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# REQUEST FOR APPROVAL OF THE PhD THESIS TOPIC

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| 1. TITLE OF THE PROPOSED TOPIC |
|---|
| 1.1. Croatian |
| Važnost simetričnih šokova za monetarnu politiku u valutnoj uniji |
| 1.2. English |
| Importance of symmetric shocks for monetary policy in a currency union |
| 1.3. Area/field |
| Društvene znanosti |

| 2. PROPOSED OR POTENTIAL SUPERVISOR(S) | | |
|---|---|---|
| 2.1. Supervisor(s) | | |
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*Minimal general criteria for supervisor selection:*

- *has to hold a PhD degree and be awarded a scientific rank,*
- *has to have at least two years of postdoctoral experience,*

- *has to have a lead (co-lead or partner) position in a national or international project, or in some other way be able to ensure support for scientific research,*
- *has to satisfy the minimal criteria of excellence.*

*If the supervisor is not an employee of the University of Rijeka, a co-supervisor from the University's constituent unit implementing the postgraduate study programme is assigned to the PhD candidate.*

2.2. Co-supervisor

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## 3. TOPIC OUTLINE

3.1. Summary in Croatian
*(no more than 4000 characters with spaces)*

Ulazak u monetarnu uniju i odricanje od vlastite monetarne politike (i valute) grupi zemalja ili regija može donijeti značajne koristi poput povećane cjenovne transparentnosti, ali i eliminiranja transakcijskih troškova te volatilnosti vezanih uz devizni tečaj. S druge strane, gubitak vlastite stabilizacijske politike predstavlja trošak koji će biti blaži ukoliko su zemlje ili regije koje tvore uniju izložene sličnim (simetričnim) makroekonomskim šokovima. Relativna važnost simetričnih šokova stoga je ključna odrednica neto koristi članstva u monetarnoj uniji.

Dominacija simetričnih šokova ključna je pri određivanju ovih troškova kako za postojeće članice monetarne unije, tako i za zemlje kandidate koje tek razmatraju optimalno vrijeme ulaska u europodručje, kao i za zemlje u znatno ranijoj fazi integracije, poput zemalja Zapadnog Balkana. U slučaju kada su poslovni ciklusi zemalja kandidata dovoljno sinkronizirani s poslovnim ciklusom europodručja, troškovi napuštanja vlastite valute i monetarne politike bit će niži.

U disertaciji razvijam metodološki okvir kojim se može pratiti relativna važnost simetričnih u odnosu na asimetrične šokove te potom procjenjujem troškove odricanja od vlastite monetarne politike kroz prizmu usklađenosti šokova. Analizu provodim najprije na razini pojedinih zemalja članica europodručja, a zatim i na granularnim, regionalnim podacima. Regionalna perspektiva usklađenosti ciklusa važna je iz razloga što se zajednička monetarna politika može nejednoliko prenositi unutar pojedinih zemalja i tako izazvati heterogene regionalne reakcije, čak i unutar zemalja koje su na nacionalnoj razini dobro sinkronizirane s europodručjem kao cjelinom i kojima zajednička politika u prosjeku odgovara. No, visok stupanj takve agregatne sinkronizacije poslovnih ciklusa na nacionalnoj razini može prikriti heterogenost unutar zemlje, uzrokovanu, primjerice, kombinacijom manjeg broja regija s natprosječnom i velikog broja regija s ispodprosječnom razinom usklađenosti sa zajedničkim ciklusom. Osim navedenih analiza za postojeće članice europodručja, koristeći razvijenu metodologiju temeljenu na važnosti simetričnih šokova, ocjenjujem i usklađenost šokova šest zemalja Zapadnog Balkana s onima u europodručju, a time i njihovu spremnost za zajedničke europske politike iz perspektive poslovnih ciklusa.

Disertacija se sastoji od tri zasebna akademska rada koji se temelje na empirijskim procjenama važnosti simetričnih šokova za provođenje i učinkovitost monetarne politike u monetarnoj uniji – za postojeće zemlje članice, regije unutar zemalja te naposljetku za zemlje Zapadnog Balkana.

Prvi rad analizira važnost (a)simetričnih šokova kod članica europodručja na razini pojedine zemlje. U radu se, po prvi put u literaturi, za svaku zemlju članicu europodručja ocjenjuje relativna važnost simetričnih u odnosu na asimetrične šokove, ali i šokova potražnje u odnosu na šokove ponude. Ovi rezultati imaju

implikacije na vođenje monetarne politike budući da je za središnju banku u monetarnoj uniji ključno razumjeti vrstu šokova koji pogađaju pojedinu zemlju i uniju u cjelini. Mogućnost uspješne stabilizacije gospodarstva koristeći se alatima monetarne politike, naime, raste u slučaju kada uniju pretežno pogađaju simetrični šokovi potražnje. Osim toga, dekompozicija na doprinose pojedinih šokova može poslužiti i kao input za konstrukciju indeksa optimalnog valutnog područja te za procjenu primjerenosti zajedničke monetarne politike za svaku zemlju članicu. Konačno, dobivenim dekompozicijama možemo i testirati raste li učestalost simetričnih šokova u zemlji nakon usvajanja eura kako sugerira hipoteza endogenosti optimalnog valutnog područja Frankela i Rosea (1998).

Drugi rad bavi se asimetričnim šokovima na regionalnoj razini budući da postoje bitne heterogenosti među regijama unutar članica europodručja koje također mogu otežati sposobnost središnje banke da stabilizira uniju kao cjelinu. Primjerice, relativno visoka važnost simetričnih šokova na razini zemlje može biti postignuta u vrlo različitim uvjetima: primjerice, u slučaju da su sve regije dobro usklađene s europodručjem kao cjelinom, ali i kada je mali broj regija iznimno dobro (natprosječno) usklađen s ukupnim europodručjem dok je većina regija nekorelirana s kretanjima u europodručju kao cjelini. U potonjem slučaju, veći dio te zemlje, u suštini, nije zadovoljan zajedničkom politikom. Kako bismo bolje razumjeli važnost regionalne dinamike za ukupnu sinkronizaciju poslovnih ciklusa unutar monetarne unije i transmisiju zajedničke politike, u ovom radu analiziram regionalne poslovne cikluse zemalja europodručja i raščlanjujem ih na regionalnu, nacionalnu i zajedničku dinamiku (na razini europodručja). Na taj način možemo steći dodatan uvid u prikladnost zajedničke politike za pojedinu zemlju i regiju – ona, naime, ne mora biti istovjetna i ovisi o kombinaciji šokova koja generira regionalne cikluse.

Konačno, treći rad proučava cikličku usklađenost između europodručja i zemalja Zapadnog Balkana. Zapadni Balkan obuhvaća šest zemalja Jugoistočne Europe - Albaniju, Bosnu i Hercegovinu, Kosovo, Crnu Goru, Sjevernu Makedoniju i Srbiju - koje čine geografsku enklavu okruženu članicama EU (Grčka, Bugarska, Rumunjska, Hrvatska, Slovenija). Budući da su dvije zemlje Zapadnog Balkana (Kosovo, Crna Gora) jednostrano već usvojile euro kao zakonsko sredstvo plaćanja, Bosna i Hercegovina održava sustav valutnog odbora vezan uz euro, dok druge zemlje održavaju devizni tečaj usko povezan s eurom, te zemlje već "uvoze" stabilizacijsku politiku europodručja i efektivno su već i eliminirale mogućnost korištenja neovisne monetarne politike kao instrumenta za postizanje makroekonomske stabilnosti. Kako bih procijenio troškove napuštanja autonomne politike, u ovom radu detaljno analiziram relativnu važnost simetričnih šokova europodručja u odnosu na lokalne, nacionalne šokove za zemlje Zapadnog Balkana te tako ispitujem spremnost za napredovanje u procesu integracije kroz prizmu korelacije poslovnih ciklusa.

3.2. Summary in English

*(no more than 4000 characters with spaces)*

It is well known that when a set of countries or regions forgo their sovereign currency and independent monetary policy to form a monetary union, important gains in terms of economic integration may be attained, as exchange rate-related transaction costs and volatility are eliminated and price transparency is enhanced. The costs of lost monetary independence will, however, be attenuated if the various countries or regions forming the union are subject to broadly similar or symmetric macroeconomic shocks. The relative importance of symmetric shocks is, therefore, a key determinant of the net benefits of a monetary union for its members, as it directly affects the appropriateness of common monetary and macroeconomic policies over time.

These same premises determine the net benefits for a single country in joining an established and ongoing monetary union, as is the case for candidate countries considering the best timing for joining the euro area or the Western Balkans that are currently at a much earlier stage of integration. If the candidate countries'

business cycles are sufficiently synchronized with those of the euro area, the costs of giving up their sovereign currency and monetary policy should be of lesser concern.

In my thesis I develop a framework to track the relative importance of symmetric versus asymmetric shocks and use that framework to study the costs of foregoing their own policy for euro area members at both country and regional levels. The regional perspective can be important, as common policies may transmit unevenly within countries and generate heterogeneous regional responses even within otherwise well-synchronized cycles between countries. Moreover, a high degree of aggregate business cycle synchronization at the country level may mask underlying heterogeneity, reflecting a combination of regions with above-average and below-average synchronization with the common cycle. I also, for the first time in a unified framework, evaluate the readiness of six Western Balkans countries for common European policies from a business cycle perspective.

My thesis consists of three separate academic papers. Taken together, the three papers provide a unified empirical assessment of the importance of symmetric shocks for the conduct and effectiveness of monetary policy in a currency union - across existing member countries, candidate countries, as well as regions within countries.

The first paper studies the importance of asymmetric shocks in euro area members at the country level. The most important result of this paper is to provide, for the first time, a rigorous shock accounting exercise to evaluate the relative importance of common symmetric versus asymmetric and demand versus supply shocks for each country. For a central bank in a monetary union, it is crucial to understand the type of shocks hitting each country and the union as a whole: the potential to stabilize the economy is larger when the union is dominantly being hit by symmetric demand shocks. In addition, this decomposition may serve as a basic building block to construct the Optimum Currency Area index for the euro area, assess the appropriateness of common monetary policy for each member country and, finally, evaluate whether the incidence of symmetric shocks in a country increases ex-post to euro adoption, as advocated by the OCA endogeneity hypothesis of Frankel and Rose (1998).

The second paper addresses asymmetric shocks at the regional level, recognizing that there exist some important heterogeneities across regions within euro area members that may also complicate the ability of the central bank to stabilize the union as a whole. For example, relatively high importance of symmetric shocks at the country level may be achieved in very different environments: when all regions are well aligned with the euro area as a whole, but also when a small number of regions is exceptionally well (above-average) aligned with the total euro area while the majority of regions is poorly integrated with the union. In the latter case, most of that country is thus unhappy with the common policy. To understand the importance of regional dynamics for overall synchronization of business cycles within the monetary union and transmission of common policy, I analyze regional business cycles of the euro area countries and break them down into regional, country-specific, and common euro area dynamics. Such a decomposition may then serve to better understand the satisfaction of each region with common policy as relative importance of symmetric euro area shocks at country level and regional level need not to be the same.

Finally, the third paper systematically studies cyclical coherence between the euro area and the enlargement countries of the Western Balkans. The Western Balkans comprises six Southeast European countries - Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia - and forms a geographic enclave of non-EU territories surrounded by EU members (Greece, Bulgaria, Romania, Croatia, Slovenia). As two Western Balkan countries (Kosovo, Montenegro) unilaterally adopted the euro as legal tender, Bosnia and Herzegovina maintains a currency board pegged to the euro, while others keep their

exchange rate tightly related to the euro, these countries already "import" stabilization policy from the euro area and have eliminated the use of independent monetary policy as a tool for macroeconomic stability. To evaluate the costs of foregoing autonomous policy, I study the relative importance of symmetric euro area versus country shocks for the Western Balkans and address the readiness to progress with the integration process through the lens of business cycle correlation.

3.3. Introduction and overview of previous research
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Monetary policy in a currency union - the euro area, for example - faces important challenges whenever individual member countries are driven by different combinations of economic shocks and, consequently, follow divergent business cycle paths. The literature on Optimum Currency Area theory (OCA) has long recognized how the dominance of symmetric shocks over asymmetric ones, which should align business cycles of euro area member countries, is arguably a crucial prerequisite for the effective functioning of the euro area as a monetary union. Only when business cycles of individual countries are well synchronized with the aggregate euro area cycle does a common one-size-fits-all monetary policy, usually based on steering interest rates, have the potential to stabilize each member country successfully (see, for example, Belke et al., 2017, or Alesina et al., 2002). Indeed, two countries with very different cyclical positions - assume that one is in a deep recession and another in an expansion - cannot be stabilized easily using the same monetary policy action. Similarity of shocks among countries - a meta or "catch-all" OCA property - is most often measured by correlations between identified shocks, as proposed in the highly influential work by Bayoumi and Eichengreen (1992). I would argue that correlation of shocks as a measure, even though intuitive and easy to calculate, proves insufficient to capture complex shock propagation mechanisms across different economies. In addition to similarity of shocks, OCA properties of country groups may also be evaluated more directly using specific OCA indices, as proposed by Bayoumi and Eichengreen (1997, 1998) and subsequently used in numerous applications; see Horvath et al. (2003), Skorepa (2013), Vieira and Vieira (2012), and Frydrych and Burian (2017). Existing methods, however, are focused on the relationship between a country's nominal exchange rate volatility and various OCA criteria. For that reason, they seem well-suited to evaluate the costs of abandoning monetary and exchange rate policies for countries outside the monetary union, but less so to monitor OCA features of an existing monetary union such as the euro area. Constructing a tractable index of similarity between shocks among countries - an OCA index - in a monetary union is therefore an additional important gap in the related literature that my thesis is going to address.

The OCA properties of the euro area, as explained before, are usually investigated from a country perspective. There is, however, some important heterogeneity across European regions that, arguably, may additionally complicate the conduct of one-size-fits-all monetary policy. To illustrate the concept, let us consider the case where only a handful of individual regions within a country is exceptionally well synchronized with the euro area cycle (and thus "happy" with the common policy), while, at the same time, the country as a whole can be highly synchronized with the total euro area. Thus, while a one-size interest rate may indeed "fit all" at the country level, it actually "fits almost none" at a more granular (regional) level, making the common policy hardly desirable for most in that country. In other words, policies that aim to stabilize the euro area at the aggregate level may, in fact, have dominantly destabilizing effects at a lower level of aggregation. In order to address the possibility that regional differences in business cycles within the euro area may indeed make a common policy less desirable than suggested by country-level analysis alone, I develop a structural model to evaluate the relative importance of country versus regional versus common euro area shocks driving regional cycles. The model equations have a state space representation that may be estimated in a two-step procedure: the first step consists of common Gibbs sub-steps for linear

regression models and vector autoregression; see, e.g., Koop et al. (2007) and Kilian and Lütkepohl (2017). The second step relies on the algorithm of Carter and Kohn (1994) with modifications as in Kim and Nelson (1999) to account for a singular covariance matrix in the state equation.

So far, the related literature has attempted to separate regional versus country and common shocks in the euro area only once; see Beck and Okhrimenko (2024). There are two important details of that work I address in my thesis. First, it relies on a simple dynamic factor model, similar to those in Kose et al. (2003), Belviso and Milani (2006), or Jackson et al. (2018), to separate regional, country, and common dynamics, but that specification is not structural and therefore cannot evaluate the impact of aggregate demand, supply, or, most importantly, monetary policy shocks on each European region. In my application, I estimate, for the first time, a structural dynamic factor model for regions in the euro area and identify structural demand, supply, and monetary policy shocks to evaluate their impact on regional activity and study the heterogeneity across regions. Structural shocks are identified using a set of sign and zero restrictions on impulse response functions, as in Arias et al. (2018). The second detail from Beck and Okhrimenko (2024) I investigate in detail is the finding that the relative importance of common shocks strongly decreases during the most recent period. I challenge that finding and test the hypothesis that regions in the euro area are increasingly more strongly affected by symmetric shocks.

Finally, the concept of similarity of shocks is not only relevant for the existing members of the union but also for the Western Balkans - Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia - potential future members still in relatively early stages of the accession process. These countries all have a perspective to accede to the European Union but, importantly, already use the euro (Montenegro and Kosovo) or have exchange rates tightly related to the euro and thus import stabilizing policies from the euro area. My thesis measures, for the first time using a novel and unified framework based on structural Bayesian VAR models, the level of coherence between the Western Balkans and the euro area and, for comparison purposes, compares that to the similarity observed in a typical small EU member. So far, Hildebrandt and Moder (2015) studied the cyclical coherence between the Western Balkans and the EU using simple correlation coefficients and found that although the degree of synchronization had been low or even negative before 2000, business cycles have clearly converged ever since. Gouveia (2014) found that there is a tendency for an increase in the degree of synchronization with the EMU for all Balkan countries. In my analysis, I provide some fresh evidence on business cycle convergence between the Western Balkans and the EU. Although the synchronization of underlying shocks is arguably a necessary, but unlikely a sufficient, precondition for successfully joining the European integrations, it is important to understand the level of cyclical similarity between the Western Balkans and the euro area.

Therefore, a unified assessment of exposure to symmetric shocks (similarity of shocks) is essential for evaluating the appropriateness and effectiveness of a common monetary policy, both for countries that are already members of a monetary union, for prospective members, and for regions within countries, especially where substantial regional heterogeneity exists. So far, the literature has not offered a comprehensive quantitative framework for tracking the relative importance of symmetric versus asymmetric shocks for euro area countries that could be used for monitoring the potential of common monetary policy to stabilize the euro area as a whole. This is a gap I try to address in my thesis.

### 3.4. Research aim and research hypotheses
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The main objective of my thesis is, first, to develop a unified framework to measure and track the relative importance of symmetric versus asymmetric shocks for existing and potential members of the euro area

and, second, by using that framework, to better understand the possible costs of foregoing their own policies. Each of the three papers has its own aims and hypotheses:

**Research aim (Paper 1):** To evaluate the relative importance of symmetric versus asymmetric shocks across euro area members ("at the country level"). Such a decomposition may provide important information about an individual country's satisfaction with being in a currency union, as it becomes increasingly difficult for common monetary policy to stabilize union members when their business cycles are dominantly driven by asymmetric shocks.

**Research hypothesis (Paper 1):** Co-movement between euro area members is time-varying and can be highly disrupted in the case of local European crises, which makes common monetary policy less efficient in stabilizing euro area member countries.

**Research aim (Paper 2):** To evaluate the relative importance of common euro area versus country versus regional drivers of regional business cycles in the euro area (165 NUTS 2 regions of 11 euro area countries). In an extreme case where a country may be highly synchronized with the rest of the union in aggregate but, at the same time, none of its regions is synchronized, no regions would be happy with the common monetary policy. It is therefore important to better understand drivers of regional business cycles in a currency union.

**Research hypothesis (Paper 2):** Regional business cycles have very different relative importance across different euro area member states, which may affect the conclusions of cross-country synchronization based on country-level data.

**Research aim (Paper 3):** To study the readiness of the Western Balkans for common stabilization policies through the lens of the shock similarity principle and by comparing business cycle properties of the Western Balkans with those of EU members.

**Research hypothesis (Paper 3):** The relative importance of common European shocks in the Western Balkans is high and comparable to that in small EU countries.

### 3.5. Materials, methodology and research plan
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The first paper studies the importance of symmetric versus asymmetric shocks among 15 euro area members. It proposes a new and time-varying optimum currency area (OCA) index assessing the evolution of the OCA properties of the monetary union from an international business cycle perspective. It may be derived from the relative importance of symmetric versus asymmetric shocks driving each country. In order to separate the two types of shocks, I rely on a sign and zero-restricted open-economy structural Bayesian vector autoregression model (BVAR). Applying my methodology, it is also possible to address how increased heterogeneity across members of a union may inflame tensions among them. Indeed, the euro area is, arguably, more appropriate through the lens of empirical OCA properties when the relative importance of common symmetric shocks is high but, at the same time, is not overly dispersed across euro area member countries. In other words, cross-country heterogeneity in business cycle fluctuations makes the common currency not equally desirable for all, which could create tensions between countries (De Grauwe, 1996) and eventually even threaten the political viability of the EMU (Orphanides, 2020). The developed framework is also useful as an interpretation of the well-known OCA endogeneity hypothesis of Frankel and Rose (1998), which suggests that the business cycle coherence of a monetary union may increase ex-post to euro adoption, as monetary integration of the country is expected to enhance trade linkages and promote investments, also across the countries of the union. In particular, I investigate whether euro adoption

has promoted business cycle synchronization, which, in my framework, is measured by the incidence of shocks that new member countries share with the rest of the euro area. To implement this test, I employ different Difference-in-Differences (DiD) approaches. Recent findings in the methodological literature point out drawbacks of a standard DiD approach (here, a panel regression with time and country fixed effects, with euro area membership being a "treatment" dummy) whenever there are multiple treatment periods (such as different entry dates); see Callaway and Sant'Anna (2021), Journal of Econometrics. Specifically in my case, as new member countries enter the euro area in a staggered manner, I apply both the standard DiD and the method by Callaway and Sant'Anna (2021). This is a relevant and topical issue, in particular for shedding light on the ongoing policy debate concerning some non-euro area EU countries that are considering adopting the euro (the Czech Republic, Romania, and, in a much earlier phase, the Western Balkans).

The second paper deals with the OCA properties of the euro area at the regional level by studying regional business cycles in the euro area. For that purpose, I develop a framework suitable for assessing the relative importance of common euro area versus country versus regional shocks driving real GDP growth at the regional level, applied to data for the 11 largest euro area countries and 165 regions at the NUTS 2 level. A Structural Dynamic Factor Model (SDFM) seems well suited for that purpose: it produces impulse responses, forecast error variance decomposition, and historical shock decomposition at three levels of aggregation - the euro area as a whole, at the country level, and at the regional level. Based on this decomposition, I first analyze the predominance of symmetric versus asymmetric shocks for granular data and, thus, examine the regional optimum currency area (OCA) properties of the euro area. After that, I evaluate within (i.e., regional) and between-country heterogeneity of identified monetary policy effects. The applied methodology is also suitable for understanding the drivers of variations in the importance of idiosyncratic shocks across regions. For example, as advocated by Krugman (1993), increased specialization of countries or regions following unification may lead to less synchronized regional cycles, resulting in less effective common monetary policy. Using the developed framework, I study the link between specialization and the incidence of regional shocks both across regions and, more importantly, over time in order to study the risks for monetary policy.

In the third paper, I study the readiness of the Western Balkans for common stabilization policies through the lens of the shock similarity principle. By specifying a two-country BVAR model for each member country, I first evaluate the relative importance of symmetric versus asymmetric shocks driving the Western Balkan business cycle over time and compare that to results for small EU members. After that, to study the synchronization of business cycle phases in the Western Balkans and the EU, I specify a simple Markov-switching model for each country and estimate the probability of being in a recession. In that way, I can compare business cycle phases in the EU and the Western Balkans. Finally, I go beyond standard quarterly national accounts and study business cycles in the Western Balkans using high-frequency indicators such as industrial production, retail sales, confidence indicators, and other monthly series. By doing so, I test whether some standard methods to track business cycle phases, known to work well in advanced economies, may safely be applied in the Western Balkans. This research may encourage researchers to apply more advanced econometric techniques to Western Balkan data - sometimes regarded as overly short and unreliable for that purpose.

3.6. Expected scientific contribution of the proposed research
*(suggested length: 500 characters with spaces)*

My research could contribute to the existing Optimum Currency Area (OCA) theory literature by applying the concept of shock similarity across several applications and therefore proposing a unified framework to

track the costs of foregoing their own monetary policy. It may also bring several important new insights for policymakers:

1. For the first time, it provides a shock accounting exercise and evaluates the relative importance of symmetric versus asymmetric shocks for euro area members and regions, which is important for tracking the stabilizing potential of common monetary policy over time and across regions.
2. My thesis proposes new tests for the OCA endogeneity and Krugman specialization hypotheses based on the relative importance of symmetric shocks.
3. It measures the readiness of the Western Balkans for common policies.

3.7. References
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3.8. Total cost estimate of the proposed research
*(in HRK)*

3.9. Proposed research funding sources

| Type of funding | Project name | Project leader | Signature |
|---|---|---|---|
| National funding | | | |
| International funding | | | |
| Other project types | | | |
| Self-funding | | | |

3.10. Ethics committee meeting at which the research proposal was approved
*(if applicable)*

## CONSENT OF THE PROPOSED SUPERVISOR WITH TOPIC APPPROVAL REQUEST

I hereby declare that I agree with the proposed PhD thesis topic.

Signature
(first and last name of the supervisor(s))

Signature
(first and last name of the co-supervisor)

## STATEMENT

I hereby declare that I have not submitted the same PhD thesis topic at any other university.

Signature
(first and last name of the PhD candidate)

Rijeka, dd/mm/yyyy
12-2-2026.