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# Euro adoption and banks profitability in Central and Eastern Europe

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**Abstract**

We provide new evidence on the effects of adopting a common European currency on banks' profitability in the Central and Eastern Europe (CEE) region. We construct a panel of 1033 bank-year observations across 11 countries between 2006 and 2020. Our results suggest that the effect of the eurozone on the banks' profitability is statistically not significant over a longer period but that the euro exerts downward pressure on banks' profits when economic conditions are stable. Additionally, we contribute to the existing literature on banks' profitability determinants in the CEE region and confirm that capitalization and bank size have positive, while liquidity and loans-to-assets ratio have a negative influence on profitability.

**Keywords:** banks profitability, euro adoption, Central and Eastern Europe
**JEL Classification:** F36, G21

# 1. Introduction

The effects of joining the Economic and Monetary Union on Central and Eastern Europe (CEE) economies are broadly debated in the region. The advantages and disadvantages of adopting a common currency are discussed in academic, policy, and public discussions, especially in countries yet to join the eurozone. Since the first eastern European Union (EU) expansion, 11 states of the former Eastern Bloc joined the EU, each with an obligation to adopt the euro as a common currency, albeit within an unspecified timeframe.[1] There is rich academic literature (reviewed later) estimating the economic effects of joining a monetary union; however, less is known about the effects of monetary integration on the performance of the banking sector. This work aims to answer whether a common currency affects the banking sector's profitability in the CEE region.

[1] Poland, Hungary, Czech Republic, Slovakia, Estonia, Latvia, Lithuania, Slovenia, Bulgaria, Romania, and Croatia

Understanding how euro adoption affects banks' profitability is important for several reasons. Banks are central to financial intermediation and economic development, especially in the CEE region, where capital markets remain relatively underdeveloped. On the on one hand, profitability is a key indicator of banks' ability to withstand economic shocks, maintain credit supply, and support investment and growth. On the other hand, profitability may reflect not just economic performance but also underlying structural issues. For example, in a tightly regulated and concentrated market like banking, high profitability may indicate a lack of competitive pressure or monopolistic practices, while low profitability may point to enhanced competition or margin compression due to increased transparency and supervision. In the context of euro adoption, it may serve as a signal of how integration into the Eurozone's institutional and regulatory framework reshapes the financial sector.

To fill the research gap, we construct an unbalanced panel of 92 banks from 11 economies between 2006 and 2020, using the data from the S&P Global market intelligence company and the World Bank Open Data. We use Return on Average Assets and Return on Average Equity as bank performance indicators and examine the influence of the EMU and ERM II memberships on those ratios. We use several lagged bank-specific controls, including banks' size, capitalisation, liquidity, and loan-to-total assets ratio. We also control for GDP growth, inflation and interest rate fluctuations and estimate several regression specifications. We conduct an alternative analysis between 2013 and 2019 to exclude the financial crisis, the European debt crisis, and the COVID-19 pandemic.

Our results suggest that the effect of the euro adoption is ambiguous over a longer period, including turbulent economic conditions, and negative during stable economic conditions. The first part of our results using a sample from 2006 to 2020 yields ambiguous results across specifications, including bank-specific and macroeconomic controls and time-, country- and bank-fixed effects. The second part of the analysis covers the period from 2013 to 2019. The results suggest a negative impact of the euro adoption on banks' profitability in this sample period. We argue that increased bank supervision in the Eurozone results in greater transparency, increased competition, and lower profit margins. Increased supervision can also improve the financial sector's stability and decrease losses during economic crises.

The euro was introduced in 1999 following a multi-stage convergence process designed to align member states' monetary and fiscal frameworks. Euro adoption requires compliance with the Maastricht criteria, covering inflation, government debt and deficit, exchange rate stability, and interest rates. These requirements, and the broader institutional shift toward ECB-led supervision have significant implications for banking systems, particularly in CEE

countries that underwent simultaneous post-socialist transition and EU integration.

For CEE countries, euro adoption represents not only a shift in monetary policy but also a structural transformation of their banking systems. Integration into the Eurozone entails joining the Single Supervisory Mechanism (SSM), which imposes more stringent capital and reporting standards, enhances supervisory coordination, and reduces national discretion in financial oversight. These changes can lead to improved transparency and risk management, but also lower interest margins and increased competitive pressure. Understanding these implications is critical, as CEE banking sectors are relatively concentrated and play a central role in financial intermediation.

While our empirical strategy focuses on estimating the overall effect of euro adoption on banks' profitability, it is useful to consider the main theoretical and institutional channels through which such effects may operate. Table 1 in the Literature Review section summarizes these mechanisms as identified in the existing literature. These include changes in regulatory and supervisory frameworks, reduced currency risk, and broader macroeconomic impacts such as lower inflation or altered volatility. The expected direction of the effects is mixed, with some mechanisms potentially improving profitability (e.g., lower cost of capital, enhanced efficiency), and others potentially reducing it (e.g., increased competition). Although our data do not allow us to disentangle these effects individually, understanding them provides context for interpreting the overall results.

# 2. Literature review

Our study is related to the two strands of literature. The first studies the determinants of banks' profitability in the European Union member states. Djalilov and Piesse (2016) use generalised methods of moments in a sample of 16 former communist states in the 2000–2013 period. They find that the banking sector in the early transition states (CEE countries, currently part of the EU) is more competitive and that higher capitalisation in this region leads to higher profitability. Also, they find that credit risk positively affects profitability in early transition economies and negatively in late transition economies (e.g., Ukraine, Moldova, Armenia). Authors indicate this is due to better capital allocation, which could be improved by increased transparency and improved screening and monitoring of banks. Pasiouras and Kosmidou (2007) use a sample of 584 commercial banks from 15 EU states from 1995-2001. They split the sample by domestic and foreign ownership and provide analysis for each subgroup. On the market level, they show that the ratio of stock market capitalisation to total assets and the ratio of stock market

capitalisation to GDP have positive effects, showing that the overall development of the banking industry increases profits of individual banks. Agoraki et al. (2021) show that equity ratio, loan ratio, default risk, liquidity risk, size, and GDP growth positively affect the bank's performance, while inflation has a negative effect. They also find positive effects of the Basel II accords on banks' profitability. This strand of literature examines determinants of banks' profitability in euro and non-Euro countries but does not explicitly study the effects of the euro currency itself.

The second strand studies the effects of the euro adoption on the macroeconomy and financial markets. The literature identifies two salient mechanisms through which the common currency can affect banks' profits via the macroeconomic and financial market effects. Firstly, adopting the euro influences the institutional design of the financial market with additional regulation, supervision and possibly superior institutional quality imposed by the EMU. Askari and Chatterjee (2005) are among the first to show empirically that financial market of the Euro Area countries became more unified with lowered cost of capital. De Freitas, Nunes and Rodrigues (2017) show that during the recent financial crisis, controlling for a number of factors, Euro Area membership reduced the probability of a Member State experiencing an economic sudden stop, constituting a strength rather than a weakness. Psillaki and Mamatzakis (2017) study the impacts of financial regulation on the cost-efficiency of the banking sector in 10 Eastern EU countries between 2004 and 2009 and find that regulation measured by the European Bank for Reconstruction and Development transitional reform indicator increases banks' cost-efficiency. Also, Chortareas, Girardone and Ventouri (2012) provide evidence of the positive effects of the capital requirement and supervisory power on net interest margin and cost-to-income ratio in 22 European states between 2000 and 2008. Fiordelisi, Ricci and Lopes (2017), based on the sample of 336 banks in the Eurozone, show that institutions directly supervised by the ECB through the SSM mechanism decreased the number of loans and increased the capitalisation, in comparison to the nationally supervised institutions.

Secondly, adopting the euro eliminates currency fluctuations against other eurozone members. A study by He, Fayman and Casey (2014) covering 22 large US banks between 1978 and 2008 provides evidence that a domestic currency appreciation positively impacts banks' earnings. However, Denderski and Paczos (2021) look into the effects of the local currency fluctuations against the euro and Swiss franc on the supply of net loans in the 10 CEE states between 1998 and 2021 and conclude that the currency fluctuations in the region do not affect the volume of extended loans.

Finally, we review the studies that directly study the effects of the euro adoption on the

macroeconomy. Dreyer and Schmid (2017) show that EU membership has clear positive effects on GDP growth, but the eurozone membership has no visible effect except at crisis times when the effect is negative. Heller and Warzala (2019) compare Eastern European states which joined the euro with Poland (which remains outside of the euro) and establish that the benefits of the eurozone only include lower fluctuations in GDP and inflation, but not protection against adverse economic shocks or a remedy to economic difficulties. Differently, Saia (2017) finds that aggregate trade flows between the UK and eurozone members would have been 16% higher and with third countries 15% higher had the UK joined the EMU.

Table 1: Summary of potential channels of the euro adoption on banks.

| **Mechanism** | **Channel** | **Potential effect on banks' profitability** |
|---|---|---|
| Regulation, supervision, institutions | Lower cost of capital | + |
| | Increased macro stability | +/- |
| | Higher capitalization/efficiency | + |
| | Increased competition | - |
| Decreased currency fluctuations | Decreased balance sheet risk | +/0 |
| Effect on the macro indicators | Lower inflation | + |
| | Higher/lower GDP volatility | -/+ |

The review of the literature suggests three channels of euro adoption influence on banks' profitability. Additional regulation has been shown to improve banks' efficiency and overall performance. Decreased currency fluctuations have an ambiguous effect on banks' profitability in the examined literature. Euro adoption could affect the overall macroeconomic factors, which in turn would affect banks. The literature suggests, however, that the eurozone has an ambiguous effect on the economy; hence, we do not expect this channel to influence the profitability of financial institutions. Considering that the three channels it is uncertain whether the effect is positive or ambiguous, especially since it is not clear which aspects of the eurozone carries the greater weight. Table 1 summarizes our hypothesized channels and directions of influence of the euro adoption on banks profitability.

Although there is a rich literature that studies the effects of the euro adoption on the macroeconomy and literature that studies the banks' profitability determinants in the EU member states, there is a noticeable shortage of empirical studies on the direct link between the euro adoption and banks' profitability. This paper is an attempt to fill this gap.

# 3. Data

We collect the data of 92 financial institutions in 11 Eastern EU countries that joined the Union in 2004 or after. The sample consists of a panel from 2006 to 2020, chosen due to data availability, comprised of 1033 bank-year observations.[2]

Table 2 summarizes the euro adoption and ERM II participation years for the 11 CEE countries in our sample. Adoption was clearly staggered, with five countries joining the eurozone between 2007 and 2015, while others remain outside or only recently entered ERM II. This staggered entry provides useful temporal variation for identification. Our panel specification leverages this variation by using year-country-level dummies for euro and ERM II participation. While staggered adoption introduces potential heterogeneity in treatment timing, we mitigate bias by including year and country fixed effects, as well as conducting separate estimations for pre- and post-crisis periods. We also treat ERM II as a distinct treatment phase to capture anticipatory adjustments.

Table 2. Euro adoption and ERM II participation in CEE countries

| **Country** | **Euro Adoption Year** | **ERM II Entry Year** |
|---|---|---|
| Slovenia | 2007 | 2004 |
| Slovakia | 2009 | 2005 |
| Estonia | 2011 | 2004 |
| Latvia | 2014 | 2005 |
| Lithuania | 2015 | 2004 |
| Croatia | 2023 (out of sample) | 2020 |
| Bulgaria | Not adopted | 2020 |
| Czech Republic | Not adopted | Not in ERM II |
| Hungary | Not adopted | Not in ERM II |
| Poland | Not adopted | Not in ERM II |
| Romania | Not adopted | Not in ERM II |

The primary source of bank-specific data is S&P Global, a market intelligence company offering templated financial data on multiple institutions, including commercial banks in the

[2] Including banks from older Eurozone countries could improve precision of control estimates but would introduce structural heterogeneity. We decided to focus on CEE countries for internal consistency across transition economies. This allows us to better isolate the euro's effect in this specific regional context.

CEE region. The data preparation included determining the top banks by total assets in each country using information from the Corporate Financial Institute (2022) and TheBanks.eu (2022) websites, sourcing the templated data on its financial performance and combining the relevant information into a single dataset. Data collection was limited by the availability of the S&P Global database. Nevertheless, the majority of the most significant banks in each of the 11 states were included in the sample, capturing a large proportion of the banking sector in the CEE region.

The dataset is amended by the information on the Eurozone membership, ERM II mechanism participation, inflation and GDP growth rates. The latter two were accessed on the World Bank Open Data. The dummy variables for eurozone membership and ERM II mechanism take the value of 1 if the state participated for at least one calendar quarter in the given year.

Table 3: Descriptive statistics - whole sample

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Euro | 1033 | .32 | .47 | 0 | 1 |
| ERM | 1033 | .05 | .22 | 0 | 1 |
| ROAA | 1033 | .75 | 1.53 | -13.25 | 5.87 |
| ROAE | 1033 | 6.03 | 18.21 | -227.19 | 54.43 |
| Total Assets | 1033 | 1.06e+07 | 1.25e+07 | 1.71e+05 | 8.18e+07 |
| Capitalization | 1033 | 10.86 | 3.66 | 1.54 | 30.36 |
| Liquidity | 1033 | 31.38 | 13.85 | .611 | 87.30 |
| Loan ratio | 1033 | 59.77 | 15.06 | 10.006 | 96.32 |
| Inflation | 165 | 2.15 | 2.17 | -1.545 | 15.40 |
| GDP growth | 165 | 2.04 | 3.35 | -14.839 | 11.97 |
| Interest rate | 1033 | 1.98 | 2.64 | -.43 | 13.08 |

*Notes: Summary statistics for the whole sample, including number of observations, mean, standard deviation, minimum and maximum.*
*Sources: bank-specific variables: S&P Global, inflation and GDP: World Bank, eurozone and ERM II membership: European Commission, interest rate: OECD.*

The overall summary statistics for the whole sample are presented in Table 3. 32% of observations come from banks operating in the eurozone and 5.1% in the ERM II. The mean of the ROAA in the sample is 0.749% with a standard deviation of 1.53p.p., and the mean of the ROAE is 6.04% with a standard deviation of 18.16p.p..

In Appendix Tables 9 and 10 we report summary statistics separately for euro and non-euro subsamples. The average ROAA for the euro sample is 0.593 versus 0.822 for the non-euro sample. Also, ROAE is greater for non-euro observations, with an average of 7.257 versus 3.440. There is no significant difference in terms of mean capitalization and liquidity ratios. Banks in the non-euro group are visibly larger on average. This is because the euro was adopted

more commonly in smaller countries, where market size naturally limits the expansion of financial institutions. Average GDP growth for both samples is almost identical; however, mean inflation in the eurozone sample takes the value of 1.509 versus 2.455 in the non-euro sample. Similarly, the mean interest rate in the non-euro sample is significantly higher at 2.865 versus only 0.89 for the euro sample. Appendix A lists all the banks included in the data sample.

Table 4 presents the correlation matrix of the variables of interest. Both ROAA and ROAE have a statistically significant negative correlation to the euro, and positive significant correlations with the size, capitalization, inflation and GDP growth. Both profitability variables do not appear to be correlated with the interest rate.

Table 4: Correlation matrix

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) ROAA | 1.00 | | | | | | | | | | |
| (2) ROAE | 0.92*** | 1.00 | | | | | | | | | |
| (3) Euro | -0.07** | -0.10*** | 1.00 | | | | | | | | |
| (4) ERM | -0.05 | -0.04 | -0.16*** | 1.00 | | | | | | | |
| (5) Total assets | 0.16*** | 0.17*** | -0.30*** | -0.08*** | 1.00 | | | | | | |
| (6) Capitalization | 0.33*** | 0.16*** | 0.00 | -0.02 | -0.09*** | 1.00 | | | | | |
| (7) Liquidity | 0.01 | 0.04 | -0.12*** | 0.04 | -0.09*** | -0.07** | 1.00 | | | | |
| (8) Loan ratio | 0.03 | -0.01 | -0.01 | -0.01 | 0.04 | 0.20*** | -0.84*** | 1.00 | | | |
| (9) Inflation | 0.11*** | 0.10*** | -0.20*** | 0.04 | 0.10*** | -0.10*** | -0.12*** | 0.13*** | 1.00 | | |
| (10) GDP growth | 0.19*** | 0.18*** | 0.00 | -0.14*** | -0.04 | -0.03 | 0.08*** | -0.06* | 0.06** | 1.00 | |
| (11) Interest rate | 0.02 | 0.03 | -0.49*** | -0.04 | 0.13*** | -0.09*** | -0.09*** | 0.18*** | 0.63*** | -0.07** | 1.00 |

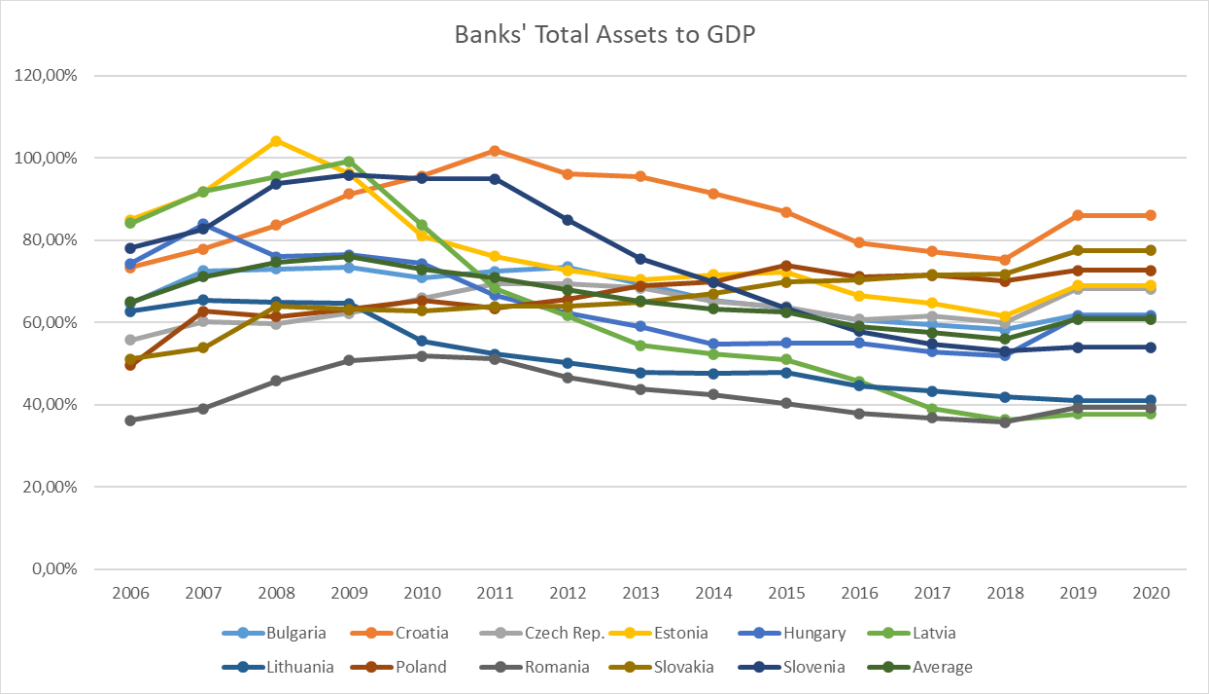
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: Correlation matrix of all, not transformed variables.
Sources: bank-specific variables: S&P Global, inflation and GDP: World Bank, eurozone and ERM II memberships: European Commission, interest rate: OECD.

We can observe a statistically significant negative correlation between the euro and total assets, liquidity, inflation and interest rate. The first is likely the result of the size of CEE states that joined the eurozone. The negative correlation with inflation suggests that countries that joined EMU have lower inflation levels. Lower inflation levels can explain significantly lower interest rates in the Eurozone.

Figure 1 shows how the size of the banking sector changed relative to the GDP. The rapid growth of the ratio was stopped and reversed by the 2007-2009 financial crisis; most countries in the sample returned to an increasing trend in 2018. In 2020, the total assets of banks in eastern EU states ranged from 38% of GDP in Latvia to 88% of GDP in Croatia. The average for the 11 states in the sample increased from 59% in 2006 to 61% in 2020.

**Figure 1: Bank assets-to-GDP ratio in CEE countries**




*Source: TheGlobalEconomy*

# 4. Methodology and Results

## 4.1 Methodology

To answer the research question, we estimate different versions of the following regression model:

$$prof_{tij} = \beta * eurozone_{tj} + \gamma * bankspecific_{t-1ij} + \delta * macro_{tj} + \eta_{tij} + e_{tij} \quad (1)$$

where $prof_{tij}$ is the profitability of bank i in country j in year t. We use Return on Average Assets (ROAA) and Return on Average Equity (ROAE) as proxies for banks' profitability. Using average ratios instead of the classic ROA and ROE allows for avoiding misrepresentation of the profitability by institutions by manipulating the value of total assets and equity at the end of the year. ROAA is defined as a ratio of Net Income to Average Total Assets. Average Total Assets are calculated by a simple average of the total assets at the year's beginning and end. ROAE is defined as a ratio of Net Income to Average Total Equity. ROAE represents the company's profitability with respect to the total capital invested by shareholders. Overall, ROAE tends to be more variable due to different levels of capitalization of banks.

Our key independent variable, $eurozone_{tj}$ is a vector of two dummy variables: $euro_{tj}$ takes the value of 1 if the country of the observation was in the eurozone for at least one calendar quarter in a given year and zero otherwise. One challenge in estimating the effect of euro

adoption is that banks may begin adjusting their operations before formal accession. To address this, our specification includes a separate dummy variable for ERM II: $erm_{tj}$takes value of 1 if the country of observations was participating in the ERM II mechanism for at least one calendar quarter and 0 otherwise. With the dummies, we aim to capture the average effect of entering the monetary union on banks' profitability, resulting from lower or no currency fluctuations and additional regulatory requirements.

In this way, the ERM II dummy allows us to identify the early-stage or anticipatory effects of the euro accession process, while the euro dummy captures the marginal effect of full Eurozone membership, conditional on prior ERM II participation and other controls.

We include two sets of control variables: bank-specific and macro-level variables. $bankspecific_{tij}$vector includes $ltotalassets_{tij}$, a logarithm of the total value of the bank's assets in 1000's of US dollars, $loansratio_{tij}$ is a ratio of net loans given to customers to total assets, $capitalization_{tij}$ as a ratio of the equity to the total assets and $liquidity_{tij}$ as a ratio of liquid assets to the total assets. We follow a widely used set of bank-level controls in the relevant literature. Returns in a given year might affect the size of assets, equity, and liquid assets contemporaneously. To address this, we use lagged independent variables. Bank controls can affect the following year's profits, but profits cannot affect the previous year's bank controls. $macro_{tj}$ vector includes $inflation_{tj}$ as annual inflation measured by the CPI index and $gdp_{tj}$ as the annual GDP growth in a given country. Both variables control for economic fluctuations in given economies and are expected to affect banks' profitability positively, as shown in the literature (e.g. Albertazzi and Gambacorta, 2009). $rate_{tj}$ is a yearly average of three-month money market rates used as a proxy of the bank rates. It is used to control for central banks' monetary policy, which significantly influences financial institutions.

$\eta_{tij}$ is a fixed-effects constant term. We estimate versions of the model with different sets of fixed effects. In the country-fixed effects, $\eta_{tij} = \eta_j$ accounts for unobserved, country-specific characteristics. This isolates the variation resulting from differences between the financial sectors to better isolate the variation induced by entering the ERM II and the eurozone. In the time-fixed effects model, $\eta_{tij} = \eta_t$ accounts for the changes in the global economic environment. In the bank-fixed effects model, $\eta_{tij} = \eta_i$ accounts for bank-specific dummies to control for unobserved banks' characteristics.

Our specification is designed to estimate the average effects of euro adoption and ERM II participation on banks' profitability, controlling for a set of bank-specific and macroeconomic variables. The ERM II dummy captures the anticipatory phase of euro adoption, during

which banks may begin adjusting in response to exchange rate stabilization and policy convergence. The euro dummy, in turn, captures the marginal effect of full Eurozone accession, reflecting institutional changes such as the shift to ECB monetary policy and integration into the Single Supervisory Mechanism. However, the specification does not capture informal expectations of euro adoption that may influence bank behaviour prior to ERM II entry. Additionally, it assumes that effects occur linearly and contemporaneously within each calendar year, without modelling dynamic or lagged adjustments explicitly. As such, our estimates should be interpreted as reduced-form average treatment effects during and after formal entry stages, rather than a complete account of the entire transition process.

## 4.2 Benchmark Results

Table 5 contains the results of six specifications with ROAA as a dependent variable.

Table 5: Benchmark results - ROAA

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Euro | 0.593*** | 0.070 | 0.636 | -0.212** | 0.309 | 0.345 |
| | (0.096) | (0.455) | (0.544) | (0.107) | (0.439) | (0.430) |
| ERM | 0.438** | 0.063 | 0.225 | -0.269 | 0.041 | 0.005 |
| | (0.223) | (0.185) | (0.342) | (0.215) | (0.190) | (0.215) |
| Total Assets | | | | 0.072*** | 0.128*** | 0.083* |
| | | | | (0.024) | (0.035) | (0.044) |
| Capitalization | | | | 0.121*** | 0.121*** | 0.059** |
| | | | | (0.015) | (0.015) | (0.024) |
| Liquidity | | | | -0.015*** | -0.011** | -0.002 |
| | | | | (0.004) | (0.005) | (0.007) |
| Loan ratio | | | | -2.372*** | -1.646*** | -1.202* |
| | | | | (0.420) | (0.505) | (0.679) |
| GDP growth | | | | 0.075*** | 0.059* | 0.069** |
| | | | | (0.013) | (0.032) | (0.031) |
| Inflation | | | | 0.108*** | 0.029 | 0.014 |
| | | | | (0.025) | (0.034) | (0.031) |
| Interest rate | | | | -0.039* | -0.052 | -0.053 |
| | | | | (0.023) | (0.042) | (0.042) |
| Observations | 1033 | 1033 | 1033 | 1032 | 1032 | 1032 |
| R-Squared | 0.042 | 0.295 | 0.531 | 0.315 | 0.413 | 0.561 |
| F-Statistic | 21.07 | 39.86 | 46.29 | 76.94 | 52.82 | 42.94 |
| Time FE | No | Yes | Yes | No | Yes | Yes |
| Country FE | No | Yes | No | No | Yes | No |
| Bank FE | No | No | Yes | No | No | Yes |

*Standard errors in parentheses*
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

*Notes: Benchmark model for ROAA. Column 1 includes OLS regression without controls, column 2 additionally includes Time and Country FE, whereas column 3 includes Time and Bank FE. Column 4 includes OLS regression with bank and macro controls. Column 5 additionally includes Time and Country FE, whereas column 6 includes Time and Bank FE.*

The euro's effect in four out of six specifications is not statistically significant. It is only statistically significant (and positive) in the simple OLS regression (column 1) and (negative) in the OLS regression with banks and macro controls (column 4). In other specifications, the coefficient of the euro dummy remains positive, albeit insignificant. A comparison of specifications (4) and (5) suggests that systematic factors, country-specific characteristics and changes in the global environment are more likely to explain the lower average profitability of eurozone banks than euro membership itself.

Including bank-fixed-effect does not change the euro coefficient and the standard error, suggesting that the time effects play a crucial role in the model dynamics. Eastern EU states have similar economies on comparable development levels and are connected to each other and the rest of the EU with strong economic ties. Hence, they experience very similar economic shocks in origin and magnitude. Kolasa (2013) proves that although CEE and eurozone fluctuations differ, significant convergence is observed after the EU accession. Benczúr and Rátfai (2010) show that most of the CEE states, excluding Romania and Bulgaria, experience similar economic fluctuations. Hence, it is possible that year-specific changes in the economic environment could explain the variation in banks' profitability and that the convergence of Eastern EU states with Western EU economies has a more profound effect than the adoption of the common currency. Benchmark results for the ERM variable represent a similar relationship.

Further, we investigate bank and macro controls' relationships with the dependent variable. We find a uniformly positive and statistically significant relationship between the size and ROAA in each specification, ranging from 0.072-0.128 p.p. This differs from Djalilov and Piesse (2016), who do not find a relationship in early transitioning countries, and Pasiouras and Kosmidou (2007), who find a negative relationship in 15 EU countries. We also find a positive effect of capitalization ranging between 0.059 to 0.121 p.p. on average. This is a standard result in the literature (e.g. Agoraki et al., 2021; Djalilov and Piesse, 2016). We find that liquidity and loan ratio negatively affect ROAA, liquidity by -0.002 to -0.015 and loan ratio by -1.202 to -2.372 p.p. on average.

GDP has a strong positive and statistically significant effect on profitability in line with expectations: a 1p.p. increase in the GDP growth increases ROAA on average by 0.059-0.075 p.p. Inflation coefficient is only significant in specification without Time FE. A possible

explanation is that inflation is strongly affected by global conditions included in the year dummies. Nevertheless, the coefficient remains positive in all three specifications. The results about the effects of inflation on banks' profitability are generally mixed in the literature. The interest rate coefficient remains negative, albeit significant, only in one specification (4). Raised interest rates are a response to inflation increasing over the central bank's target; hence, a reversed, negative relation is expected.

Table 6 contains corresponding regressions with ROAE as a dependent variable.

Table 6: Benchmark results - ROAE

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Euro | 3.440*** | 0.606 | 6.968 | -3.635*** | 2.095 | 2.380 |
| | (1.183) | (6.491) | (6.155) | (1.333) | (6.461) | (6.767) |
| ERM | 2.691 | 0.522 | 2.173 | -3.367 | -0.417 | -1.235 |
| | (3.065) | (1.792) | (3.820) | (3.103) | (2.007) | (2.431) |
| Total assets | | | | 0.909*** | 1.505*** | 1.277** |
| | | | | (0.294) | (0.475) | (0.552) |
| Capitalization | | | | 0.699*** | 0.722*** | 0.483 |
| | | | | (0.181) | (0.194) | (0.371) |
| Liquidity | | | | -0.096* | -0.063 | -0.014 |
| | | | | (0.054) | (0.073) | (0.115) |
| Loan ratio | | | | -23.446*** | -15.966** | -15.889 |
| | | | | (4.836) | (6.361) | (9.672) |
| GDP growth | | | | 0.784*** | 0.647 | 0.690* |
| | | | | (0.170) | (0.403) | (0.391) |
| Inflation | | | | 1.040*** | 0.163 | 0.046 |
| | | | | (0.280) | (0.424) | (0.396) |
| Interest rate | | | | -0.467 | -0.324 | -0.481 |
| | | | | (0.289) | (0.546) | (0.550) |
| Observations | 1033 | 1033 | 1033 | 1032 | 1032 | 1032 |
| R-Squared | 0.011 | 0.225 | 0.411 | 0.179 | 0.292 | 0.434 |
| F-Statistic | 4.61 | 37.18 | 34.93 | 60.56 | 40.38 | 31.66 |
| Time FE | No | Yes | Yes | No | Yes | Yes |
| Country FE | No | Yes | No | No | Yes | No |
| Bank FE | No | No | Yes | No | No | Yes |

*Standard errors in parentheses*
*$^{*}$ p < 0.10, $^{**}$ p < 0.05, $^{***}$ p < 0.01*
*Notes: Benchmark model for ROAE. Column 1 includes OLS regression without controls, column 2 additionally includes Time and Country FE, whereas column 3 includes Time and Bank FE. Column 4 contains OLS regression with bank and macro controls. Column 5 additionally includes Time and Country FE, whereas column 6 includes Time and Bank FE.*

Results for the ROAE are similar in sign and significance. Further, controls are weaker in significance, most probably due to higher ROAE variability, but show the same relation with the dependent variable.

## 4.3 Robustness Results

The sample period includes years of significant economic shocks, the 2007-2009 financial crisis, the following European debt crisis of 2010-2012, and the 2020 Covid pandemic. In Tables 7 and 8 we present the results to additional specifications for tranquil times of 2013-2019 when economic conditions were primarily stable. Table 7 presents the results.

Table 7: Robustness results - ROAA in tranquil times

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Euro | 0.695*** | -0.961** | 0.425 | -0.476*** | -1.154*** | 2.959 |
| | (0.120) | (0.424) | (0.386) | (0.143) | (0.318) | (2.959) |
| ERM | 0.527 | -0.242 | 0.824 | -0.435 | -1.157* | 2.803 |
| | (0.459) | (0.583) | (0.553) | (0.467) | (0.655) | (2.961) |
| Total assets | | | | 0.064* | 0.080 | -0.063 |
| | | | | (0.038) | (0.056) | (0.165) |
| Capitalization | | | | 0.129*** | 0.129*** | 0.111 |
| | | | | (0.022) | (0.022) | (0.069) |
| Liquidity | | | | -0.014*** | -0.010 | -0.002 |
| | | | | (0.005) | (0.007) | (0.014) |
| Loan ratio | | | | -2.314*** | -2.275*** | -5.014*** |
| | | | | (0.579) | (0.705) | (1.585) |
| GDP growth | | | | 0.167** | 0.088 | 0.076 |
| | | | | (0.068) | (0.082) | (0.072) |
| Inflation | | | | 0.045 | -0.116 | -0.123 |
| | | | | (0.044) | (0.079) | (0.076) |
| Interest rate | | | | -0.301*** | -0.280** | -0.194 |
| | | | | (0.082) | (0.129) | (0.126) |
| Observations | 600 | 600 | 600 | 600 | 600 | 600 |
| R-Squared | 0.060 | 0.295 | 0.533 | 0.302 | 0.378 | 0.576 |
| F-Statistic | 17.56 | 36.91 | 41.51 | 60.64 | 57.13 | 50.10 |
| Time FE | No | Yes | Yes | No | Yes | Yes |
| Country FE | No | Yes | No | No | Yes | No |
| Bank FE | No | No | Yes | No | No | Yes |

*Standard errors in parentheses*
*$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$*
*Notes: Robustness results for ROAA, years 2013-2019. Column 1 includes OLS regression without controls, column 2 additionally includes Time and Country FE, whereas column 3 includes Time and Bank FE. Column 4 contains OLS regression with bank and macro controls. Column 5 additionally includes Time and Country FE, whereas column 6 includes Time and Bank FE.*

The results suggest that adopting the common currency exerts negative pressure on banks' profit margins: the Euro coefficient is negative and statistically significant in three specifications, most importantly in the two that control for bank-specific and macroeconomics conditions with and without country- and time-fixed-effects (columns 4 and 5). Further, inflation does not influence profitability; the effect of GDP growth is positive but more limited than in the full sample, and we can observe a strong, negative impact of interest rate. Capitalizations and loan ratio still play significant roles in explaining performance variation in the sample. However, the size of the bank plays a less important role, weakening in significance and magnitude compared to the whole period. We observe similar changes in the ROAE specification in Table 8.

Table 8: Robustness results - ROAE in tranquil times

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Euro | 4.198*** | -13.367** | -0.974 | -6.593*** | -13.120*** | -17.833 |
| | (1.499) | (6.061) | (4.717) | (1.665) | (3.899) | (40.878) |
| ERM | 3.824 | -5.560 | 5.380 | -4.848 | -11.461 | -16.509 |
| | (4.600) | (6.934) | (6.250) | (4.772) | (7.515) | (41.273) |
| Total assets | | | | 0.659 | 0.681 | 1.684 |
| | | | | (0.507) | (0.782) | (2.260) |
| Capitalization | | | | 0.683** | 0.720*** | 1.539 |
| | | | | (0.273) | (0.273) | (1.049) |
| Liquidity | | | | -0.051 | 0.006 | 0.137 |
| | | | | (0.068) | (0.083) | (0.179) |
| Loan ratio | | | | -19.820*** | -21.315** | -58.407*** |
| | | | | (6.575) | (8.446) | (20.729) |
| GDP growth | | | | 1.906** | 1.178 | 1.043 |
| | | | | (0.952) | (1.063) | (0.921) |
| Inflation | | | | 0.353 | -1.192 | -1.224 |
| | | | | (0.517) | (0.880) | (0.871) |
| Interest rate | | | | -3.256*** | -1.924 | -0.852 |
| | | | | (0.977) | (1.636) | (1.590) |
| Observations | 600 | 600 | 600 | 600 | 600 | 600 |
| R-Squared | 0.018 | 0.226 | 0.417 | 0.175 | 0.262 | 0.473 |
| F-Static | 4.26 | 33.51 | 29.68 | 45.86 | 33.31 | 24.76 |
| Time FE | No | Yes | Yes | No | Yes | Yes |
| Country FE | No | Yes | No | No | Yes | No |
| Bank FE | No | No | Yes | No | No | Yes |

*Standard errors in parentheses*
*$^{*}$ p < 0.10, $^{**}$ p < 0.05, $^{***}$ p < 0.01*
*Notes: Robustness model for ROAE, years 2013-2019. Column 1 includes OLS regression without controls, column 2 additionally includes Time and Country FE, whereas column 3 includes Time and Bank FE. Column 4*

*contains OLS regression with bank and macro controls. Column 5 additionally includes Time and Country FE, whereas column 6 includes Time and Bank FE.*

## 4.4 Discussion

Specifications presented in Benchmark Results section, estimated on the longer period, including the financial crisis and the COVID-19 pandemic, suggest no influence of the euro adoption on the banks' profitability. Initial exploratory regression without controls suggests a positive effect of the Eurozone membership. However, this appears misleading when considering bank-specific characteristics, macroeconomic situation, and unobserved factors across time, states and institutions. All Euro and ERM coefficients from the full specifications in columns (5) and (6) in Tables 5 and 6 are statistically insignificant. The consistent estimates of bank and macro controls across specifications manifest the robustness of our approach.

Specifications presented in Robustness Results section are estimated on the shorter, tranquil period. Table 7 indicates the negative effect of euro adoption on banks' profitability in both specifications without fixed effects and with Time and Country FE (columns 4 and 5). The significance is not present in regression with Bank and Time FE; restricted sample size and a significant number of variables cause the variability resulting from the euro to be much harder to isolate. Again, the coefficients of control variables appear to be consistent across specifications. Table 8 with ROAE specification presents similar results and reinforces the message.

The results from both periods suggest that the eurozone does not positively affect banks' profitability in the CEE region, partially contradicting the hypothesis based on the literature review. Our results suggest that the effect could be negative during stable economic times and absent over a longer period. We hypothesize that this is an effect of increased competition from improved transparency and supervision, resulting in lower profit margins. This is different from the examined literature (Psillaki and Mamatzakis (2017), Chortareas, Girardone and Ventouri (2012), Fiordelisi, Ricci and Lopes (2017)). However, the mentioned studies cover different periods and countries. The absence of the Euro effect results in the benchmark specifications (including turbulent economic times), which may indicate that eurozone banks perform better during crises. This also could result from an improved supervisory system, which positively affects the financial system's stability.

A decline in profitability associated with euro adoption, particularly under stable economic conditions, may suggest heightened competitive pressure, reduced pricing power, or narrowing interest margins due to tighter supervision and transparency. However, it could also

reveal broader structural changes in market power. Given that the banking sector in many CEE countries is already concentrated, declining profitability might signal a move away from oligopolistic structures towards more competitive markets.

# 5. Conclusions

This research contributes to the existing literature on the benefits of the euro adoption by examining its effect on banks' performance in 11 Central and Eastern European states. We gathered a sample of 92 banks from 2006 to 2020 with 1033 bank-year observations. We estimated the benchmark model with country-fixed effects, including dummy variables for eurozone and ERM II membership and several control variables. Further, we analyzed the period excluding the Financial Crisis and the Covid pandemic.

Our results suggest that the euro adoption and ERM II have no effects on banks' profitability in the CEE region over a long period but are negative during stable economic conditions. Regressions on the full sample from 2006 to 2020, including bank-specific and macroeconomic controls and Country and Time Fixed Effects, do not yield statistically significant results. Regressions on a sample from 2013 to 2019, a period of stable economic conditions, yield a negative effect of the euro adoption on banks' profitability. We consider a possible explanation of the impact of increased banking supervision in the Eurozone, which increases transparency, boosts competition, lowers the profit margin, and assures greater stability of the financial sector during crises. Importantly, there is no indication that the euro adoption and ERM II mechanism have strictly positive effects on banks' profitability.

An important limitation of this study is that GDP growth and inflation are treated as independent variables. However, a rich literature has established that the euro adoption has a taming effect on inflation and could positively affect GDP growth. Thus, some of the impact of the euro adoption on banks' profits could also be ascribed to the macroeconomic channels. We leave this avenue for future research.

This paper additionally contributes to the discussion on banks' profitability determinants in the CEE region. We find that capitalization and bank size positively affect while liquidity negatively affects banks' profitability.

# References


Agoraki, M.E.K., Kouretas, G.P. and Tsamis, A. (2021). The determinants of performance in the Eurozone banking sector: core versus periphery Eurozone economies. *International Journal of Finance & Economics, 26*(1), pp.416-429. https://doi.org/10.1002/ijfe.1796

Albertazzi, U. and Gambacorta, L. (2009). Bank profitability and the business cycle. *Journal of Financial Stability, 5*(4), pp.393-409. https://doi.org/10.1016/j.jfs.2008.10.002

Askari, H. and Chatterjee, J. (2005). The Euro and financial market integration. *JCMS: Journal of Common Market Studies, 43*(1), pp.1-11. https://doi.org/10.1111/j.0021-9886.2005.00543.x

Benczúr, P. and Rátfai, A. (2010). Economic fluctuations in Central and Eastern Europe: the facts. *Applied Economics, 42(*25), pp.3279-3292. https://doi.org/10.1080/00036840802112380

Chen, W.D., Chen, Y. and Huang, S.C. (2021). Liquidity risk and bank performance during financial crises. *Journal of Financial Stability, 56*, p.100906. https://doi.org/10.1016/j.jfs.2021.100906

Chortareas, G.E., Girardone, C. and Ventouri, A. (2012). Bank supervision, regulation, and efficiency: Evidence from the European Union. *Journal of financial stability, 8*(4), pp.292-302. https://doi.org/10.1016/j.jfs.2011.12.001

Cojocaru, L., Falaris, E.M., Hoffman, S.D. and Miller, J.B. (2016). Financial system development and economic growth in transition economies: New empirical evidence from the CEE and CIS countries. *Emerging Markets Finance and Trade, 52*(1), pp.223-236. https://doi.org/10.1080/1540496X.2015.1013828

Corporate Financial Institute. (2021). List of Finance Companies. Available at: https://corporatefinanceinstitute.com/resources/careers/companies/ (Accessed on 13.07.2022).

De Freitas, M.L., Nunes, L.C. and Rodrigues, M.S. (2018). Euro area membership and the probability of a sudden stop: an empirical assessment. *JCMS: Journal of Common Market Studies, 56*(4), pp.818-836. https://doi.org/10.1111/jcms.12641

Djalilov, K. and Piesse, J. (2016). Determinants of bank profitability in transition countries: What matters most?. *Research in International Business and Finance, 38*, pp.69-82. https://doi.org/10.1016/j.ribaf.2016.03.015

Dreyer, J.K. and Schmid, P.A. (2017). Growth effects of EU and EZ memberships: Empirical findings from the first 15 years of the Euro. *Economic Modelling, 67*, pp.45-54. https://doi.org/10.1016/j.econmod.2016.09.007

ECB (2022), ‘Single Supervisory Mechanism’. Available at: https://www.bankingsupervision.europa.eu/about/thessm/html/index.en.html (Accessed: 15.08.2022).

ECBa, (2020), ‘Economic and Monetary Union’. Available at: https://www.ecb.europa.eu/ecb/history/emu/html/index.en.html (Accessed: 25.08.2022).

ECBb, (2020), ‘Convergence Report’. Available at: https://www.ecb.europa.eu/pub/pdf/conrep/ecb.cr202006~9fefc8d4c0.en.pdf (Accessed: 25.08.2022).

Fiordelisi, F., Ricci, O., & Stentella Lopes, F. (2017). The Unintended Consequences of the Launch of the Single Supervisory Mechanism in Europe. Journal of Financial and Quantitative Analysis, 52(6), 2809-2836. doi:10.1017/S0022109017000886

He, L.T., Fayman, A. and Casey, K.M. (2014). Bank profitability: The impact of foreign currency fluctuations. *Journal of applied business and economics, 16*(2), pp.98-104.

Heller, J. and Warzala, R. (2019). The effects of entering the Eurozone on other Central and Eastern European Countries in relation to Poland. *Journal of competitiveness*, pp.5-21. . https://doi.org/10.7441/joc.2019.01.01

Kolasa, M. (2013). Business cycles in EU new member states: How and why are they different?. *Journal of Macroeconomics, 38*, pp.487-496. https://doi.org/10.1016/j.jmacro.2013.08.007

Pasiouras, F. and Kosmidou, K. (2007). Factors influencing the profitability of domestic and foreign commercial banks in the European Union. *Research in International Business and Finance, 21*(2), pp.222-237. https://doi.org/10.1016/j.ribaf.2006.03.007

Psillaki, M. and Mamatzakis, E. (2017). What drives bank performance in transitions economies? The impact of reforms and regulations. *Research in International Business and Finance, 39*, pp.578-594. https://doi.org/10.1016/j.ribaf.2016.09.010

Saia, A. (2017). Choosing the open sea: The cost to the UK of staying out of the euro. *Journal of International Economics, 108*, pp.82-98. https://doi.org/10.1016/j.jinteco.2017.06.001

TheBanks.eu, (2022). Banks by Country. Available at: https://thebanks.eu/ (Accessed 14.07.2022).

TheGlobalEconomy, (2020), “Bank assets to GDP – Country rankings”. Available at: https://www.theglobaleconomy.com/rankings/bank_assets_GDP/European-union/ (Accessed: 15.08.2022).

# Appendix

## A. List of banks included in the sample by country:

**Bulgaria**
*Allianz Bank Bulgaria*
*Central Cooperative Bank*
*DSK Bank EAD*
*Eurobank Bulgaria*
*Expressbank*
*First Investment Bank*
*Piraeus Bank Bulgaria*
*Raiffeisenbank (Bulgaria) EAD*
*UniCredit Bulbank AD*
*United Bulgarian Bank*

**Croatia**
*Addiko Bank Croatia d.d.*
*Agram banka d.d.*
*Hrvatska postanska banka d.d.*
*Nova hrvatska banka d.d.*
*Podravska banka d.d.*
*Privredna banka Zagreb*
*Raiffeisenbank Austria d.d.*
*Splitska banka d.d.*
*Zagrebacka banka d.d.*

**Czech Republic**
*Ceska sporitelna*
*Ceskoslovenská obchodní banka*
*Fio banka*
*Komercni banka*
*MONETA Money Bank*
*PPF banka*
*Raiffeisenbank CZ*
*Sberbank CZ*
*UniCredit Bank Czech Republic and Slovakia*

**Estonia**
*AS LHV Pank*
*AS SEB Pank*
*AS TBB pank*
*Bigbank AS*
*Coop Pank AS*
*Luminor Bank AS Estonia*
*SwedBank Estonia*

**Hungary**
*Budapest Hitel- és Fejlesztési Bank Zrt.*
*CIB Bank Zrt.*
*Erste Bank Hungary Zrt.*
*MKB BANK Nyrt.*
*OTP Bank Nyrt.*
*Raiffeisen Bank Zrt.*
*UniCredit Bank Hungary Zrt.*

**Latvia**
*AS Citadele banka Latvia*
*AS Industra Bank*
*AS LPB Bank*
*AS PNB Banka*
*AS Rietumu Banka*
*AS SEB banka Latvia*
*BluOr Bank AS*
*JSC "Baltic International Bank"*
*Regionala Investiciju Banka AS*

**Lithuania**
*AB SEB bankas*
*AB Siauliu Bankas*
*Citadele Bankas AB*
*Luminor Bank AB*
*Swedbank Lithuania*
*UAB Medicinos Bankas*

**Poland**
*Alior Bank*
*Bank Handlowy*
*Bank Millennium*
*BNP Paribas Polska*
*Getin Noble Bank*
*ING Bank Slaski*
*mBank*
*Santander Bank Polska*

**Romania**
*Alpha Bank Romania SA*
*Banca Comerciala Romana S.A.*
*Banca Romaneasca S.A.*
*Banca Transilvania S.A.*
*BRD - Groupe Société Générale S.A.*
*CEC Bank S.A.*
*OTP Bank Romania S.A.*
*Raiffeisen Bank Romania S.A.*
*UniCredit Bank Romania S.A.*

**Slovakia**
*365.bank, a. s.*
*OTP Banka Slovensko*
*Prima banka Slovensko*
*Privatbanka*
*Slovenská sporitel'na*
*Tatra banka*
*UniCredit Bank Slovakia*
*Vseobecna uverova banka*

**Slovenia**
*Addiko Bank*
*Banka Intesa Sanpaolo*
*Banka Sparkasse*
*Dezelna banka Slovenije*
*Gorenjska banka*
*Nova Kreditna Banka Maribor*
*Nova Ljubljanska Banka*
*SID - Slovenska izvozna in razvojna banka*
*SKB banka*
*UniCredit Banka Slovenij*

# B. Descriptive Statistics

Table 9: Observations by year

| Year | Freq. | Percent | Cum. |
|---|---|---|---|
| 2006 | 27 | 2.61 | 2.61 |
| 2007 | 30 | 2.90 | 5.52 |
| 2008 | 40 | 3.87 | 9.39 |
| 2009 | 43 | 4.16 | 13.55 |
| 2010 | 46 | 4.45 | 18.01 |
| 2011 | 82 | 7.94 | 25.94 |
| 2012 | 82 | 7.94 | 33.88 |
| 2013 | 82 | 7.94 | 41.82 |
| 2014 | 86 | 8.33 | 50.15 |
| 2015 | 88 | 8.52 | 58.66 |
| 2016 | 88 | 8.52 | 67.18 |
| 2017 | 89 | 8.62 | 75.80 |
| 2018 | 86 | 8.33 | 84.12 |
| 2019 | 81 | 7.84 | 91.97 |
| 2020 | 83 | 8.03 | 100.00 |
| **Total** | **1,033** | **100.00** | |

*Notes: Number of observations per year including proportion of the sample and cumulative distribution*
*Source: own calculations based on S&P Global data.*

Table 10: Observations by year - Euro observations

| Year | Freq. | Percent | Cum. |
|---|---|---|---|
| 2006 | - | - | - |
| 2007 | 2 | 0.60 | 0.60 |
| 2008 | 2 | 0.60 | 1.21 |
| 2009 | 7 | 2.11 | 3.32 |
| 2010 | 8 | 2.42 | 5.74 |
| 2011 | 23 | 6.95 | 12.69 |
| 2012 | 23 | 6.95 | 19.64 |
| 2013 | 22 | 6.65 | 26.28 |
| 2014 | 31 | 9.37 | 35.65 |
| 2015 | 37 | 11.18 | 46.83 |
| 2016 | 37 | 11.18 | 58.01 |
| 2017 | 38 | 11.48 | 69.49 |
| 2018 | 35 | 10.57 | 80.06 |
| 2019 | 32 | 9.67 | 89.73 |
| 2020 | 34 | 10.27 | 100.00 |
| **Total** | **331** | **100.00** | |

*Notes: Number of euro observations per year including proportion of the sample and cumulative distribution*
*Source: own calculations based on S&P Global data.*