{-11})	(1.86e^{-11})	(1.86e^{-11})	(1.86e^{-11})
REER$_{(t-1)}$	-0.00193	0.000289	-2.83E-05	0.000337
	(0.00564)	(0.000448)	(0.000715)	(0.000456)
GFCF	1.808	-0.214	0.440**	0.432*
	(1.555)	(0.198)	(0.187)	(0.232)
ORES	-0.543	0.235**	0.0408	0.028
	(0.822)	(0.114)	(0.053)	(0.0811)
INFRA	0.233	0.0235	-0.0154	-0.0646
	(0.711)	(0.116)	(0.173)	(0.105)
GOV	5.557	1.313	-0.0643	-0.962
	(11.71)	(1.215)	(2.387)	(1.275)
Economic crisis				
Asian crisis (1997-1998)	0.318	0.325	0.274	2.759***
	(2.628)	(0.716)	(1.136)	(0.903)
Dotcom Bubble (2001)	-1.334	-0.262	-0.127	1.441
	(1.303)	(0.605)	(0.918)	(1.506)
Global Financial crisis (2007-2008)	-2.907	2.709	1.916***	-0.384
	(5.949)	(1.786)	(0.686)	(0.834)
Sovereign Debt crisis (2011-2012)	4.392	0.0635	0.616	-0.7
	(9.197)	(0.977)	(1.364)	(0.851)
Constant	-54.25**	1.988	-16.07***	-13.73**
	(25.2)	(4.283)	(4.874)	(5.494)
Observations	694	648	1,227	230
Number of countries	36	35	84	15

Figures in parentheses are robust standard errors.; ***, **. * are significant respectively to p<0.01, p<0.05, p<0.1; e=10

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Capital controls to manage foreign exchange reserves and foreign debts[*]

Chokri Zehri[1]

Abstract

The study explores the relationship between foreign exchange reserves (FER) and foreign borrowing (FB) within the framework of the management of capital flows. To investigate this relationship and examine the effect of capital control on foreign exchange reserves and external debt of two approaches are applied, the panel vector autoregression model (PVAR) and a traditional model of the reserve demand for 25 emerging countries over the period 1985-2019. The results show a negative association between FER and FB; the direction of the causality was from debts to reserves. Capital controls, as an instrument to reduce the short-term inflows, fail to restrict the accumulation of exchange reserves and conversely, succeed in limiting the recourse to foreign borrowing. Net foreign assets replacing foreign exchange reserves highlights different impacts of capital controls and raise the issue on a correct evaluation of foreign exchange reserves.

Key words: *capital controls, debts, reserves, foreign assets*

JEL classification: *f32, f36, f37*

1. Introduction

By considering the domestic outputs, the rise in foreign exchange reserves (FER) is now a recent discussion by financial policymakers. Moreover, the high volume of FER in emerging economies is supposed to have affected real interest rates, current account, and exchange rates (Aizenman and Jinjarak, 2019). According to Kharusi and Ada, (2018) FER are accumulated as a guarantee opposing the spillover risk of financial instability. Frequently, financial unbalances have a slight impact on

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economies with a large stock of FED. Many countries, such as China, Hong Kong, Taiwan, and Singapore, have accumulated reserves, and all seemed to be relatively unharmed (Obstfeld et al., 2010). The accumulation of such reserves is achieved through a positive trade surplus and a large save of foreign currencies.

Likewise, the foreign borrowing (FB) increased at high levels for emerging economies, notably, for Asian and Latin American economies (Figure 1). The rise in FB is caused by the incentives created by the capital account openness that ease access to external funding (Aizenman, Jinjarak, and Park, 2015). Several reasons for this exorbitant progress are suggested as implications of financial openness. Developing economies approved this process and were decreased with the 2008 crisis by the adoption of capital controls particularly in the short term.

The analysis applies a panel of 25 emerging countries experienced with capital controls for the period 1985-2019. Table 1-A in appendix displays the list of these countries which are defined as emergent according to the IMF classification.

On the first hand, the study contributes to previous studies by employing a recent approach based on a panel VAR regression (Abrigo and Love, 2016). This approach allows using jointly panel data with VARs. A vast literature has focused on the explanation of foreign exchange reserves by foreign borrowing, but, surprisingly, few studies examine the reverse relationship that explains foreign borrowing by reserves.

On the second hand, the study examines the impact of restrictive policies using capital controls on FER and FB (Eichengreen and Mody, 1999). As a response to the detrimental effects of capital account openness, emergent economies have reintroduced capital controls to limit the short-term capital inflows (Magud, Reinhart, and Kenneth, 2018; Farhi and Werning, 2014; Zehri and Abdelkarim, 2020). An optimal combination between reserves accumulation, external debts, and restrictive policies on capital flows is considered crucial to the financial system stability (Aizenman et al., 2006; Jeanne and Ranciere, 2006). The empirical evidence suggests that capital controls may be an obstacle to the accumulation of exchange reserves when it reduces capital flow movements (Farhi and Werning, 2014). Similarly, capital controls reduce access to external credit markets and therefore reduces the recourse to external debt (Bachetta et al., 2013).

Through a traditional model of the demand for reserves (Lane and Burke, 2001; Obstfeld et al., 2010), the study highlights the function of FB in the reserve's possession. The restrictive policy on capital flows, proxy by a dummy variable 'tax', has also a crucial role to examine their impacts on FER and FB. Consequently, the main three policies often used in the optimal management of capital flows literature, FER, FB, and capital controls, were included in the empirical models (Jeanne, 2007; 2010). Many debates have also emerged about elements composing international reserves. The main is considering gold as part of foreign exchange

reserves (Flood et al., 2001). The study employs the variable 'total of reserves and related items' as defined by the World Bank (WDI database). For robustness checks and to be more precise about the definition of international reserves, the study uses the net foreign assets (NFA) instead of the international reserves variable (FER).

The results highlight a clear relationship between foreign exchange reserves and external debts. In terms of causality, the direction exists from FER to FB, the opposite sense does not appear. These findings are also confirmed throughout the Impulse Response Functions analysis (IRFs), which shows a clear response of FB to a shock on FER, and oppositely, any response is detected for a shock of FER on FB. The restrictive policies using capital controls did not prevent emerging countries from accumulating exchange reserves, while it reduced foreign borrowing. Given the employ of net foreign assets as a dependent variable, the behavior of capital controls has changed providing an adverse impact on the accumulation of nets foreign assets.

The *research hypotheses* arising from the previous debate are summarized as follow:

H1: FER can be explained by FB and no relationship can be identified for the opposite sense.

H2: Capital controls serve to reduce capital inflows and then to decrease the accumulation of FER.

H3: Capital controls, as an instrument of restrictive policies, will reduce the recourse to FB.

H4: Net foreign assets, considered as a substitute to FER, will have the same impacts of capital controls as on exchange reserves.

The paper is organized as follows. The next section presents the literature review of the relationships FER, FB, and capital controls. The second section presents the models' specification. Section three is divided into three parts; the first details the PVARs analysis. The second regresses a traditional model of international reserves. The third, for robustness check, introduce net foreign assets that substitute FER variable. The last section concludes and provides proposals for well-managing capital controls.

2. Literature review

Recent studies have highlighted the reasons for the buildup in official reserves in emerging markets since the 1980s. Ghosh et al., 2017 suggest that international reserves are accumulated as preventive demand against both current- and capital-account shocks, furthermore as an effective policy to deal with the exchange rate

undervaluation. As a result of capital account crises of the 1990s, particularly in Asian countries in 1997, prevention against capital account shocks has become crucial and requires a satisfactory stock of foreign exchange reserves. The export booms following these crises have demonstrated the benefits of undervalued currencies for export-led growth. In the 2008 financial crisis, the undervaluation of the currency became also important in explaining the accumulation of reserves. This undervaluation can be deliberate through sterilized intervention. The author highlight that emerging economies are becoming more risk-averse and have learned that the potential shocks are larger than previously.

The literature evidence highlight the excessive capital flows to emerging economies and approve, in some cases, the relationship between the FER with FB (Koepke, 2019). Primarily, raising resort to external debts gives a boost to reserve aggregation. Secondly, the accumulation of FER can be substituted by many possibilities of FB. If external transactions can be supported via debt, fewer reserves are required (Mody and Murshid, 2005). At the same time, a large volume of reserves can be considered as a guaranty to contract new external debts. International capital markets become more stable with a high stock of reserves accumulated. Contrarily, rollover risk and the likelihood of lender shocks are intensified when liquid assets are non-abundant (Feldstein, 1998).

Some other studies find several difficulties to establish a clear link between reserves and external debts (Summer 2006; Jeanne and Korinek, 2011). For a country, that recourse to foreign lenders and desires to apply an effective financial policy needs to analyze the ratios relating to both variables (reserves and debts). Unfortunately, the huge stock of FER holding by emergent countries cannot be only clarified by the standard ratio of reserves sufficiency (Cerutti et al., 2019). Moreover, the main sources of exchange reserves come from international trade, and regarding this framework, any relationship was found for FER and FB or vice versa (Eaton and Gersovitz, 1980). Landell-Mills (1989) suggest the possibility to obtain a root of funding reserves from borrowing, but international transactions are usually carried out directly by debt.

The theoretical and empirical literature on reserves/debts relationship can be approached in multiple ways. The study groups those under three concepts mainly debated in the managing capital flows literature: Guidotti-Greenspan rule; sudden stop and fire sale and prevention of financial instability.

2.1. Guidotti-Greenspan Rule, 1999

After the Korean crisis, a new rule of thumb is discussed by the International Monetary Fund. This rule consists to build a ratio regrouping the short-term external debt with the reserves sufficiency. Greenspan and Guidotti suggested that the economy should manage its foreign assets and their external debts. They

propose the "Guidotti-Greenspan rule" which country must accumulate reserves with sufficient amount to cover the external liabilities and to remain without the resort to external debt for at least one year.

 Greenspan (1999) improves "Guidotti-rule" by introducing a slight novelty that the maturities of external debts must surpass a determined period, for example, 3 years. He also suggests using a "liquidity-at-risk" standard for which an economy must hold reserves that allow a strong probability to not resort to external debt for at least one year (95% probability). Some studies consider that emerging economies need to have adequate reserves relative to the demand for short-term external debt (Bussiere and Mulder, 1999). Therefore, these economies present a small trend to hold few reserves once they have a high level of short-term debt. Some studies disagree with this rule (Summers, 2006), they show that it was not respected by several emerging countries.

2.2. Sudden stop and fire sale

The damaging effects of short-term external debts in foreign currency are determined through many features such as an increase in the costs of a sudden stop, constraints in the credit market, and more exposition to financial vulnerabilities (Eichengreen, Hausmann and Panizza, 2003). Such effects conduct costly and precocious liquidation of investments. These effects become more intense when the level of foreign exchange reserves is low. This process can lead to higher deleveraging costs and lower resale price of investments (fire sale) Aizenman (2009). In emerging economies, the rise in the foreign currency demand increases the deleveraging pressure. Consequently, this pressure conducts an overvaluation of the exchange rate specifically when foreign exchange reserves are low and restricted. This will prompt banks to sell a large part of their investments to finance the repayment of their external debts.

Each bank supposes the feasible fire-sale price as a cluster. This is then considered as a fire-sale externality, somewhat similar to saturation (Krugman, 2000). Many studies are focused on the literature of "sudden stop" for capital inflows to analyze the relationship between FER, FB, and capital controls. Calvo and Reinhart (2000) suggest that developing economies can be creditworthy of their external liabilities when it was big inflows and unfortunately, solvency becomes more difficult in sudden stops periods and when these flows leave the country. Arce, Bengui, and Bianchi (2019) analyze a theoretical model of guarantee dealing with sudden-stop events. The combination of external debt, international reserves, and controls are analyzed when investors are risk-averse and the socks on productivity are equally distributed.

The possession of a satisfactory stock of international reserves and external debts will prompt effective tax smoothing. The ratio of FER to short-term external debt

tended to fulfill a prevent indicator of financial instability. Besides, the empirical studies are lesser decisive about the role of exchange reserves to predict financial crises. Some studies search for an optimal policy for managing capital flows (Jeanne and Rancière, 2006). Facing the random sudden stop, the authors define an optimal level of international reserves in a model explaining the smooth of national consumption. Summer (2006) contradicts previous studies by suggesting that the sudden stops theory presents many shortcomings, specifically a failure to prevent crises. This conclusion is valid also for economies that accumulate reserves exceeding the "Guidotti-Greenspan rule".

2.3. Prevention of financial instability

The facts show that accumulating more exchange reserves relative to short-term external debt gives security to deal with an eventual financial instability in comparison to countries with few reserves. The ratio of international reserves / external short-term debt is considered in many empirical studies as the main variable to signal a financial crisis. Also, the IMF studies praise this ratio as the most significant forecaster of reserves adequacy in developing countries (Jeanne 2010 and IMF 2000). Short-term external debt is considered by Obstfeld et al. (2010) as an effective predictor of financial vulnerability specifically for the emerging countries. The reserves accumulation favors liquidity availability and reduces the vulnerability of an economy to external shocks, specifically with poor macroeconomic conditions. In the same way, Bussiere and Mulder (1999) show that short-term external debt as a percent of international reserves constitute a practical measure applied effectively to individual economy cases. The authors also utilize the log-ratio of short-term external debt to GDP as a further variable to their regressions explaining fluctuations of international reserves. Other studies suggest a simple benchmark for adequacy reserves (Wijnholds et al. 2001). Many variables are used in this benchmark but the most significant is the ratio of reserves to external debts.

Some studies are focused on the social cost generated by holding FER. Rodrick (2006) estimates that the cost of holding reserves is expensive as the cost of foreign borrowing. The study proposes to reduce the level of FB instead of holding reserves and this proposition is more suitable for the case of emergent economies. Other studies are searching for an ideal policy to manage of FER, FB, and capital controls (Bianchi and Mendoza, 2018; Korinek 2010; Jeanne and Korinek 2011). In circumstances where households face borrowing constraints, Bachetta et al. (2013) have noted that the equilibrium of a liberalized economy might not be socially effective and if the three policies (FER, FB, and capital control) are well combined they can ameliorate the welfare. Jeanne (2010) has suggested that the optimal level of reserves is equal to short-term external debt level added by the cost of the crisis, and minus the opportunity cost of reserves accumulation.

Figure 1: Increase in total reserves and short-term external debt in (a) South Asia; (b) Latin America
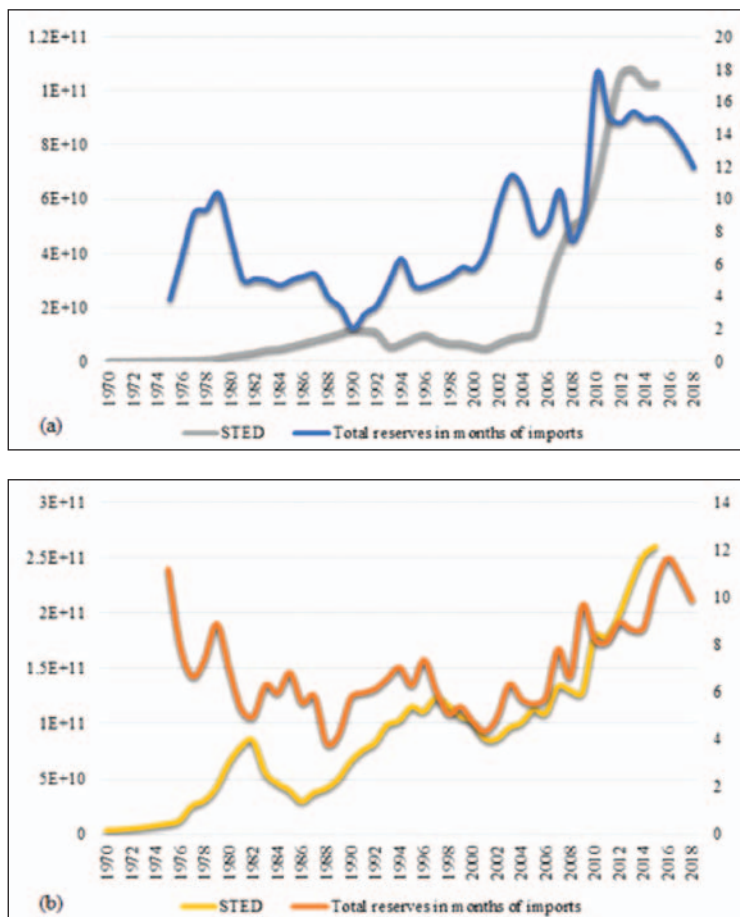
Source: author's illustration

3. Methodology

Many recent studies examine the linkage of international reserves and external debts using panel regressions (Espinoza, 2014; Qian and Steiner, 2017; Arce et al. 2019), but any of them has investigated this relationship with a panel VARs model (PVAR). Compared to other empirical methods, the panel VARs presents many advantages. First, when there are few theoretical studies on this relationship, the use of the VARs is recommended for the guidance of the model formulation. For our study, rare is the theoretical literature that examines, particularly, the causality from FB to FER. Second, the endogeneity bias presents a serious problem for many

empirical studies. Glick and Hutchison (2005); Kharusi and Ada (2018) and Qian and Steiner (2017) all take in consideration this problem of endogeneity, and have tried to solve it by including a lagged variables or by imposing additional restrictions to their regressions. VARs may reduce the endogeneity bias by considering all variables as probably endogenous. Third, following the VARs regressions, we can obtain the impulse response functions which record any retarded effects of the considered variables; the classical panel models are unable to display these dynamic effects. The missed variable bias is also considered with panel VARs by employing the country fixed effects, which catch time-unchanging parts that may affect both foreign exchange reserves and foreign debts. Panel VARs has also the merit to be used with a short temporary scale which may be compensated by the gain from the cross-sectional scale.

The first part of the empirical analysis employs a PVAR approach in which a system of two regressions relating foreign exchange reserves (FER) and foreign borrowing (FB) is presented. These equations will allow finding the causality direction between FER and FB. The PVAR models with specific random effects are defined as follows:

$$FER_{i,t} = \alpha_1 FER_{i,t-1} + \alpha_2 FER_{i,t-2} + ... \beta_1 FB_{i,t} + \beta_2 FB_{i,t-1} + ... + \delta X_{it} + u_i + e_{it} \quad (1)$$

$$FB_{i,t} = \alpha_1 FB_{i,t-1} + \alpha_2 FB_{i,t-2} + ... \beta_1 FER_{i,t} + \beta_2 FER_{i,t-1} + ... + \delta X_{it} + u_i + e_{it} \quad (2)$$

Where FER: foreign exchange reserves; FB: foreign borrowing. X_{it}: the vector of explanatory variables of FER and FB (trade, M2, GDP, pop, expo). u_i and e_{it} are vectors of dependent variable-specific panel random effects and idiosyncratic errors, respectively.

The second part aims to determine the impact of capital controls on foreign exchange reserves and foreign borrowing. Unfortunately, no previous study is made for this issue. The most robust path is to use a traditional model of the demand for reserves and to include our proxy of capital controls. We follow the studies of Obstfeld et al., 2010; Lane and Burke, 2001; Aizenman et al., 2003 who also employed this model. We include our dummy variable "tax" as a proxy of capital controls to explain the logarithm of FER. This dummy variable cannot be introduced in the PVAR model for robustness reasons for the model. The traditional model of reserves used is defined as follow:

$$\ln(FER)t = \alpha_0 + \alpha_1 \ln(pop)t + \alpha_2 \ln(trade)t + \alpha_3 \ln(FB)t + \alpha_4 (tax)_t + \\ + \alpha_5 \ln(M2)t + \alpha_6 \ln(expo)t + \alpha_7 \ln(GDP)t + \varepsilon t \quad (3)$$

Similarly, we define the model explaining foreign borrowing as follow:

$$\ln(FB)t = \alpha_0 + \alpha_1 \ln(trade)t + \alpha_2 \ln(pop)t + \alpha_3 \ln(FER)t + \alpha_4 (tax)_t + \\ + \alpha_5 \ln(M2)t + \alpha_6 \ln(expo)t + \alpha_7 \ln(GDP)t + \varepsilon t \quad (4)$$

4. Empirical data and analysis

The empirical literature highlights a set of variables explaining foreign exchange reserves and external debts. We present here a brief review of these variables. Heller (1966) has begun the modern study of optimal international reserves and shows the big role of trade openness (*trade*) in the accumulation of reserves. The population *(pop)* is also considered a relevant variable, it measures the country's size. When the size of the country is large it may accumulate more reserves and resort more often to external debts (Lane and Burke, 2001). The financial depth is an explicative variable of international reserves and foreign borrowing. According to Obstfeld et al. (2010), the size of domestic financial liabilities is proxy by the M2/GDP ratio (*M2*) that can be shifted into foreign currency. The export volatility (*expo*) offers a prudential incentive for keeping international reserves and usually presented as a proxy for international financial instability (Aizenman and Marion, 2003). The Gross Domestic Product per capita (*GDP*) considered the most representative macroeconomic indicator of a country's economic strength. With a high GDP growth rate, the country may increase international reserves and will enjoy the confidence of borrowers to have more external debts (Grubel, 1971; Frenkel, 1974; Landell-Mills, 1989; Bordo and Eichengreen, 1998). The capital controls constitute the main variable of the study. These controls are proxy by "*tax*" that takes 0 for no capital controls and 1 when controls exist. This dummy variable is set by monitoring the dates of instituting restrictions on capital flows in each country of the sample. The variables FER and FB will be defined, respectively, as dependent variables in equation (3) and (4) and if not will be presented among the explanatory variables to define their impacts on each other (Cheung and Ito, 2009). The data of all variables are gathered from two main sources, the International Financial Statistics database (IFS) of the International Monetary Fund and the World Development Indicators (WDI) of the World Bank.

Table 1 summarizes the variables used in the empirical models. The de jure capital controls "tax" range from 0 to 1 (any controls to largest controls applied). The average controls are high (0.7) showing a tightness of restrictions among the sample countries. The standard deviation is low (0.15) proving the difficulty moving to a higher level of restrictions. The descriptive statistics highlight the great part of foreign exchange reserves, foreign borrowing, and net foreign assets in the global economy of emergent economies. The average across countries is superior to 20% of the country's GDP. It was noticed a clear disparity and large heterogeneity of their accumulation across countries (the standard deviation exceed 10 for FER, FB, and NFA).

Table 1: Summary statistics

Variable	Mean	Std. Dev	Min	Max
FER	21.30	11.05	3.96	52.89
FB	22.99	13.25	6.90	67.84
GDP	3.61	0.56	-0.45	18.24
pop	17.13	1.91	12.33	21.05
M2	13.81	2.64	2.20	35.34
expo	24.31	1.49	20.69	28.60
trade	14.12	0.61	2.21	54.39
tax	0.71	0.15	0	1
NFA	35.27	12.54	8.36	52.95

Source: author's calculations

In the first part, the study employs PVARs to examine the linkage between the two variables, FER and FB. The study considers that the impact of the variables, on each other, appears only after one year at least, for this reason, we apply one delay on these variables. The following table displays the results of the PVARs analysis.

Table 2: PVAR analysis for FER and FB

		Coefficient	Std. Err.	Z	P>|z|	[95% Conf. Interval]	
	FER_1	0.01	0.05	0.17	0.86	-0.99	0.11
	FB_1	-0.22	-0.56	-4.00	0.00	-0.33	-0.11
	trade_1	3.54	0.46	7.58	0.00	2.62	4.45
FER	M2_1	-1.87	0.44	-4.21	0.00	-2.74	-0.99
	pop_1	-1.48	0.23	-8.76	0.00	-2.87	-1.56
	expo_1	2.03	0.32	7.58	0.00	2.43	4.36
	GDP_1	0.22	0.22	1.00	0.31	-0.21	0.65
	FER_1	-0.74	0.28	-2.62	0.01	-0.12	-0.01
	FB_1	0.79	0.03	21.24	0.00	0.72	0.87
	trade_1	0.28	0.15	1.86	0.06	-0.14	0.57
FB	M2_1	-1.01	0.16	-6.03	0.00	-1.35	-0.68
	pop_1	-2.48	0.25	-9.76	0.00	-2.91	-1.98
	expo_1	0.36	0.28	1.96	0.04	-0.24	0.64
	GDP_1	0.82	0.98	8.36	0.00	0.63	1.01

Source: author's calculations

PVAR is followed by a Granger causality analysis to determine the direction of the causality of FER and FB. The causal relationship, as detailed above, remains undefined, and this section will allow us to shed some light on this debate. The results of the causality test are presented in Table 3.

Table 3: Granger causality test

Equation	Excluded	Chi2	df	Prob > chi2
FER	FB	15.98	1	0.000
	trade	27.32	1	0.000
	M2	17.69	1	0.000
	pop	8.95	1	0.003
	GDP	1.004	1	0.316
	expo	30.11	1	0.002
	ALL	187.31	6	0.000
FB	FER	6.83	1	0.319
	trade	3.46	1	0.063
	M2	36.32	1	0.000
	pop	45.12	1	0.000
	GDP	69.97	1	0.000
	expo	50.10	1	0.003
	ALL	248.67	6	0.000

Source: author's calculations

The analysis is deviously based on a demand for reserves model in which, after controlling the explanatory variables (trade, M2, pop, expo, GDP), the impact of FER on FB is interpreted as evidence of theoretical and empirical literature. We do this by relying on the orthogonalization of impulse responses (IRFs). This method detail the reply of one variable to the changes in a different variable in the VARs, with keeping all other changes equal to zero (Abrigo and Love, 2016).

Figure 2 draws the evolution of the IRFs.

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Figure 2: IRFs for equations 1 and 2
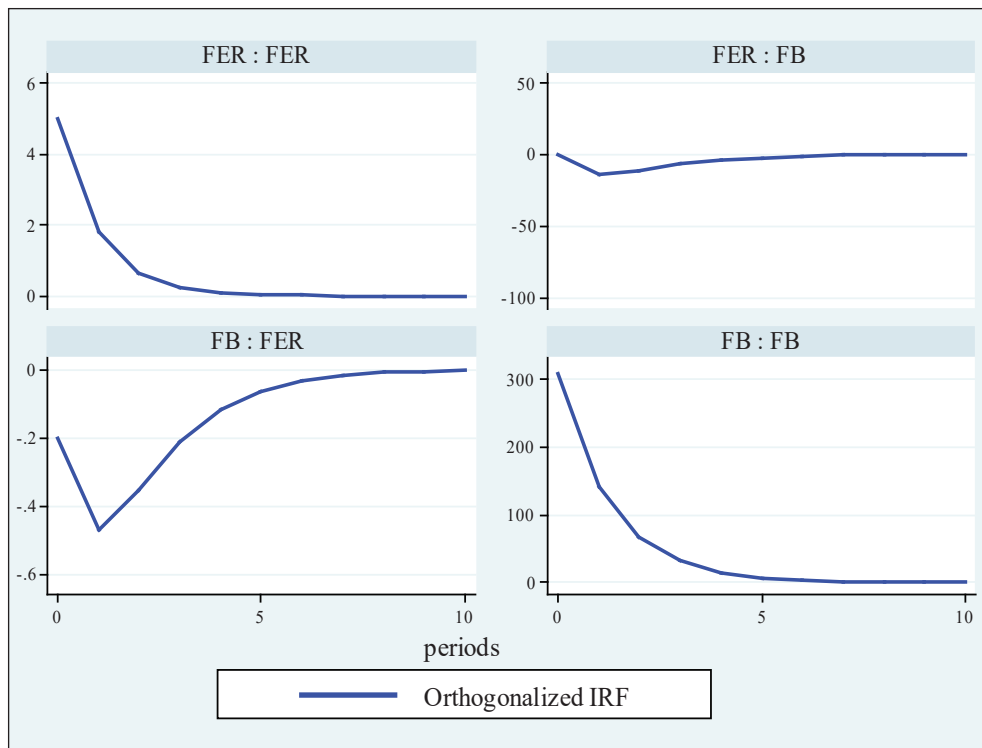
Source: author's calculations

In the second part, the study employs the traditional model of the demand for reserves. First, we explain the foreign exchange reserves by the control variables previously detailed, by the proxy of capital controls "tax", and by foreign borrowing variable. Second, we regress the same model using FB as the dependent variable. Tables 4 and 5 display respectively, the results of the regression for equations 3 and 4.

Table 4: Regression model FER = f (FB, tax)

FER	Coefficient	Std. Err.	Z	p>|z|	[95% Confidence Interval]	
FB	-0.09	0.04	-0.24	0.81	-0.09	0.07
tax	0.51	0.21	2.40	0.01	0.09	0.94
GDP	0.82	0.10	8.08	0.00	0.62	1.02
pop	0.91	0.13	6.72	0.00	0.64	1.17
M2	0.19	0.24	0.81	0.42	-0.28	0.68
expo	0.80	0.36	2.19	0.02	0.08	1.52
trade	0.61	0.23	2.65	0.02	0.15	1.06
cons	-4.66	2.61	-1.79	0.07	-9.77	0.45

Source: author's calculations

Table 5: Regression Model FB = f (FER, tax)

FB	Coefficient	Std. Err.	Z	p>|z|	[95% Confidence Interval]	
FER	0.28	0.27	1.02	0.30	-0.25	0.81
tax	-0.32	0.76	-2.48	0.04	-0.23	0.81
GDP	0.62	0.18	3.29	0.00	0.25	0.99
pop	-1.10	0.40	-2.73	0.01	-1.89	-0.31
M2	0.82	0.39	2.08	0.03	0.04	1.60
expo	0.80	0.36	2.19	0.02	0.08	1.52
trade	0.70	0.37	1.91	0.05	-0.01	1.43
cons	21.63	6.22	3.48	0.01	9.44	33.83

Source: author's calculations

Several critics have been addressed to the exact definition of foreign exchange reserves, their components, and the problem to consider gold as part of this variable (Flood et al., 2001). When foreign exchange reserves are measured by international financial institutions, several items may be introducing to this measure, among them there is especially a debate regarding gold. In practice and as an example, the European central banks, in 2000, retained approximately $226 billion of foreign-exchange reserves, not including their large gold holdings. Flood et al., (2001) have found that the trends are modified when measured reserves include gold holdings. These later represent an interesting part of countries' reserve assets within the guidance of the Bretton Woods arrangement. Several empirical analysis has examined the factors of financial crises in the 1980s and 1990s by employing a reserves calculation that excludes gold. Thus if models of reserve accumulation

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over the last forty years are to be reviewed, gold must be considered. Our study uses the definition of the World Bank that define foreign exchange reserves by "reserves and related items" that include gold holdings.

As a response to this puzzle and for robustness check, the study replaces FER by nets foreign assets (NFA). The following model is regressed using NFA as the dependent variable and Table 6 displays the results of this regression.

Table 6: Regression Model NFA = f (FB, tax)

NFA	Coefficient	Std. Err.	Z	p>|z|	[95% Confidence Interval]	
FB	0.29	0.98	0.34	0.02	0.36	4.23
tax	-0.36	5.17	-2.06	0.04	-20.82	-0.50
GDP	1.49	3.89	0.38	0.70	-6.16	9.14
pop	0.30	1.63	4.44	0.00	43.65	72.95
M2	-0.32	6.02	-0.88	0.37	-17.17	6.51
expo	0.13	0.28	2.54	0.03	0.07	1.63
trade	-0.01	6.33	-2.72	0.01	-29.66	-4.76
cons	-3.38	7.83	-5.54	0.00	-13.96	-9.81

Source: author's calculations

The PVAR model (equation 1), explaining the FER by the determinants of reserves, show a negative and significant coefficient of FB (Table 2). This result confirms the findings of Lane and Burke (2001). The authors have studied the determinants of cross-country changes in the level of foreign-exchange reserves over 1981-1995. They establish some empirical linkage that may develop new theoretical patterning of reserves conduct. They consider Reserves as collateral for borrowing on world capital markets and as a determinant of the likelihood of default on credit. Similarly, few reserves may reflect an increased probability of default on credit markets and can conduct to greater debts charges which are commonly proxied by interest rate spreads on international financial markets. For emergent economies, the authors have found a partial negative correlation between the level of external debt and reserves.

This result is also in accordance with Obstfeld et al. (2010). The authors identified negative coefficients of foreign borrowing variables on reserves holdings. They developed a financial-stability model that explains reserve accumulation in the modern framework of globalized capital markets. Their main finding is that external debt factors for reserve accumulation highlight that a negative (capital outflow) balance-of-payments shock can arise from the capital account when the export assets to outside unexpectedly stop.

The findings of the second equation, display also a negative association between the two variables. The FER coefficient is negative and significant showing that the accumulation of foreign exchange reserves reduces the country's foreign borrowing. With a significance level of 1%, the PVAR Granger causality test displays only one direction causality from FER to FB (Table 3). Figure 2 reports graphs of IRFs for the VARs with two variables estimated (FER and FB) for the sample of countries. It supports our claim that FB explains the accumulation of FER and shows that the impact of the FB shock on FER takes more than 5 years until it goes out. Oppositely, no impact was found of FER on FB.

The second approach using a traditional model of the demand for reserves and including the capital controls proxy shows that emerging economies have succeeded to accumulate exchange reserves although the restrictive policy applied on capital flows. Table 4 displays a positive and significant coefficient of "tax" on reserves. This result is common to the China case. This country is known for its restrictive policy on capital movements while it is very active in the capital market by accumulating a huge stock of foreign exchange reserves. Bachetta et al. (2013) have suggested an optimal accumulation reserves model for China in which the Chinese central bank should motivate credits to the private sector and at the same time accumulate foreign exchange reserves. Capital controls do not pose a barrier to this process. The authors find that a country can benefit from rapid growth without applying capital account liberalization. In the Chinese context, they explain excessive reserve holdings by the interest rate spreads, domestically, and externally. The reserves accumulation in China has exceeded that of an open economy. Concerning the management of capital controls and foreign exchange reserves, Bachetta et al. (2013) have developed a model where households face a credit restriction; they found that an optimal competitive equilibrium of a liberalized economy can be reached with a combination of capital controls and reserve policy.

According to the results of Table 4, FB has a negative but insignificant association with FER. As previously debated, the direct relationship of FB to FER is weakly debated in the empirical literature. The insignificant coefficient of FB proves the difficulty to establish a clear relationship (Table 4). The result joins Lane and Burke (2001) and Obstfeld et al. (2010) who did not find any impact of external debts. Table 5 shows a negative and significant coefficient of 'tax', suggesting that capital controls may reduce debts contracted in foreign currencies. Globally, from the results of Tables 4 and 5, capital controls, applied by emerging countries, have failed to limit the accumulation of foreign exchange reserves and contrarily, succeed to reduce the level of external debts (Espinoza, 2014).

For the control variables, the most relevant findings are those of the M2 variable which is measured by the ratio M2/GDP. This variable accomplishes a major role in the rise of FB (Table 5), and at the same time, defines the vulnerability of an economy to the financial risks. The empirical literature on the financial crises

(Obstfeld, 2012; Mulder et al., 1999; Glick and Hutchison, 2005 and De Beaufort-Wijnholds et al., 2001) consider the M2 monetary aggregate as a proxy of financial instability. This literature highlights a clear linkage between exchange reserves and financial instability. Reserve holdings are used as a key tool to deal with internal financial instability in a world of growing financial integration. Based on these studies, domestic financial liabilities including foreign currency, capital account openness, access to foreign currency through foreign borrowing markets, and exchange rate policy are all significant determinants of reserve holdings. Recently, Aizenman (2019) suggests that the liabilities of the financial system, especially, those denominated in foreign currency, are elements of M2 and a significant part of these liabilities comes from external debts. Excessive international reserves do not prevent a country's financial instability. Aizenman (2019) highlights the role of these external debts in this instability. He argues his opinion by the experience of Korea and Mexico during and after the world financial crisis. For these cases, a large stock of international reserves does not avoid a country from financial instability and it is above all a because of a heavy balance sheet of foreign currency loans.

The results of the replacement of FER by NFA are displayed in Table 6. The estimates show a positive coefficient of FB demonstrating that external debts encourage the accumulation of NFA. Contrarily, the coefficient of "tax" is negative and significant showing that capital controls reduce the NFA. The stocks of NFA are usually created by commercial banks and allow them to resort to external debts. This opportunity can be weakened by the use of capital controls, explaining the negative coefficient of "tax". Admitting that central bank has the authority to stock foreign exchange reserves and commercial banks can participate to the accumulation of net foreign assets, it can be assumed that the policies, sometimes divergent, of the central bank and the commercial banks, explain the changes in the sign of "tax" in the Tables 4 and 6.

5. Results and discussion

The study is part of the capital flows management framework and has developed significant results. The analysis has grouped three main policies often used in studies searching an optimal policy for managing capital flows: foreign exchange reserves, foreign borrowing, and capital controls.

Starting with examining the links that may exist between foreign exchange reserves and external debts, the results of the PVAR model confirmed this association. Table 2 shows significant coefficients of FB and FEF, respectively, in equations 1 and 2. The presence of this relation supports the theoretical literature previously detailed. When a country obtains external debts, this may raise the stock of exchange reserves, similarly, a country with highly stock reserves going to have the

confidence of international borrowers to provide these debts denominated in foreign currency. These reserves constitute a kind of guarantee in the event of default of reimbursement.

Surprisingly, Table 2 shows a negative sign of both coefficients of FER and FB, stating a negative impact of external debts and exchange reserves, one upon the other. This can be explained by the fact that a country which has satisfactory foreign exchange reserves will not need to resort to external debt, and similarly, a country without a sufficient stock of foreign exchange reserves will request external credits to pay its international trade transactions. Thus, an inverse relationship is established which may explain the negative coefficients of reserves and external debts.

The results of the causality test displayed in Table 3, show causality in one direction, from FB to FER, and suggesting that external debts explain the evolution of foreign exchange reserves. These results are confirmed by the IRFs graphs which show that a shock on external debts will harm foreign exchange reserves and this impact survives 5 years before disappearing. Foreign exchange reserves are more sensitive to changes in external debts. The observation is obvious to what extent a large part of the foreign exchange reserves accumulated by the emerging countries come mainly from external debts. A shock to these debts (for example, a sharp drop in external debts) will negatively affect the reserve stock and this effect will last a long period. The second part of the study has introduced capital controls impacts. The results of the traditional model of the demand for reserves have shown these impacts on reserves and external debts.

Capital controls are part of a country's restrictive policy to reduce capital flows, especially short-term ones. These controls were expected to stop or at least reduce foreign exchange reserves, the results in Table 4 show a positive coefficient for the "tax" index and unexpectedly, capital controls did not prevent the accumulation of foreign exchange reserves. When a country applies capital controls it is mainly to prevent movements of speculative capital flows and not flows which bring in foreign exchange reserves. Restrictive policies applied by emergent economies, in terms of capital control, are selective and mainly target flows which harm the financial system (short-term speculative flows). Regarding the impact of capital controls on foreign borrowing, the coefficient of "tax" in Table 5 is significant and negative. This result highlights the adverse impact of controls on debts. At a later stage, they are harmful to the economy, especially when their levels are high. The establishment of capital controls, as previously detailed, will target these flows.

Considering net foreign assets as a close variable to foreign exchange reserves, the coefficient of "tax" in Table 6 presents a different impact of capital controls in which there is a reduction of NFA. These multiple results of "tax" still raise the debate, discussed in the previous section, on the dilemma to find an exact measure of foreign-exchange reserves.

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The study has contributed to the empirical literature of the management of capital flows by using two-approach PVAR and the traditional model of the demand for reserves. As our knowledge, it was the first time to examine the linkage between reserves and debts and to consider the role of capital controls within these approaches. The study gives some lessons to economic policymakers. On the one hand, a complementary or opposite linkage can be found between foreign-exchange reserves and external debts. This mainly depends on the objectives set by a country and according to the charges associated with the external debts. Foreign borrowing, if properly allocated, often considered as an engine for investment and growth. An arbitrage in terms of opportunity cost can be decided to resort to external debts or not. On the other hand, capital controls are instruments usually utilized to reduce short-term capital inflows. These controls must be oriented to the flows that harm the economy. The policymakers may evaluate the advantages and disadvantages of the entry of these flows, particularly those in forms of external debts. Depending on their undesirable effects, the intensity of capital controls to be established is decided. This explains why some countries have successfully used capital controls to promote their economy while others have failed. This debate leads us to open other research notably on the effectiveness of capital controls.

6. Conclusions

With the effort of emerging countries to reduce the high level of their external debts, we have noticed an increased accumulation of foreign exchange reserves. This observation has been demonstrated empirically following a negative relationship between the variables FB and FER. The results allow us to confirm the first research hypothesis with clear evidence on the impact of FB on FER, this impact is not approved in the opposite direction. The current account surpluses are performed by emerging countries that have accumulated sizable reserve stocks, and; therefore, lower their external debts.

The restrictive policy using capital control did not prevent emerging countries from increasing their stock of international reserves when these controls succeeded in reducing the recourse to external debt. The second hypothesis is infirmed, unexpectedly, the accumulation of exchange reserves is not stopped by capital controls, while, the third hypothesis is confirmed. Net foreign assets employed as a substitute for foreign exchange reserves show a different behavior of capital controls. These later reduce the accumulation of foreign assets, infirm the fourth hypothesis, and again raise the issue on the components to include in international reserves.

Several shortcomings can be addressed to this study, such as the choice of the proxy variable for capital controls "tax", several studies use other proxies, in particular, the KAOPEN index of Chinn and Ito and/or indexes established by monitoring the

reforms provided by The Annual Report on Exchange Arrangements and Exchange Restrictions of the International Monetary Fund.

Other limits arise about the use of foreign exchange reserves, the exact definition of this variable differs across countries, we replaced it with nets foreign assets but the results found were different. Certainly, like any empirical analysis, inquiries can be asked about the choice of the empirical methods, the sample, the analysis period, etc. These shortcomings can serve as guidelines to improve the study, in particular with a more robust choice for capital control proxies, international reserves, etc. Likewise, resort to other types of models or to expand the sample and/or the analysis period.

In conclusion, while sustaining some of the previous studies, the paper also displays a simple approach that could be applied to further explore the optimal policy for managing capital flows across different countries. This optimal policy will undoubtedly involve the use of capital controls which will mainly target short-term external debts flows but which will keep the opportunity to the country to increase its stock of foreign-exchange reserves.

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Kontrola kapitala u svrhu upravljanja deviznim pričuvama i inozemnim zaduživanjima

Chokri Zehri[1]

Sažetak

U ovom radu istražuje se odnos između deviznih rezervi (FER) i inozemnog zaduživanja (FB) u okviru upravljanja kapitalnim tokovima. Da bi se istražio ovaj odnos i ispitao učinak kontrole kapitala na devizne pričuve i inozemne dugove za 25 zemalja u razvoju tijekom razdoblja 1985. - 2019.godine, primjenjena su dva pristupa: model autoregresije panelnih vektora (PVAR) i tradicionalni model potražnje deviznih pričuva. Rezultati pokazuju negativnu povezanost između FER-a i FB-a, a smjer uzročnosti je od dugova prema deviznim pričuvama. Kontrola kapitala, kao uspješna politika za ograničavanje kratkoročnih tokova, ne utječe na akumuliranje deviznih pričuva i, suprotno, smanjuje kratkoročne vanjske dugove. Korištenje neto inozemne imovine umjesto deviznih rezervi ukazuje na različite učinke kontrole kapitala i stoga se nameće pitanje o mogućnosti točne procjene deviznih pričuva.

Ključne riječi: *kontrola kapitala, dugovi, rezerve, inozemna sredstva/inozemna imovina*

JEL klasifikacija: *F32, F36, F37*

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Appendix

Table 1-A: List of Sample Countries

Brazil	Indonesia	South Korea	Algeria
Chile	Malaysia	Hungary	Pakistan
Colombia	Thailand	China	Poland
Egypt	Taiwan	Peru	Ecuador
Greece	South Africa	Russia	Vietnam
India	Mexico	Philippines	Turkey
Nigeria			

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Total factor productivity drivers in the selected EU countries: Cointegration approach[*]

Zoran Borović[1], *Mladen Rebić*[2], *Dalibor Tomaš*[3]

Abstract

In this paper, we will present the results of our survey on TFP and its main drivers. For this purpose, our analysis is based on a sample of thirteen EU countries for the period 1995 - 2016. In the first iteration, we have estimated the TFP for selected countries. The main goal of this paper is to determine the existence of a long-run relationship, ie. cointegration between the TFP and its main drivers. To do so, in the second iteration we have used the relatively new panel ARDL (Autoregressive Distributed Lag) model proposed by Pesaran (1997) and Pesaran and Shin (1999). The obtained results in this paper reveal the existence of a long-term relationship, i.e. co-integration between the TFP on one hand, and R&D, and ICT, on the other hand, confirming the basic hypothesis that there is a long-term and statistically significant relationship, i.e. co-integration between the above-mentioned variables.

Key words: *growth, total factor productivity, foreign direct investment, research and development, information and communication technologies, Cobb-Douglas production function, cointegration*

JEL classification: *F20, F21, F23*

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1. Introduction

Total Factor Productivity (hereinafter TFP) is one of the most celebrated residuals in economic science. It represents the growth in output after taking into account the growth contributions from inputs. Academics have spent hours, and hours on conceptualizing, measuring and interpreting TFP. The concept of TFP has been very intriguing for policymakers. The policymakers have spent a lot of effort to understand how policies might positively impact on a country's TFP.

Through the history, the academics, scientist, and policymakers were obsessed with TFP, its measuring, and interpretation. Why were they so obsessed with TFP? Because productivity is the only sustainable source of long-term economic growth and without it, the entire economy will start to slow down. The only factor which does not suffer from diminishing returns as other homogeneous inputs typically do is the TFP.

The TFP is of great importance for state economic growth. Even if its contribution is relatively small, compared to labour or investment as growth drivers, small annual improvements do add up over longer periods of time. The TFP is considered to be a main driving force behind the sustainable long-term growth. If TFP slows down, in long-term, it will cause the economy's inability to generate growth or prevent a decline. Therefore, the TFP and its slowdown is a matter of major concern in Europe, and recently in the USA and in several emerging market economies.

The models, based on a standard neoclassical growth framework, do not appear to be consistent with recent facts regarding the EU's growth performance. Recent growth theories, based on "Schumpeterian" creative destruction mechanisms are more likely to interpret recent developments in the EU's growth performance than standard neoclassical growth theories. This theory focuses on innovation as the key driver of growth in economies at, or close to, the "technology frontier (Havik, et al., 2008. p. 5). The rate of innovation and the rate at which "state-of-the-art" technologies are adopted are the two main driving forces behind the countries economic growth in theories, based on "Schumpeterian" creative destruction mechanisms. Countries that are close to the technology frontier will mainly grow thanks to the introduction of new technologies, whilst the "follower" grouping of countries will derive the largest share of their TFP growth from the adoption of better, but already existing, technologies which are available "at the frontier" (Havik, et al., 2008. p. 5). Beside innovations as the key driver of growth, there are some newly added factors which have been identified as additional drivers of productivity: Foreign Direct Investment (FDI), Information and Communication Technologies (ICT), Research and Development (R&D), and trade openess.

Many researches use a different panel technique to estimate the TFP on a sectoral level and to investigate the impact of productivity drivers on the TFP for different periods and on different samples. Some of them use an EU KLEMS database as

a source for data. Our goal is twofold. First, to calculate the TFP for the 10 EU countries by applying growth accounting. Second, we aim to investigate the longterm impact of productivity drivers on the TFP, for the selected countries, by using the cointegrating technique.

In this paper we will estimate the TFP over several years and focus our analysis on a rich set of TFP drivers: Foreign Direct Investment (FDI), Information and Communication Technologies (ICT), Research and development (R&D), human capital (h), and trade openness (OPP). We will conduct our analysis on the following EU countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. At this time, the UK is still a fully member of the EU. The basic hypothesis of this paper is that there is a long-term and statistically significant relationship, i.e. co-integration between the TFP and its main drivers: Foreign Direct Investment, trade openess, Information and Communication Technologies, Research and Development, and human capital. The obtained results in this paper reveal the presence of co-integration between the TFP and its main drivers.

This paper is organized in the following manner. Section 2 discusses the existing literature and gives some theoretical background. Section 3 provides information on data, model specification and appliedmethodology. Section 4 presents empirical results and discussion. Section 5 concludes the paper.

2. Literature review

Total Factor Productivity (TFP) is the portion of output not explained by the amount of inputs used in production (Comin, 2008). According to Sahu & Narayanan (2011), the TFP measures the effects of technological change and increases in efficiency over long periods of time, and it is estimated as a residual from the production function. On the other hand, the TFP measures only externalities and other free gifts associated with economic growth (Griliches, 2007). The TFP can be considered as a measure of our ignorance, it is simply a measure of what we do not know (Abramovitz, 1956). The TFP is labelled as a measure of ignorance, because there is little known about this non-input, very often unobservabledeterminants of economic growth.

Summarizing all the previous quotes and definitions, it is clear that TFP means different things to different authors. The different authors have a different stand regarding a TFP, and their views of TFP are summarized in the following paragraphs (Lipsey, et al., 2001. p. 3):

– One group holds that changes in TFP measure the rate of technical change (Law, Krugman, Young). We refer to this as the "conventional view";

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– The second group holds that TFP measures only the free lunches of technical change, which are mainly associated with externalities and scale effects (Jorgenson, and Griliches). We refer to their position as the "J&G view";

– The third group is sceptical that TFP measures anything useful (Metcalf, and Griliches).

Our position is close to the "conventional view".

For a sustainable, and long-term growth, productivity improvements, based on technological progress, and human capital accumulation are of great importance. The endogenous growth models, by Romer (1990), Rivera-Batiz and Romer (1991), Grossman and Helpman (1991), and Aghion and Howitt (1992, 1998), are innovation-based and build upon the contribution of R&D. Romer (1988) and Lucas (1998) have been analyzing the role of human capital in speeding up economic growth, within the framework of the endogenous growth theory. Human capital can have both direct and indirect effect on economic growth. On one hand, the human capital has a direct effect on growth since it enters the production function. On the other hand, the human capital is strictly complementary with R&D activities in speeding up productivity growth (Autor et al. 1998; Berman et al. 1998; Borensztein et al. 1998; Redding 1996).

Gehringer, et al. (2014) conducted a survey based on 17 Eastern European countries for the period 1995-2007, and the main results show that TFP variation is mainly explained by factors common to all countries: human capital, trade openness, rationalization efforts, and the use of information and communication technologies. They have used heterogeneous production functions, based on a value-added approach on a sectoral level. The estimation of the TFP and investigation of the TFP determinants is carried out by augmented mean group estimator. If the analysed countries aim at improving TFP and therefore, their economic performance in the global economy, they should favour specific policies that enhance human capital formation, widen the use of ICTs and control labour costs.

The available empirical specifications normally reflect areduced form of the basic innovation-imitation model, with most of them regressing TFP growth on two key explanatory variables (Havik, et al., 2008. p. 6):

– a measure of the technology gap (i.e. the distance between the TFP of the country analysed and that of the country with the highest level of efficiency); and

– an estimate of the growth rate of TFP at the frontier (i.e. the TFP growth rate of the most efficient country).

The measure of the technology gap describes the impact of the adoption of more efficient existing technologies on the TFP growth. The second variable

describes the impact of innovation and knowledge spillovers which are taking place in the technologically most advanced country on the TFP growth in the "catching up" country. In most papers, authors in addition to the above basic explanatory variables include a policy and institutional factors that may affect the rate of TFP growth independently. These policy and institutional factors may also interact with the "technology gap" and "technology spillovers" variables to have an impact on TFP. More recently, additional factors, have been identified as additional drivers of productivity. These newly added factors are Foreign Direct Investment (FDI), Information and Communication Technologies (ICT), R&D, and trade.

The sectoral TFP growth in a panel of OECD countries was analyzed by Nicoletti and Scarpetta (2003). The further away are countries from the technology frontier, this impact becomes stronger. The adoption of existing up-to-date technologies are prevented mainly by entry regulation and by public ownership, and because of this prevention, the impact of TFP is greater away from the frontier. Away from the frontier, the TFP growth is more strongly based on adoption rather than on innovation. The same study shows that human capital has a positive impact on TFP growth, although not always significant.

A study on TFP determinants across sectors in a panel of OECD countries was performed by Griffith, Redding and Van Reenen (2004). The authors have stressed the importance of both the direct and indirect impact of R&D on productivity growth. The R&D has a direct impact on the TFP growth rate through enhancement of a firm's innovative potential. The indirect impact of R&D on the TFP growth rate is achieved by increasing the absorptive capacity of firms and industries, thus facilitating the adoption of existing technologies and spurring TFP convergence.

The role of quality of human capital (QHC) as a determinant of productivity growth for ''new' and 'old' EU members was investigated by Balcerzak and Pietrzak (2016; 2016a). In order to measure the QHC and to obtain the time series, they have used a TOPSIS method. To investigate the impact of the QHC on the TFP growth, for both 'new' and 'old' EU members, the dynamic panel model was applied. Their results confirm the positive influence of the QHC on TFP for both 'new' and 'old' EU members.

3. Model specification and methodology

The first step in our analysis is to estimate the TFP levels over time and across countries. In our analysis, we will apply the Cobb-Douglas production function. We can apply the Cobb-Douglas production function because we consider the analysed countries to be very homogenous in relation to structural and institutional factors

affecting productivity[4]. The standard Cobb-Douglas production function can be written as:

$$Y = AK^{\alpha}L^{\beta} \tag{1}$$

Where Y represents output or real GDP, the K stands for the economy-wide capital stock, L represents employment, and α +β=1. The A is interpreted as the TFP.

There are many empirical approaches to evaluate the TFP in modern literature (see. Welfe (ed.) 2007; Severgnini and Burda, 2010, pp. 447–466; Gehringer et al., 2014). To obtain the TFP we will use the growth accounting, which basics were presented in Solow (1956 and 1957.). The main assumptions of the Solow growth model are competitive markets and constant returns to scale. With some rearrangements, we can rewrite the standard Cobb-Douglas production function as:

$$\Delta \log Y = \Delta \log A + \alpha \Delta \log K + \beta \Delta \log L \tag{2}$$

The TFP, as a rate of the technological progress, can be calculated as a residual from the equation (2). The parameters α and β are the factors marginal (social) products. These parameters are defined as:

$$\alpha = \frac{\partial Y}{\partial K}\frac{K}{Y} \tag{3}$$

$$\beta = \frac{\partial Y}{\partial L}\frac{L}{Y} \tag{4}$$

In practice, we assume that factors are paid their full marginal products so that α and β represents the share of capital and labour in the realized GDP.

The labor share β indicates how much of national income is distributed to labor and how much to capital. There are several ways to calculate the share of labour β. Batini, et al, (2000) suggests that the share of labor can be calculated as:

$$\beta = \frac{WN}{PY} \tag{5}$$

Where W is labour cost per employee, N is employment, P is the GDP deflator at factor cost, and Y is national income. US Bureau of Labor Statistics calculates the labour share as[5]:

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[4] According to Balcerzak and Pietrzak (2016a), countries which have joined the EU before 2004. can be considered as very homogenous in relation to structural and institutional factors affecting productivity

[5] https://www.bls.gov/opub/mlr/2017/article/estimating-the-us-labor-share.htm

$$\beta = \frac{EC+PC}{O} \tag{6}$$

Where EC stands employee compensation, PC stands for proprietors labour compensation, and O stands for Output. According to Ganev (2005) the labour share is calculated as:

$$\beta = \frac{COE+NMI}{GDP} \tag{7}$$

Where COE is the compensation of employees, and NMI is the net mixed income. In our survey, we will use the Compensation of employees as a percentage of GDP, published by EUROSTAT, as a proxy for labour share. Compensation of employees is defined as the total remuneration, in cash or in kind, payable by an employer to an employee in return for work done by the latter during the accounting period and it is consists of wages and salaries, and of employers' social contributions[6].

We will use the equation (2) to calculate the TFP, and after we calculate the TFP over time and across countries, we will use the predicted TFP to estimate the productivity drivers in the selected countries.

3.1. The Capital stock

The data on capital stock are very often provided by the official statistics office. But, statistical offices from different countries can use a different method to obtain capital stock. The perpetual inventory method is the most common method, used in many studies for assessiment of capital volume, and it can be described with equation:

$$K_t = I_t + (1 - \delta)K_{t-1} \tag{8}$$

Where δ represents the depreciation rate and I stands for investments. The subscript t stands for the beginning of the time period t and t-1 represent the previous time period. All other variables have the same meaning as in expression (1). Our nex step is to assess the anchor capital stock. There are four methods for the assessment of the anchor capital stock. First method assumes the steady state of the economy. If we assume the stady state of the economy, then the anchor capital volume will grew at a constant rate σ. The initial capital, or anchor capital is estimated with following equation:

$$K_0 = \frac{I_0}{\sigma+\delta} \tag{9}$$

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[6] https://ec.europa.eu/eurostat/cache/metadata/en/tipslm13_esms.htm

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Where K_0 is the initial capital stock, I_0 are investments in the anchor period, and other variables have the same meaning as in previous equations. The main problem with this method is the estimation of the steady-state growth rate of the capital. The steady-state growth rate of the capital can be obtained in different ways. One way is to use a growth rate of the investments as a proxy for the steady-state growth rate of the capital (De la Fuente and Doménech, 2006; Berlemann and Wesselhöft, 2014). The other way is to use the growth rate of output as a proxy for the steady-state growth rate of the capital. In the steady-state, the output and capital grow at the same rate, thus, we can use the growth rate of output as a proxy for the steady-state growth rate of the capital (Harberger, 1988). In this case, it would be necessary to remove all shocks to the growth rate of the capital and output, which can be done by smoothening the series with a Hodric-Prescot filter with $\lambda = 100$. The steady-state growth rate of the capital can be obtained by regressing the log investment on time (Berlemann and Wesselhöft, 2014).

The second method is similar to the previous one. The initial capital stock is calculated by dividing the real fixed investment in the first period I_0 with depreciation rate δ (Ganev, 2005a and 2005b):

$$K_0 = \frac{I_0}{\delta} \qquad (10)$$

The third method for the initial capital calculation is to divide the product of GDP in anchor year and average investment rate for the entire period with the sum of the average growth rate of the GDP and depreciation rate δ (Easterly and Levine, 2001):

$$K_0 = \frac{Y_0 \sum_0^t \frac{(I/Y)}{T}}{\sum_0^t \frac{\Delta Y}{Y} + \delta} \qquad (11)$$

The fourth method for the initial capital calculation requires dividing the real fixed investment in the first period I_0 with the sum of the average growth rate of the investments and depreciation rate δ (Kyriacou, 1991):

$$K_0 = \frac{I_0}{\sum_0^t \frac{\Delta I}{I} + \delta} \qquad (12)$$

We can rewrite the equation (5) and get geometric depreciation method:

$$K_t = (1 - \delta)^t K_0 + \sum_{i=0}^{t-1}(1 - \delta)^i I_{t-i} \qquad (13)$$

The expression (5) implies that some part of the capital stock will have eternal life, i.e. the amortized value of initial capital will never be equal to zero. Our survey requires that capital has to have a finite life, i.e. it will depreciate entirely for a finite number of years. For this reason, we will use a linear depreciation method:

$$K_t = (1 - t\delta)K_0 + \sum_{i=0}^{t-1}(1 - t\delta)I_{t-i} \tag{14}$$

The linear depreciation method will enable a linear reduction of the initial capital, and the value of investments that are made between the initial and the present moment. In this way, the capital stock will be a fully depreciated for $1/\delta$ periods. The current capital stock is the weighted sum of initial capital value, K_0, and intervening investment expenditures, with weights corresponding to their undepreciated components (Burda, et al., 2008).

For the purpose of our analysis, we will use the expression (9) to estimate the initial capital stock, and linear depreciation method to obtain the current capital stock.

For calculating capital stock in the initial period and for estimating the capital stock from period to period, the depreciation rate is of great importance. Here, we assume that the depreciation rate is constant over the period and across countries. We set the depreciation rate at 0.05. In many studies and papers in literature the depreciation rate is set within the range between 0.04 and 0.10 (Vanags and Bems 2005; Griliches, 1980; Nehru and Dhareshwar, 1993; Romer, 1988; Kamps, 2006; Berlemann and Wesselhöft, 2014; Harberger, 1988; Nadiri and Prucha, 1996). The depreciation rate at 0.05 is used by De la Fuente and Doménech (2006), Hernandez and Mauleon (2003) for the economy of Spain, Cororaton (2002) for the Philippines, and Felipe (1997) for a group of countries in East Asia.

4. Empirical data and analysis

We will conduct our analysis on following EU countries for the time period 1995-2016: Austria (Aus), Belgium (Bel), Denmark (Den), Finland (Fin), France (Fra), Germany (Ger), Greece (Gre), Ireland (Ire), Italy (Ita), Netherlands (Net), Portugal (Por), Spain (Spa), Sweden (Swe), and United Kingdom (UK). Variables, their definition and sources are presented in Table 1.

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Table 1: Variables description

Variable	Description	Source
Y	GDP, the chain linked volumes (2005), in millions of euros	EUROSTAT
y	GDP per employee	Authors calculation
I	Gross fixed capital formation, the chain linked volumes (2005), in millions of euros	EUROSTAT
K	Capital stock	Authors calculation
k	Capital/labor ratio	Authors calculation
L	Employment type: Harmonized ILO definition (in millions)	World Economic Outlook Database,
α	Capital share as a percentage of GDP	Authors calculation
β	Labor share: Compensation of employees as a percentage of GDP	EUROSTAT
TFP	Total Factor Productivity	Authors calculation
R&D	Gross domestic expenditure on R&D as a % of GDP	EUROSTAT
OPP	Calculated as a sum of export and import as a percentage of GDP	World Bank national accounts data, and OECD National Accounts data files.
FDI	Foreign direct investment, net inflows (% of GDP)	World Bank national accounts data, and OECD National Accounts data files.
h	human capital investment rate -as proxied by secondary enrolment rate	World Bank national accounts data, and OECD National Accounts data files.
ICT	ICT/non ICT real capital stock ratio	EUROSTAT

We have transformed the data regarding the FDI because some observation for the FDI are negative. The transformation was necessary, because, in our analysis, we use the data in their logarithmic form. The transformation was carried out using the following procedure (Busse and Hefeker, 2007; Ren, et al., 2012):

$$Y = log\left(x + \sqrt{x^2 + 1}\,\right) \qquad\qquad (15)$$

Where Y is the transformed value of FDI and x stands for the initial value of the FDI. We have assessed the capital stock and anchor capital by applying the equations (9) and (14) on investment data. The Belgium is excluded from further analysis due to objective lack of data.

We have calculated the TFP by applying the equation (2). The average value of α is approximately 0.54, and the average value of β is approximately 0.459. The descriptive statistics for TFP, R&D, ICT, FDI, human capital, and openness are presented in Table 2.

Table 2: Descriptive statistics for TFP, R&D, ICT, FDI, and openness (in logs)

	TFP	OPP	ICT	R&D	FDI	h
Mean	1.372474	4.303829	-3.399300	0.523463	1.639568	4.698559
Maximum	1.895809	5.398877	-2.659260	1.363537	5.164162	5.053384
Minimum	0.3496219	3.613829	-4.605170	-0.867501	-2.733828	4.475193
Std. Dev.	0.3465166	0.376657	0.313432	0.504795	1.283988	0.1165512
Observations	286	286	267	278	285	278

Source: Authors calculation

One of the assumptions of the classic OLS requires that explanatory variables are not linearly correlated. The presence of an exact linear correlation between the explanatory variables indicates the problem of multicollinearity. In our case there is no multicollinearity, i.e. there is a very small level of correlation between the explanatory variables. The correlation matrix shows the absence of a linear correlation between the explanatory variables.

Table 3: Correlation matrix (in logs)

	FDI	OPP	ICT	R&D	h
FDI	1.0000				
OPP	0.3977	1.0000			
ICT	-0.0160	-0.1192	1.0000		
RD	0.016	0.292	0.0603	1.0000	
H	0.2471	0.3563	0.1339	0.3483	1.0000

Source: Authors calculation

We continue our analysis with an assessment of the effect of the productivity drivers on the TFP. First, we will test the time series for stationarity. Testing the series of data for stationarity is necessary for two reasons. First, if we apply the static panel on the variables which follow the unit root process, we will have a spurious regression as a result. Second, testing variables for the order of integration will help us to choose an appropriate model for panel analysis. Testing variables for the order of integration was carried out by Im, Pesaran, and Shin test (IPS). The results for unit root tests are presented in Table 4. The detailed results for unit root tests are in the appendix.

Table 4: Unit root test for TFP, R&D, ICT, FDI, human capital, and oppenes (in logs)

Variable	Level	1st difference	I(d)
TFP	No unit root		I(0)
R&D	Unit root	No unit root	I(1)
ICT	Unit root	No unit root	I(1)
FDI	No unit root		I(0)
Openness	No unit root		I(0)
h	Unit root	No unit root	I(1)

Source: Authors calculation

Our goal here is to determine the existence of co-integration between the TFP, on one hand, and the productivity drivers, on the other hand. Because our series does not have the same level of integration, the use of standard co-integration tests are not allowed. Here, we will rely on the results of the relatively new panel ARDL (Autoregressive Distributed Lag) model proposed by Pesaran (1997) and Pesaran and Shin (1999). This model will provide a consistent and effective estimation of both long- and short -term effects, on the basis of panel data series with a different level of integration, lower than I (2), which includes a relatively large number of observation units and time. The ARDL model includes the lagged dependent variable, and it can also include the lagged explanatory variables. The form of the dynamic ARDL (p, q) model was defined by Paseran and Shin (1990):

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} x_{i,t-j} + \mu_i + \varepsilon_{ij} \qquad (16)$$

Where i represents the number of observation units i =1,2,....,N; t represents the number of time instances t =1,2,....,T; x_{it} is vector of independent variables of dimension k ´1; λ_{ij} is coefficient of lagged dependent variable; μ_i is parameter that determines the specific effects of the group or observation unit.

First step in our analysis is to determine the optimal lag for Pooled Mean Group (PMG)-ADRL model. To do so, we will estimate autoregressive distributed lag (ARDL) model for each country in the panel, and then, we will determine optimal lag for each variables for that country based on the Bayesian information criteria (BIC). The optimal lag for PMG-ADRL model is selected as the most common lag for each variable. Optimal lag for all variables is set to 1.

In addition to PMG model, we have also estimated the Mean Group (MG) model, and then, we have used the Hausman test to choose which model is more adequate. The MG estimator estimates the mean of long and short-run coefficients across countries by the unweighted average of the individual country coefficients, which

makes him less informative than the PMG. By using an MG estimator, we cannot obtain a coefficient which is common for each country in the panel, because long and short-run coefficients are country-specific. The PMG estimator was introduced by Pesaran, Shin and Smith (1999), and it allows for long-run coefficients to be common for all countries in the panel. So, this means that the PMG estimator), restricts the long-run slope coefficients to be the same across countries but allows the short-run coefficients (including the speed of adjustment) and the regression intercept to be country-specific. We have estimated five models with different combination of explanatory variables. We have estimated five models because the models which includes a lot of different explanatory variables do not pass specification test (Hessian has become unstable or asymmetric). The results of our analisys for the PMG estimators are presented in Table 5.

The Hausman test reports the p value for Chi-Square statistic at 0.61, 0.35, 0.93, 0.64 and 0.87, respectively for all five models, which implies that the homogeneity restriction is not rejected jointly for all long-run parameters. This confirms that a PMG estimator is more efficient than MG estimator. For this reason, Table 5 contains only the PMG estimators. We compare all five models by log-likelihood criteria, and we conclude that model 1 is better than the other models. According to the log-likelihood criteria, model 1 is just slightly better than model 4. Here, we will apply the Akaike's information criterion and Bayesian information criterion which will enable us to choose the best model.

Table 5: Estimated long run coefficients using PMG ARDL model for evaluation of the existence of co-integration relationship between TFP and productivity drivers (in logs)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Long-run Coefficients					
ICT	0.0950811 ***	0.1091575***			0.1244064***
	(0.0266817)	(0.0213162)			(0.0149308)
R&D	0.0841364 **	0.4772302***	0.5902807***	0.2346918***	0.5313717***
	(0.047987)	(0.053411)	(0.0610128)	(0.0504122)	(0.0331552)
FDI			0.0191521***		0.0101428***
			(0.0052104)		(0.0029771)
h			- 1.093551***	0.1753788***	-0.724348***
			(0.1350851)	(0.0391181)	(0.069101)
OPP		-0.412328***	-0.4192759***		-0.4600276***
		(0.042809)	(0.042383)		(0.0288861)
ECT	-0.3982966 ***	-0.408068***	- 0.2477289 **	-0.360839***	-0.2960148**
	(0.1150139)	(0.1153099)	(0.0958865)	(0.1194723)	(0.1292536)

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Variables	Model 1	Model 2	Model 3	Model 4	Model 5
			Short-run Coefficients		
Δ ICT	-0.0064955	-0.0117654			0.0067605
	(0.0309741)	(0.0299594)			(0.0377807)
Δ R&D	-0.1140146	-0.0179613	-0.0509522	-0.1747626	0.0613922
	(0.1287712)	(0.1335947)	(0.1358471)	(0.2982841)	(0.1481448)
ΔFDI			0.0014513		0.0076899
			(0.0046736)		(0.0097311)
Δ h			-0.0365738	-0.3599339	-0.1243105
			(0.1968467)	(0.2921474)	(0.2787216)
Δ OPP		0.2546442***	0.0548608		0.050424
		(0.0914019.)	(0.1709838)		(0.2225295)
Constant	0.7060294 ***	1.349571 ***	2.001414*	0.1241152***	2.078365**
	(0.2018922)	(0.3925864)	(0.7735208)	(0.0444187)	(0.9074986)
Hausman test	Prob>chi2 = 0.61	Prob>chi2 = 0.35	Prob>chi^2 = 0.9399	Prob>chi2 = 0.64	Prob>chi^2 = 0.87563
Log Likelihood	464.9448	503.2095	511.6984	465.0472	536.9844
Obs.	238	228	244	226	226

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors calculation

According to the Akaike's information criterion, the model 4 is more effective estimator. According to the Bayesian information criterion, the model 1 is more effective estimator. When we analyze the log-likelihood criteria, the Akaike's information criterion, and Bayesian information criterion, we conclude that model 1 is the most efficient estimator. Therefore, based on the Hausman test we accept the PMG estimator as relevant for our analysis, and we will base our conclusion on the PMG estimation of model 1. Detailed analysis of the Akaike's information criterion and Bayesian information criterion is in the appendix.

5. Results and discussion

The goal of our survey is twofold: firstly, to calculate the TFP for the 10 EU countries by applying the two-step model, and secondly, we aim to investigate the existence of the longterm impact of productivity drivers on the TFP, for the selected countries, by using the cointegrating technique. In our research, we have used the most common explanatory variables like human capital, R&D, ICT, FDI, and country trade openness, as main productivity drivers. Investigation of long term

impact of productivity drivers on TFP, by standard econometric tools, requires that all time series have the same level of integration. In our case, some variables are stationary at the level, and some are stationary at the first difference. Therefore, the use of standard co-integration tests such as Pedroni, and Fisher Johansen are not allowed. When time series do not have the same level of integration, econometric theory suggests the application of the relatively new panel ARDL (Auto Regressive Distrubuted Lag) model. This model will provide a consistent and effective estimation of both long- and short -term effects, on the basis of panel data series with a different level of integration, lower than I (2), which includes a relatively large number of observation units and time. In our survey, we have estimated the three models with a different combination of explanatory variables for the PMG and MG estimators. We have chosen the PMG estimation of model 1 based on the Hausman test, the Akaike's information criterion, Bayesian information criterion, and log-likelihood criteria.

In the long run, R&D, and ICT do have a positive and statistically significant impact on the TFP. The positive impact R&D, and ICT on the TFP is in order with empiric literature. And reproducing these results with our methodology was very reassuring. The estimated coefficient for the R&D is 0.0841, which means that an increase of human capital by 1% will lead to increase of the TFP by 8.41%. The increase of ICT by 1% will result in an increase of the TFP by 9.5%. All variables in our target model are statistically significant at 5% (R&D is statistically significant at 5%, and ICT is statistically significant at 1%).

The Error correction term (ECT), has to be negative and not lower than -2 in order to exist a long-run relationship between the variables of interest. For our target model the ECT is negative and statisticaly significant at 1%, which proves existance of the long term relationship between our variables. The coefficient for the ECT is -0.39829, which means that speed of adjustment to the long run equilibrium is almost 40%.

6. Conclusion

This paper analyses TFP trends in thirteen selected EU countries for the period 1995 to 2016. Most of the analysed countries converge around the same level of the TFP. Also obtained results in this paper reveal the existence of a long-term relationship, i.e. cointegration between the TFP on one hand, and R&D, and ICT, on the other hand, confirming the basic hypothesis that there is a long-term and statistically significant relationship i.e. cointegration between the above-mentioned variables. The results of our research are in order with the empiric literature, and reproducing these results with our methodology was very reassuring. Our survey confirms the fact that the strongest impact on the growth of the TFP has the ICT,

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which is emphasized as the most important driver of total factor productivity in selected EU countries. We have confirmed hypothesis of the direct impact of the R&D on the TFP growth rate through enhancement of a firm's innovative potential. The ICT firms are very often considered to have the potential for innovations, which is in order with our results.

The importance of the results of the research is reflected in the identification of the most significant drivers of TFP growth, as well as in determining the magnitude of the impact of all TFP drivers. The results send a clear message to the governments of selected countries that in order to increase economic performance, a special focus needs to be placed on specific policies that encourage investment in R&D and greater use of ICT. During the research, we faced a number of problems, such as poor availability of data and information related to this issue. Due to the aforementioned limitation, future research on this topic should include specific information about measurement of the technology gap (i.e. the distance between the TFP of the country analysed and that of the country with the highest level of efficiency), estimation of the indirect impact of R&D on the TFP growth rate, which can be achieved by increasing the absorptive capacity of firms, and an estimate of the growth rate of TFP at the frontier (i.e. the TFP growth rate of the most efficient country).

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Pokretači ukupne faktorske produktivnosti u odabranim zemljama EU: kointegracijski pristup

Zoran Borović[1], Mladen Rebić[2], Dalibor Tomaš[3]

Sažetak

U ovom radu predstavit ćemo rezultate našeg istraživanja o TFP-u i njegovim glavnim pokretačima. U tu svrhu, naša se analiza temelji na uzorku od trinaest zemalja EU-a za razdoblje od 1995. do 2016. godine. U prvoj iteraciji procijenili smo TFP za odabrane zemlje. Glavni cilj ovog rada je utvrditi postojanje dugoročnog odnosa, tj. kointegracije između TFP-a i njegovih glavnih pokretača. Da bi to učinili, u drugoj iteraciji koristili smo relativno novi model ARDL (Autoregressive Distributed Lag) model koji su predložili Pesaran (1997) i Pesaran i Shin (1999). Dobiveni rezultati u ovom radu otkrivaju postojanje dugoročne veze, tj. kointegracija između TFP-a s jedne strane i istraživanja i razvoja i ICT-a s druge strane, potvrđujući osnovnu hipotezu da postoji dugoročan i statistički značajan odnos, tj. kointegracija između gore navedenih varijabli.

Ključne riječi: *ekonomski rast, ukupna faktorska produktivnost, inovacije, Kob-Daglasova proizvodna funkcija, strane izravne investicije, istraživanje i razvoj, informatičke i komunikacione tehnologije*

JEL klasifikacija: *F20, F21, F23*

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Appendices

Table 6: The result of the unit root tests (in logs)

Variable	Exogenous variables	Method	p Value
TFP	trend	Im-Pesaran-Shin	0.0380
R&D	trend	Im-Pesaran-Shin	0.8572
Δ R&D	trend	Im-Pesaran-Shin	0.0000
ICT	trend	Im-Pesaran-Shin	0.2356
Δ ICT	trend	Im-Pesaran-Shin	0.0000
FDI	trend	Im-Pesaran-Shin	0.0000
OPP	trend	Im-Pesaran-Shin	0.0311
h	trend	Im-Pesaran-Shin	0.8638
Δ h	trend	Im-Pesaran-Shin	0.0000

Table 7: The Akaike's information criterion, and Bayesian information criterion for model 1

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
PMG	238		464.9448	6	-916.6897	-895.8561

Table 8: The Akaike's information criterion, and Bayesian information criterion for model 4

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
PMG	226		465.0472	8	-918.0945	-890.7302

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to read carefully the Guidelines
amended with detailed methodological instructions

GUIDELINES FOR AUTHORS

Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business is an international peer reviewed journal open to scientists from all over the world in different fields of economic theory, economic policy and related research. As a rule, papers are published in English. However, the Journal may publish articles in other world languages.

Editorial procedure

The Editorial Board receives all manuscripts. After reviewing and accepting the manuscripts, Editor-in-Chief subjects them to the members of the Editorial Board for the assessment process, and in case of the specific content of the text, to external experts as well. After evaluation, Editor-in-Chief proposes Editorial decisions for further action including: (a) which manuscript, if necessary, should be returned to the author with suggestions, comments and recommendations for improvement, primarily methodological presentation of research materials, (b) which manuscripts could be sent to peer-review process, (c) which manuscripts should be rejected because of the reasons as follows:

- the subject matter does not meet the required scientific level,
- the article with a similar topic has already been published by the same author,
- the subject matter does not meet the criteria of the Journal, especially if:
  - the content is beyond the concept of scientific publishing orientation of the Journal (distinguished by the relevant databases), and
  - does not meet international scientific and methodological standards that the Journal must comply with.

If an article is not accepted, the Editorial Board sends a notification to the author, but the manuscript is not returned.

If the manuscript is improved adequately, it is sent to two reviewers for extramural review.

If the manuscript is considered for publishing, the author will receive the Authorship Statement (*Copyright Assignment Form*), which should be filled in, signed and returned to the editor. In this way the authors confirm the originality of the article and validity of authorship.

In order to avoid withdrawing the paper until it is published or rejected, by signing the Authorship Statement, the authors assert compliance with the review process.

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Book reviews, reviews on doctoral dissertations, as well as reviews on international conferences and seminars are not submitted to extramural reviews. They are accepted or rejected by the Editor and co-editors.

Review process

All scientific articles submitted for publication in *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business* are double-blind peer review by two academics appointed by the Editorial board: one from Croatia and one from abroad. Reviewers stay anonymous for the authors and so do the authors for the reviewers. The reviewers are asked to apply highest international standards in their assessment of the submitted work. Reviewers receive an article and a *Reviewer Evaluation Form* with instructions how to fill it in. If the article does not fulfill the primary criteria of originality and relevance to the subject, it should not be accepted.

The categories in which articles, if judged positively, might be classified are:

Original scientific paper is a scientific paper that includes new results based on the research. The information given in the article can be verified by:

a) reproducing methodological procedure and obtain the same/similar results or with tolerable degree of mistakes as estimated by the author himself, or

b) repeating the author's observations and judge his analyses, or

c) checking the author's analyses and deduction on which the author's analyses are based.

Preliminary communication is an article that includes at least one or more pieces of scientific information, but does not include the necessary details to check the scientific cognition.

Conference paper is an article that deals with the author's presentation at a conference, and has not been previously published as a full text.

Review article is an article that analyzes a special scientific problem already dealt with in published scientific works, but his approach is original and new.

Professional paper is an article that deals with specific problems in some professional areas.

After receiving the reviews, the Editorial Board will give clear general instructions to the author for further work on the manuscript. The comments and suggestions made by the reviewers should be addressed and closely followed by the author prior to final recommendation on acceptance or rejection made by the Editorial Board.

Only manuscripts with two positive reviews are published.

After completion of peer review and amendment of the text of the accepted articles by the authors and editors, Editor-in-Chief, proposes the sequence of accepted papers in the table of contents.

Criteria for the order are:

(1) categorization according to the degree of scientific excellence,

(2) in case of two different levels of categorization of a particular article by reviewers, Editor-in-Chief proposes a decision to the Editorial Board, and as a rule, in favour of the author, i.e. a higher category,

(3) appreciation of topical issues, authors and common interest of the Journal taking into account the competitiveness at the same level of scientific excellence (category).

In order to increase the quality and number of papers published, the Editorial Board strives to fasten the publishing process by informing the authors on the status of their papers within ten working days of the submission. Provisional deadline for finishing the reviewing process, technical revisions and online publication of the paper shall last no longer than two months. Moreover, as of 2018, the forthcoming papers that will be included within the regular biannual issues are initially published on our Journal's website.

Organization of the manuscript

The manuscript should include the research aim and tasks, with detailed methodology, the research objective, achieved results and findings, conclusions and a list of references.

The authors of the manuscript should conform to the format and documentation requirements that are given below:

The separate page should contain: the article title, the author's full name, academic affiliation (title, institution, scientific field), phone, fax, e-mail address and personal website. If there are more authors than one, full names, respective affiliations and addresses of co-authors should be clearly stated. Authors'academic affiliation should be:

– in the language of the article,
– in Croatian language,
– in English if the original language of the article is other than English.

The first page should contain: the article title, abstract, JEL classification and key words in the language of the article. At the end of the article all data should be also:

– in Croatian language,
– in English if the original language of the article is other than English.

Main body of the text should contain: introduction, headings, footnotes, references in the text, tables, figures, conclusions and references.

Technical requirements

The manuscript submitted for publication should be in Microsoft Office Word (Ver. 95+), with maximum length up to **8,000** words in length (16-20 A4 size pages), printed in font style Times New Roman (12 point), single-spaced, justified and

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without any special styling. Should a word, a phrase or a sentence be highlighted, <u>italic font style can be used and never bold</u>. Paragraphs are divided by double spacing and all margins are at 2.5 cm. In case the paper exceeds the normal length, the Editors' consent for its publication is needed.

JEL classification should be suggested by the authors themselves according to the classification available on the Journal of Economic Literature website: http://www.aeaweb.org/journal/jel_class_system.html.

Footnotes could be used only as an additional explanatory section of the text and should be numbered consecutively in Arabic numerals.

Section headings (from Introduction to Conclusions) must be short, clearly defined and bear Arabic numerals. If there are subsection headings they are outline numbered (e.g. 1; 1.1.; 2.; 2.1.; 2.1.1. etc.)

All *tables and figures* should bear Arabic numerals and must have captions. Tables set in MS Word may be included in the text.

Note: If MS Excel or other programs are used for tables, figures or illustrations, make sure to enclose them as a separate file on disk, separately from the text.

Before submission of the manuscript, the authors of the manuscript are advised to conform to the format and documentation requirements.

Text organization and style

Authors should apply scientific methodology in presenting the contents of their papers complying with the standards of scientific publications ("Harvard style"). This implies the procedure as follows:

(1) Title and the content of the paper:

The title is the most important summary of a scientific article, which reflects the scope of investigation and the type of study. Therefore, the title should not contain words such as "analysis", "methods" and similar.

The content of the paper consists of:

- *Abstract* – below the title
- *Key words*
- *JEL classification.*

It is followed by the main body of the paper divided into sections. The section headings are as follows:

- *Introduction*
- *Literature review*
- *Methodology/method/model/conception of analysis* (the third section)
- *Empirical data (documentation background) and analysis* (the fourth section)
- *Results and discussion* (the fifth section)
- *Conclusions* (the sixth section).

(2) The content of some parts of the material presented:

   a. Abstract – up to 100-250 words must contain:

- purpose and research objective,
- methodology/method/model/conception of analysis,
- main findings and results of research (analysis),
- the underlined conclusion of research.

The abstract should not be written in paragraphs!

   b. Key words should disclose the essence of the article (up to 5 key words).

   c. JEL classification – the author should classify the subject matter of the article according to the code of The Journal of Economic Literature (JEL).

   d. Introduction – defines the problem and the subject matter of the research referring to recent bibliography and findings. However, these can more specifically be dealt with in the second section *Literature review*. The last part of the introduction is reserved for setting the hypothesis of the research that will be later on analyzed at the beginning of the conclusions. Finally, Introduction ends up by giving clues of the organization of the text.

   e. Literature review – precedes a research section providing readers with a cutting-edge context of the referential literature dealing with crucial points of current knowledge based on the relevant results of the current research. Literature review should be a synthesis of previous research, justifying the theoretical and empirical contributions of the respective paper, a not a simple listing of previous scientific contributions.

   f. Methodology/method/model/conception of analysis – usually in the third section of the paper, methodology/method/model/conception of the analysis should be transparently presented and pointed out in case of the research results being subjected to re-testing by interested researchers (it is one of the fundamental principles of the scientific methodology).

   g. Empirical data and analysis – contain documentation background and the results of the empirical analysis. The data sample shall be elaborated and the obtained results shall be explained based on statistical and econometric features, and their economic meaning.

   h. Results and discussion – explain the results, especially their economic significance and messages. In this section, the author(s) need to elaborate how their results and conclusions contribute to the scientific field and provide practical implications and recommendations.

   i. Conclusions – is not supposed to be a summary! Conclusions are the author's original thoughts and evaluation of the obtained results including the items as follows:

- Explanation of the working hypothesis – proved or not proved.
- Assessment of the results of research/analysis with the focus on what can be classified as a new contribution to economic science.
- Attention drawn to research limitations and problems.

- Guidelines to future research.
- Assessment of institutional-systemic implications of the results obtained by the research (suggestions and recommendations for direction or changes of economic system, economic and financial policy, development policy, instruments, measurements or similar).

It is recommended not to write conclusion in paragraphs.

(3) References should include only the titles (sources) that have been referred to and quoted in the paper.

TABLES should be included in the text in order to present the exact values of the data that cannot be summarized in a few sentences in the text. Each column heading for numerical data should include the unit of measurement applied to all data under the heading. Large numbers can be expressed in smaller units with appropriate column headings (in thousands, millions, etc), and logical presentation of data using table grid option in MS Word for table lines (both vertical and horizontal). Each table should be self-explanatory, bearing Arabic numerals (e.g. Table 1, Table 2, etc.) with an adequate title (clearly suggesting the contents) and the source of the data should be stated below the table, if other than author's.

FIGURES (*GRAPHS, DIAGRAMS, ILLUSTRATIONS*) should also be included in the text. They should be numbered in sequence with Arabic numerals, followed by the figure title, and the legend to the figure that contains all the necessary explanations of symbols and findings. The source of the data presented in the figure should be stated below the figure if other than author's.

Note. The text should not simply repeat the data contained in tables and figures, i.e. the text and the data in tables and figures should be related in the text by means of reference marks.

REFERENCES. The ISI citations should be followed by all authors of *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/ Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business* (please, refer to http://www.isinet.com) and references to other publications must be in Harvard style. At each point in the text that refers to a particular document, insert the author's surname and publication year in brackets: (Rowley, 1996) or (Cutler and Williams, 1986), or in the case of more than two, the first author (from the title page) followed by "et al." (Matlock et al., 1986). If the author's name is repeated no ibid is used but his surname is repeated. If the author's name occurs naturally in the text, the year follows in the brackets: <u>*The work of* S*tevens (2001) was concerned with what they teach at Harvard Business School.*</u> In case of direct quotations the page numbers should be added, e.g. (Jones, 1995: 122–123).

At the end of the article a list of references is organized alphabetically as follows:

- **Books:** Surname, Initials (year) *Title,* Place of publication: Publisher. See example:

Callicott, J. B. (1994) *Earth's Insights: A* S*urvey of Ecological Ethics from the Mediter-ranean Basin to the Australian Outback,* Berkeley: University of California Press.

If there are <u>two or three authors</u> you put down their surnames followed by initials:

Ridderstråle, J., Nordström, K. (2004) *Karaoke Capitalism Management for Mankind,*
    Harlow: Pearson Education Ltd.

If there are <u>multiple authors (four or more)</u> the first author's surname (from the title
page) is followed by et al.:

Norton, M. B. et al. (1981) *A People and a Nation – A History of the United States,*
    Boston: Houghton Mifflin Company.

• **Journals:** Surname, Initials (year) "Title", *Journal,* Volume, Number, pages. See
example:

Kostelich, E. (1995) "Symphony in Chaos", *New Scientists,* Vol. 146, No. 1972, pp. 36–39.

Fox, S. (1994) "Empowerment as a Catalyst for Change: An Example from the
    Food Industry", *Supply Chain Management,* Vol. 2, No. 3, pp. 29–33.

If there are <u>multiple authors (four or more)</u>, the first author's surname (from the title
page) is followed by et al. See example:

Di Noia, C. et al. (1999) "Should Banking Supervision and Monetary Policy Tasks be
    Given to Different Agencies?", *International Finance*, Vol. 2, No. 3, pp. 285–361.

If there are <u>multiple works by the same author published in the same year</u>, the "a, b,
c" is used after the year. See example:

Quah, D. T. (1993a) "Empirical Cross-section Dynamics in Economic Growth",
    European Economic Review, Vol. 37, No. 2–3, pp. 426–434.
---------- (1993b) "Galton's Fallacy and Tests of the Convergence Hypothesis",
    Scandinavian Journal of Economics, 95, Vol. 95, No. 4, pp. 427–443.
---------- (1994) "Exploiting cross Section Variation for Unit Root Inference in
    Dynamic Data", *Economics Letters*, Vol. 44, No. 1–2, pp. 9–19.
---------- (1996a) "Empirics for Economic Growth and Convergence", *European
    Economic Review*, Vol. 40, No. 6, pp. 951–958.
---------- (1996b) "Regional Convergence Clusters across Europe", *European
    Economic Review*, Vol. 40, No. 6, pp. 951–958.

The author should provide **Digital Object Identifier (DOI)** for each reference that
can be found whether it exists at CrossRef http://www.crossref.org/ and DOI
appears in the form such as https://doi.org/10.5468/ogs.2016.59.1.1.

DOI is inserted by the author at the end of references as shown in the example as
follows:

Hall, J.K., Daneke, G.A., Lenox, M.J. (2010) "Sustainable Development and
    Entrepreneurship: Past Contributions and Future directions", Journal of Business
    Venturing, Vol. 25, No. 5, pp. 439–448, https://doi.org/10.1016/j.jbusvent.2010.
    01.002.

• **Internet sources:** Author's/editor's surname (year), "Title of the article", *Title of
the journal* [type of medium], date of publication, volume number, pagination or
online equivalent, <availability statement> [date of accession if necessary]:

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Martin, C.L. (1998) "Relationship Marketing: a High-Involvement Product Attribute Approach", *Journal of Product and Brand Management* [Internet], Vol. 7, No. 1, pp. 6–26. Available at: <http://www.apmforum.com/emerald/marketing-research-asia.htm> [Accessed: October 3, 2002]

• **Chapter/section from a book of collected writings:** Author of the chapter/section (year of publication) "Title of the Chapter/section". In Author/editor of collected work, *Title of collected works,* Place of publishing: Publisher. Example:

Porter, M.A. (1993) "The modification of method in researching postgraduate education". In Burges, R.G. ed., *The research process in educational settings: ten case studies,* London: Falmer.

• **Conference papers from conference proceedings:** Author of the conference paper (year of publication) "Title of the conference paper". In *Title of conference proceedings.* Place of publication: Publisher, pagination of section referred to:

Fedchak, E. & Duvall, L. (1996) "An engineering approach to electronic publishing". In *Proceedings of the International Workshop on Multimedia Software Development,* 25–26 March, Berlin, Los Alimos, Ca: IEEE Comput. Soc. Press, pp. 80–88.

• **Theses and dissertations:** Author's name (year) *Title of doctoral dissertation,* the name of the awarding institution:

Whitehead, S.M. (1996) *Public and private men: masculinities at work in education management,* PhD thesis, Leeds Metropolitain University.

• **Official publications:** Title of publication/organisation/institution (year) *Title*, Place of publishing: Publisher. Example:

Department of the Environment (1986) *Landfilling wastes,* London: HMSO (*Waste management paper, 26*).

Guidelines for other publications

The Journal reserves the main printing space for scientific articles accepted from scientists all over the world. However, the other part is devoted to reviews of scientific achievements, which are classified by the editorial board as follows:

• **Book review.** A brief overview of the book is written in a clear and concise manner evaluating the structure, style and scientific achievements of a particular book. It starts with the title of the book, and the main data: the author's name, academic affiliation, title of the book, subtitle (if any), year of publishing, publisher, volume (including number of pages), type of publication (hardcover or paperback), language, ISBN and the author's contact address (e-mail address). If there are more authors than one, full names, respective affiliations and addresses of co-authors should be clearly stated. At the end of the text it is written "Reviewed by" stating the reviewer's name, academic title and affiliation. In addition to the book review, the copy of the cover page of the book is submitted.

• **Review on Doctoral Dissertations.** It starts with the following data: the name of the author of PhD dissertation, author's affiliation (institution he or she works for), the title of the PhD dissertation, the names of the members of the committee in charge, their affiliation, the date when the PhD dissertation was defended including the name of the awarding institution, and in which field of science has PhD been granted. The review evaluates the structure, style, research methodology and results. It analyzes theoretical and practical contribution to a particular scientific field, and implications for further research. At the end of the review, there is the reviewer's name, academic title and affiliation.

• **Reviews on International Conferences and Seminars.** It starts with the following data: title of the conference (seminar), organizer(s), date of the conference (seminar), venue, language, the name and e-mail address of the contact person, conference/seminar websites, and how, when and where conference material will be published and can be obtained (i.e. selected and reviewed conference papers). The review should provide a clear and comprehensive overview of the main objectives of the conference, mentioning the keynote speaker(s), participants' panel discussion on scientific achievements, research findings and suggestions for further research and pressing questions in need of answer. The reviewer's name is stated at the end of the text with his or her academic title and affiliation.

• **In Memoriam.** It is a short text (not longer than 1 A4 page) written in memory of a scientist or special contributor and his works. The author's name is stated at the end of the text with his or her affiliation.

• **Letters to the Editor.** Special section is available for comments, opinions and suggestions by readers, authors and other contributors.

Other important notes

If the author of the manuscript does not conform to the primary format and documentation requirements that are given in the instructions, editors reserve the right to reject the article, or adapt it to comply with the Journal standards, providing other acceptance criteria are fulfilled.

Therefore, avoid complex formatting; the text will be styled according to the Journal design specifications.

The editorial board makes the final decision on acceptance criteria and priority order in the table of contents.

The authors receive one copy of the journal in which their articles are published.

The author(s) should register via (https://orcid.org/signin) in order to obtain an ORCID identifier. The ORCID identifier is a researcher's unique and permanent identifier which allows for better visibility and interoperability of wide range of information systems.

Publisher does not charge "submission fee". If the paper is accepted for publication, the author receives notification on paying publishing fee (285 EUR) and should pay it prior to the publication of the paper. The author is obliged to cover bank charges.

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Proofreading

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An article submitted to the journal should be authentic and original contribution of the author and should have neither been published before nor be concurrently submitted to any other journal as to avoid double publication.

Once the article has been accepted for publishing, the author commits him/herself not to publish the same article elsewhere without the Editorial Board's permission. In the event that the Editorial Board gave permission for publication in another journal, it should be stated that the article has previously been published in the journal *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/ Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business*.

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Electronic submission of the manuscript should be accompanied by the author's cover letter containing: the article title, the author's full name, academic affiliation (title, institution, scientific field), phone, fax, e-mail address and personal website. If there are more authors than one, full names, respective affiliations and addresses of co-authors should be clearly stated. Authors'academic affiliation should be:

– in the language of the article,
– in Croatian language,
– in English if the original language of the article is other than English.

The address is: zbornik@efri.hr.

More detailed information on the *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business* can be obtained on the website of the Faculty of Economics University of Rijeka: http://www.efri.uniri.hr/en/proceedings.

EDITORIAL BOARD

Uredništvo skreće pozornost autorima
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detaljnom metodologijom organizacije teksta

UPUTE AUTORIMA

Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business međunarodno je recenziran časopis, otvoren za suradnju znanstvenicima iz cijelog svijeta iz različitih područja ekonomske teorije i prakse. Tekstovi se objavljuju, u pravilu, na engleskom jeziku. Međutim, časopis može objavljivati tekstove i na ostalim svjetskim jezicima.

Politika uređivanja

Uredništvo zaprima sve rukopise. Glavni i odgovorni urednik tekstove, nakon pregleda i prihvaćanja, upućuje u postupak prosudbe ("assessment process") članovima Uredništva, ali i ekspertnim stručnjacima izvan Uredništva u slučaju specifičnog sadržaja teksta. Poslije prosudbe, glavni i odgovorni urednik predlaže Uredništvu odluke za daljnji postupak i to: (a) koje se rukopise, u slučaju potrebe, vraća autoru sa sugestijama, preporukama i primjedbama radi poboljšanja, prije svega, metodološke prezentacije građe istraživanja; (b) koje rukopise uputiti u postupak recenzija ("reviewing process"); (c) koje rukopise odbiti, budući da:

- tema ne zadovoljava zahtijevanu znanstvenu razinu;

- autor je članak sa sličnom temom već objavio;

- tema ne ispunjava kriterije časopisa, osobito ako je:
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Ukoliko članak nije prihvaćen Uredništvo autoru šalje obavijest, ali rukopis se ne vraća.

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Prikazi knjiga, doktorskih disertacija, međunarodnih konferencija i drugih znanstvenih skupova ne podliježu recenziji. Uredništvo odabire i uređuje prikaze koji su relevantni za objavljivanje u časopisu sukladno koncepciji uređivačke politike.

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Svi znanstveni članci obvezno se recenziraju. Za svaki članak predviđena su dva recenzenta, jedan iz inozemstva i jedan iz Hrvatske, a oba su anonimna. Imena autora također su za recenzente anonimna. Recenzenti pišu recenziju prema dobivenim uputama i na propisanom formularu. Ukoliko članak, prema stajalištu recenzenta, ne udovoljava međunarodnim standardima i kriterijima časopisa, Uredništvo članak ne prihvaća. Ukoliko pak recenzent članak pozitivno ocijeni, može ga kategorizirati u jednu od kategorija vrsnoće:

Izvorni znanstveni članak (Original scientific paper) je originalno znanstveno djelo u kojem su izneseni novi rezultati fundamentalnih ili primijenjenih istraživanja. Informacije iznesene u članku potvrđuju da je moguće:

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Izlaganje sa znanstvenog skupa (Conference paper). Može biti objavljeno samo kao cjeloviti članak koji je prethodno referiran na znanstvenom skupu, a u obliku cjelovitog članka nije objavljeno u zborniku skupa.

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- *Ključne riječi*
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- metodu/model/koncepciju analize,
- glavni rezultat istraživanja (analize),
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g. Empirijski podaci i analiza – sadržavaju dokumentacijsku podlogu i rezultate empirijske analize. Potrebno je opisati i prikazati uzorak podataka korišten u analizi te prezentirati i objasniti statistička te ekonometrijska obilježja dobivenih rezultata uz tumačenje njihova ekonomskog sadržaja.

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Perišin, I., Šokman. A., Lovrinović, I. (2001) *Monetarna politika,* Pula: Sveučilište u Rijeci, Fakultet ekonomije i turizma "Dr. Mijo Mirković".

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---------- (1994) "Exploiting cross Section Variation for Unit Root Inference in Dynamic Data", *Economics Letters*, Vol. 44, No. 1–2, pp. 9–19.

---------- (1996a) "Empirics for Economic Growth and Convergence", *European Economic Review*, Vol. 40, No. 6, pp. 951–958.

---------- (1996b) "Regional Convergence Clusters across Europe", *European Economic Review*, Vol. 40, No. 6, pp. 951–958.

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Hall, J. K., Daneke, G. A. Lenox, M. J. (2010) "Sustainable Development and Entrepreneurship: Past Contributions and Future directions", Journal of Business Venturing, Vol. 25, No. 5, pp. 439–448, https://doi.org/10.1016/j.jbusvent.2010.01.002.

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Martin, C.L. (1998) "Relationship Marketing: a High-Involvement Product Attribute Approach, *Journal of Product and Brand management*, Vol. 7, No. 1, pp. 6–26, //http:www.apmforum.com/emerald/marketing-research-asia.htm [pristupljeno: 3. 10. 2002]

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