

**OPPORTUNITIES ARE USEFUL TO THOSE WHO TAKE THEM – HOW
CAPITAL MARKET INTEGRATION AFFECTS CAPITAL ALLOCATIVE
EFFICIENCY IN THE EUROZONE**

By

Julius Edvilas Raudonikis

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Supervisor: Tomy Lee

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I, the undersigned, **Julius Edvilas Raudonikis**, candidate for the MA degree in Economic Policy in Global Markets declare herewith that the present thesis titled “*Opportunities are Useful to Those Who Take Them – How Capital Market Integration Affects Capital Allocative Efficiency in the Eurozone*” is exclusively my own work, based on my research and only such external information as properly credited in notes and bibliography.

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Vienna, 10 June 2025

Julius Edvilas Raudonikis

Abstract

This thesis explores the relationship between Eurozone capital market integration and capital allocative efficiency, asking whether integration improves the ability of national capital markets to allocate resources toward sectors with rising value-added. Using panel data from 17 Eurozone countries between 2005 and 2024, the study measures allocative efficiency through an elasticity approach and constructs a composite integration index based on six cross-border financial flow indicators sourced from the European Central Bank. Investor risk aversion – identified as a barrier to cross-border investment – is captured using bank-level pricing behavior. Fixed effects regression models reveal three main findings: first, greater integration is associated with higher allocative efficiency; second, risk aversion independently reduces efficiency; third, risk aversion dampens the positive effect of integration on capital allocative efficiency. The analysis further shows that cross-border borrowing, and foreign ownership of corporate debt securities are the most impactful components of integration. These results suggest that while integration improves capital allocation, its benefits are conditional on behavioral and institutional factors. Furthermore, the results show that countries with lower investor risk aversion benefit the most from capital market integration. The thesis contributes to the literature by quantifying these dynamics at each Eurozone country's level, offers policy implications for accelerating integration and puts an emphasis on the need to consider risk aversion as a significant variable in the progress towards European capital market union.

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List of abbreviations

CMU – Capital Market Union

CEE – Central Eastern Europe

EU – European Union

ECB – European Central Bank

GDP – Gross domestic product

GFC – Great financial crisis of 2008

IHS – Inverse hyperbolic sine transformation

IP – Intellectual property

MRT – Marginal rate of transformation

IPO – Initial public offering

TFP – Total factor productivity

PCA – Principal component analysis

QE – Quantitative easing

Chapter 1 – Introduction

The European Union has been trying to implement its capital markets union project for the past 10 years. The aim is to merge European capital markets, which currently function on a largely national member state basis, into a single European market, capable of generating the economies of scale required for financing European projects to deal with climate change, energy, defense, and other societal challenges. Moreover, by merging European capital markets into one, Europeans will be able to invest their financial resources (capital) to get higher returns and more value generation. In economics terminology, this is called capital allocative efficiency.

The alternative view challenges the claims that the European capital market integration will increase capital allocative efficiency. European investors may keep their investments in their home regions even with capital market integration, due to their domestic information advantage (van Nieuwerburgh and Veldkamp 2009). Other barriers to cross-border investment include a lack of trust by European investors in their counterparts in other European countries, and differences in culture and language (Asgharian and Hansson 2004; Berger, De Young, and Udell 2001; Affinito and Piazza 2008). In addition, empirical evidence indicates that de facto financial integration tends to decline as investors' aversion to cross-border investment risk increases, reflecting a persistent home bias that hinders deeper capital market integration (Maurin, Minnella, and Lake 2024). Such risk-averse behavior ultimately constrains the potential benefits of integration, as limited cross-border diversification and capital mobility prevent the EU from fully realizing improved risk-sharing and more efficient allocation of capital across investors in different member states (Maurin, Minnella, and Lake 2024).

In essence, then, there are more barriers to integration and efficiency gains than just regulatory barriers, and that integration, if accomplished, may still fail to improve European capital allocative efficiency. Therefore, the possible effects of integration on efficiency must be empirically tested to determine whether the capital markets union (CMU) project is worth the opportunity cost of focusing political capital towards it, rather than other pressing challenges that Europe faces. The research question raised by this thesis then is: *What is the effect of Eurozone capital market integration on Eurozone capital market allocative efficiency?*

To answer this question, I use a panel data study of 17 Eurozone countries from 2005 to 2024 using national, sectoral, and individual bank data. The Eurozone is chosen because it contains 17 countries within it that have a common currency and a common monetary policy. This allows research to fix the effects of currency and monetary policy to focus on the inner workings of the capital markets of countries within a single currency area. Furthermore, this makes the modelling of capital market integration considerably easier, since there is no need to account for currency fluctuations. Capital allocative efficiency is measured using a modified version of the approach introduced by Wurgler (2000), based on how investment responds to changes in sectoral value-added. Capital market integration is captured through a principal component analysis of six cross-border financial flow indicators sourced from the European Central Bank. To account for investor preferences, I compute a risk aversion index using the method developed by Tsionas (2016), which relies on individual bank data to compare observed prices of financial products with counterfactual prices implied by production technology. These three components – efficiency, integration, and risk aversion – are combined in a panel regression framework, including country fixed effects and interaction terms, to assess how integration affects allocative efficiency, and whether this effect depends on underlying investor risk preferences.

The findings of the thesis are the following. First, capital market integration – the merging of Eurozone capital markets – does contribute to the more efficient functioning of Eurozone capital markets. Second, investor risk aversion is found to negatively contribute to the functioning of Eurozone capital markets. Third, the effect of capital market integration is dampened by risk aversion – with higher investor risk aversion, the positive effect of integration is lower. Finally, borrowing from financial institutions in other Eurozone countries has the biggest impact on integration and the associated largest increase in capital allocative efficiency. This thesis contributes to the literature on the European capital market union by showing that even incremental changes in integration lead to more efficient workings of capital markets at the country level. Furthermore, it contributes to the policy discussion by displaying to policymakers what contributes to capital market integration the most, and thereby, what instruments they should target to increase capital market integration.

The rest of this thesis is structured as follows. I first outline some background about the capital markets union in Chapter 2. I then move on to review the literature concerning my research question in Chapter 3. I discuss the methodology in Chapter 4 and the results in Chapter 5. Chapter 6 discusses the results, implications, and policy recommendations. The conclusion finishes in Chapter 7.

Chapter 2 – Background

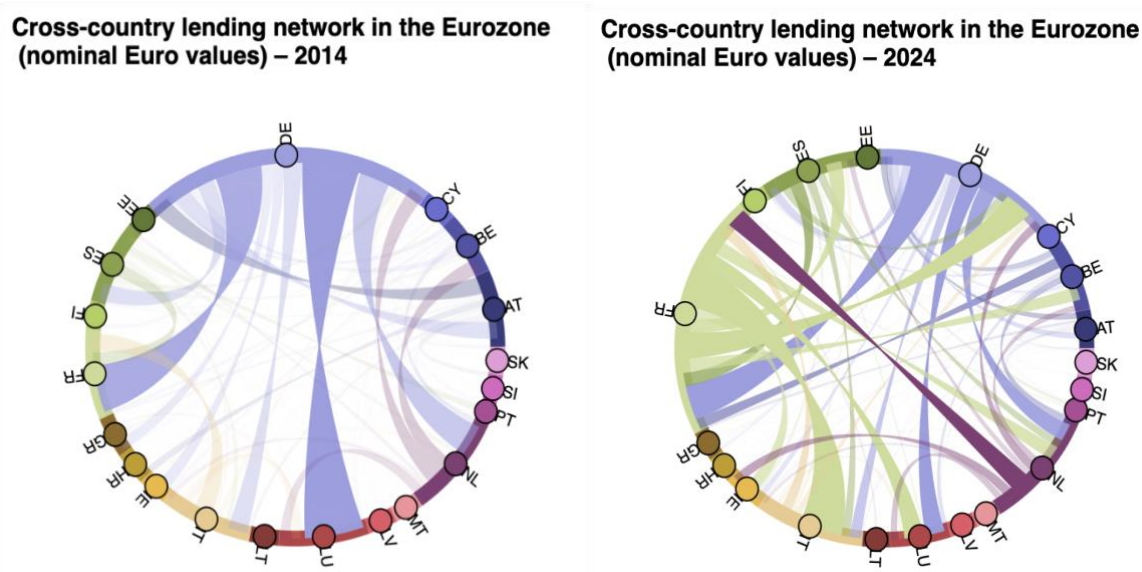
In 2014, after the devastating impacts of the great financial crisis of 2008 (GFC) and the Eurozone debt crisis of 2010, the European Commission came up with the capital markets union (CMU henceforth). To give some background, during the GFC, investment across the EU decreased by 20%, while the worst-hit countries experienced investment decreases of 40% (Szczepanski 2019). In 2009, because of the crisis, EU GDP decreased by 4% from the previous year (Szczepanski 2019). After the crisis part was over, the recovery on the two sides of the Atlantic was not equal. The United States returned to its pre-crisis volumes of investment very quickly; meanwhile multiple indicators suggest that European investment and capital markets started clogging – Europe stopped investing (Vermeulen 2016). Given this incomplete recovery, the European Commission (EC) proposed the capital markets union (CMU) in 2014.

The CMU project has two facets meant to combine European capital markets into a single capital market big enough to revitalize the European economy by efficiently allocating savings and risk to those with the best uses for them. The two facets are: 1) optimizing financial market infrastructure, such as stock markets; 2) increasing lending and investing across European borders by all capital market participants. These efforts to consolidate European financial markets and their infrastructure have been undermined by a number of political and psychological factors of investors. From the political side, national governments resist transferring authority to supranational institutions, preferring to maintain control over economic governance decisions at home (Puetter and Puntischer Riekmann 2020). Furthermore, a number of studies document that risk aversion is displayed by all manner of European capital market participants, reducing their participation in the financing of the real economies of Eurozone countries (Guiso, Sapienza, and Zingales 2013; Lippi and Rossi 2020).

The combining and optimization of European financial market infrastructure is necessary because there is a duplication of financial infrastructure and institutions across the Eurozone. Currently, there are 33 stock markets in the European Union, making 1.22 stock markets per member state. Out of these 33 stock markets, 18 make up less than 1% of the total stock market capitalization of the European Union (Wright and Hamre 2021), have low trading volumes, and a low number of initial public offerings (IPO's). These stock markets are a redundant duplication of efforts and merging them with others would bring in more liquidity into the market and capital to those firms listed on that market, benefiting business. There are also 40 clearing houses and securities depositories in the entire EU that face the same issues of duplication and low economies of scale. Despite the necessity to merge these exchanges, clearing houses, and depositories, these efforts are stalled or are met by resistance that prevents the merger (Thomadakis et al. 2022). Thus, the issue of financial infrastructure duplication persists.

The situation is better on the cross-EU border lending facet – lending has increased since the GFC over the past 10 years. This can be seen in Figure 1, which indicates cross-border lending in 2014 and 2024. Each line is the volume of Euros being lent by domestic financial institutions to counterparties in other Eurozone countries. E.g., the light blue line from Germany to France is the number of Euros being lent by German financial institutions to French counterparties. As Figure 1 indicates, there has been a tightening of the network of loans being lent across EU borders over the past 10 years – Europeans lent much more to each other in 2024 than they did in 2014. Figure 1 thus shows that some progress has been made towards EU capital market integration, as Europeans lend more to each other.

Figure 1. Eurozone cross-border lending over time, in nominal and percentage of GDP terms



Source: European Central Bank (2024) data and author's calculations

However, despite these improvements in integration displayed in Figure 1, the CMU has fallen short of its targets and goals. Recent literature has noted that the CMU project primarily focuses on the demand side (firms needing capital), while somewhat neglecting the need to increase the low investor willingness to participate in European capital markets (Belke and Allroggen 2019) and increase the quality of investing and lending. This increase in cross-border volumes, shown in Figure 1, shows volumes, not allocations; whether this flow of money has resulted in better quality lending and investing, as desired by the CMU, is not obvious.

More money flowing does not mean better allocations, if the quality of institutional lending has been shown to have dropped in quality. After the GFC, the European Central Bank (ECB) engaged in quantitative easing (QE) to support the recovery of European economies and the injection of cash into distressed European banks. Empirical studies have shown that following this QE move by the ECB, banks increased loan supply, but that supply was largely extended to low-quality firms with pre-existing lending relationships with the same banks (Acharya et al. 2016). Consequently, there was no positive impact on real economic activity like employment or investment, because these low-quality firms receiving most of the new loans used this extra cash to build up cash reserves, rather than invest in the quality of their business operations (Acharya et al. 2016).

Furthermore, the quality of institutional lending and investing has also suffered because of the decrease in risk appetite following the GFC. Empirical studies have found that risk appetite is an important dampener of capital allocation in Europe after the GFC. More specifically, risk tolerance of European investors has decreased after the GFC (Guiso, Sapienza, and Zingales 2013; Lippi and Rossi 2020). In one of the most seminal papers on the topic of risk appetite, Guiso, Sapienza, and Zingales (2013) show that risk appetite decreased among European investors generally, even those who did not hold risky assets during the GFC (Guiso, Sapienza, and Zingales 2013).

All of this shows that Eurozone capital markets have not been working as efficiently as they could be, for reasons including the duplication of financial infrastructure, zombie lending, high levels of risk aversion, and potentially other uncaptured barriers. It is therefore important to test whether combining these capital markets can dislodge some of these barriers and increase the efficiency of European capital markets as a whole.

Chapter 3 – Literature review

Capital market efficiency has been implied in previous studies, but not explicitly defined or modelled. A paper by Orłowski (2020) has examined the relationship between equity, portfolio debt, and real economic growth in the EU. However, this paper implies that positive real GDP increases due to an increase in equity-to-GDP ratio are due to an increase in capital allocation efficiency. Despite this, capital allocation efficiency is not defined or modelled in the paper.

To answer the posed research question and define capital allocative efficiency, this paper will take the definition of capital market allocative efficiency from Wurgler (2000). Here, allocative efficiency is understood as the ability of capital markets to shift investment from sectors in the economy where value added is decreasing to sectors in the economy where value added is increasing. Such conceptualization is realistic, because investors should be investing in those firms and industries with growing value added and thus growing prospects and decreasing their exposure to industries in a sector where value added is declining. Wurgler estimates this ability using a regression that is detailed more in the methodology in

chapter 4. These time-series coefficients of capital allocative efficiency will be used as an independent variable to answer the posed research question.

The Wurgler (2000) method is selected for its transparency, simplicity, and interpretability. It provides a robust and practical approach to measuring capital allocation efficiency (Zhang et al., 2021). Unlike methods that require estimating a production function for each country to derive the marginal productivity of capital, Wurgler's method avoids this complexity. This is particularly important when working with Eurozone countries, because Member States vary widely in economic structure. For example, countries like Poland, the Baltic states, and others in the CEE region rely heavily on FDI, exports, and infrastructure-driven TFP growth, while economies like Germany and France are more research and development, capital-intensive, and IP-driven. These differences make it difficult to impose a single production function across all countries, strengthening the case for using a more flexible and comparable measure like Wurgler's.

To measure capital market integration in the Eurozone, this paper adopts the theory law of one price, which states that identical financial instruments should yield the same return across countries in an integrated market (Adam et al., 2002). However, due to persistent frictions, researchers also rely on quantity-based indicators such as cross-border capital flows to capture capital market integration (Baele et al., 2004). In the context of the CMU, rising intra-euro area flows of loans, deposits, and debt securities are viewed as signs of diminishing barriers, improved arbitrage, and market efficiency (Lane & Milesi-Ferretti, 2007). This study follows prior literature in using six such indicators: cross-border loans, deposits, and debt securities, each measured both as incoming (funds received) and outgoing (funds sent). Cross-border loan flows, especially interbank and firm-level lending, are widely used to track banking integration and private risk-sharing (ECB, 2024). Deposit flows reflect household and firm trust in foreign banking systems and remain low, though rising post-2022 due to interest rate differentials and digital banking (ECB, 2024). Finally, cross-border debt securities holdings are key indicators of capital market integration, with ECB and academic studies documenting that euro adoption substantially increased intra-area bond investment (Santos Silva & Tenreyro, 2010). These indicators are employed by the ECB, European Commission, and researchers to construct integration indices, as they reveal to what extent capital is allocated without regard

to borders. Higher flows suggest the removal of home bias, legal asymmetries, and informational frictions – all conditions under which the law of one price can function in practice (Baele et al., 2004). Therefore, the six selected ECB indicators form a robust empirical basis for constructing an integration index aligned with both theoretical and policy-oriented definitions of a unified European capital market.

The contribution of this paper to literature is three-fold. First, the extensions of capital allocative efficiency estimates over time, using the Wurgler (2000) method to create an annual time-series of changes in efficiency in each country, allowing this paper to estimate the contribution of integration to efficiency at a much higher frequency than the existing literature. Second, this paper contributes to the literature by using panel country data to integrate risk aversion as a control variable when estimating the effect of capital market integration on allocative efficiency in Europe. Third, by analyzing capital allocative efficiency and capital market integration on a country basis, this thesis provides policymakers and academics with a view of how well each country is integrating into European capital markets, as well as how well their national capital markets are functioning. This may provide more insight into new policy or research avenues for capital market researchers.

Chapter 4 – Methodology

To answer the research question, this paper utilizes a quantitative methodology to derive each variable, followed by the main model of this thesis. The method entails regressing capital allocative efficiency on capital market integration and risk appetite.

Table 1. Descriptions of modelled variables

<u>Variable</u>	<u>Description</u>
Capital allocative efficiency	• Independent variable • Derived as an elasticity of how well a country's capital market is able to shift investment into sectors with growing value added
Capital market integration	• Dependent variable • Derived as a composite index from 6 indicators of capital market integration using principal component analysis
Risk appetite	• Control variable

- Derived as an index from the difference of observed and counterfactual bank product prices

Before describing the research process, I will briefly outline the data sources. For capital allocation efficiency, I will be using yearly Eurostat data containing all the NACE sectors of each Eurozone country's economy. For each sector, the yearly investment (gross capital formation) and value-added entries are taken. For capital market integration, I will be using six indicators of capital market integration, taken from the ECB. To get a capital market integration index, I will conduct a principal component analysis (PCA) to derive a composite index for capital market integration for each country. Finally, for risk appetite, the main control variable, I will be using 958 individual bank data points, taken from the S&P Capital IQ. This individual bank data contains income from loans, gross loans issued and other bank expenditures. Utilizing individual bank data, I will compute a risk appetite index using the methodology of Tsionas (2016).

The methodology begins by estimating capital allocative efficiency using a modified version of Wurgler's (2000) equation, adapted for time-series analysis at the country-year level:

Equation 1. Modified Wurgler (2000) equation for capital allocative efficiency

$$\Delta \ln I_{ict} = \alpha_c + \eta_{ct} \Delta \ln V_{ict} + \varepsilon_{ict}$$

In contrast to Wurgler's approach, which provides a single efficiency estimate over an entire period of up to 33 years, this method generates a yearly time series of efficiency indicators for each country. This is achieved by introducing a time index in the elasticity term, allowing us to estimate capital allocation efficiency separately for each year using sectoral investment and value-added data (and their one-year lags). The resulting annual efficiency indicators serve as the dependent variable in subsequent analysis. Due to significant cross-country heterogeneity and the presence of influential outliers (e.g. Ireland, Luxembourg, and the Netherlands), the efficiency estimates are transformed using the inverse hyperbolic sine (IHS) function. This transformation reduces the impact of extreme values while preserving interpretability and is later reversed to make the estimated coefficients meaningful.

To derive a capital market integration index, I proceed in two steps. Using the six capital market integration indicators from the ECB, I conduct a principal component analysis (PCA) and create a capital market integration index for each country, spanning from 2005 to 2024. The indicators I use are: the amount

of deposits that other Eurozone countries hold in a given country; the amount of loans lent out to counterparties in other Eurozone countries by a given country; the amount of debt securities of a given country owned by counterparties in other Eurozone countries; the amount of loans that a given country has borrowed from counterparties in other Eurozone countries; the difference between the amount of loans a given country has received from other Eurozone countries, and the Eurozone average; the difference between the amount of debt securities counterparties in other Eurozone countries have bought of a given country and the Eurozone average.

Table 2. Variables used to estimate a composite capital market integration index

<u>Description</u>	<u>Country fund flow direction</u>
The number of deposits that other Eurozone countries hold in a given country	Receiving (foreign deposits held at home)
The amount of loans lent to counterparties in other Eurozone countries by a given country	Sending (sending funds to other countries)
The amount of debt securities of a given country owned by counterparties in other Eurozone countries	Receiving (investors buy our bonds, and we receive funds)
The amount of loans that a given country has borrowed from counterparties in other Eurozone countries	Receiving (banks in foreign countries lend our business funds)
The difference between the amount of loans a given country has received from other Eurozone countries and the Eurozone average	Receiving (funds we have received – EU average of how much other countries have received from other countries)
The difference between the amount of debt securities counterparties in other Eurozone countries have bought from a given country and the Eurozone average	Receiving (funds we have received from debt securities sales – EU average of how much other countries have received from their debt securities sales)

Having calculated the indicators described in Table 2, I ran a PCA analysis to calculate a combined capital market integration index. The weights of the PCA are shown in Appendix A.

To calculate risk aversion for each country and year, I utilize the structural method of Tsionas (2016) to calculate bank aversion using individual bank data. The method relies on inferring bank risk preferences by comparing observed prices of bank products (the prices banks charged for loans, deposits, and investments) and the counterfactual prices of what the banks should have charged, given their marginal rate of transformation. The data of 958 individual banks contains information on the gross loans issued, deposits taken, investment securities invested in, as well as revenues from loans, deposits, and investment securities.

Based on this data, I calculate, for each year, the actual prices charged for loans and investments. I do this by dividing revenue from loans by the amount of gross loans, which gives the price of loans. This is repeated for investment securities and deposits. I then estimate a translog production function that links loan output to investment output, allowing for flexible substitution between these two financial activities. From this function, I derive the marginal rate of transformation (MRT), which captures how banks could theoretically shift output between loans and investments, purely based on their production technology. This approach to estimating MRT is directly drawn from Tsionas' (2016) methodology.

Having calculated each bank's marginal rate of transformation (MRT) between loans and investments for every country and year, I then construct a bank-level risk aversion index by comparing the counterfactual price ratio, implied by technology through the MRT, to the actual price ratio observed in the market. The idea, drawn from Tsionas (2016), is that if banks were operating purely to maximize efficiency based on their production function, the prices they set would align with the MRT. Deviations from this benchmark reflect preferences or aversions toward risk. A larger gap between the counterfactual and observed price ratios implies that a bank is choosing safer or more stable activities even when the technology allows otherwise – an indication of higher risk aversion. To account for differences in the scale of bank operations, this log-difference is normalized by the log of the output ratio between investments and loans, ensuring that the measure is not distorted by size effects. I compute this index for each bank and then aggregate to the country-year level using trimmed means, which remove extreme values at both ends of the distribution. Missing values over time are interpolated to maintain continuity, and bootstrapped confidence intervals are used to assess the stability and statistical precision of the estimates.

Table 3. Descriptive statistics of variables used in modelling

Variable	N	Mean	SD (Total)	SD (Within)	SD (Between)
IHS Efficiency	306	0.651	2.862	2.795	0.612
Log integration	323	-0.770	1.005	0.492	0.971
IHS Risk aversion	323	2.793	2.401	2.085	1.231
Loans lent to EU counterparties (pct of GDP)	301	51.402	135.213	29.723	151.340
EU counterparty deposits held domestically (pct of GDP)	301	36.183	76.694	26.646	82.244
Debt securities bought by EU counterparties (pct of GDP)	323	0.477	1.298	0.632	1.303
Loans borrowed from EU counterparties (pct of GDP)	323	1.242	2.908	1.380	2.927
More loans received than EU average (pct of GDP)	323	0.708	2.896	1.388	2.907
More debt securities issued than EU average (pct of GDP)	323	0.209	1.282	0.611	1.296

The descriptive statistics of the calculated variables are displayed in table 2. Given the substantial between-country variation in integration, efficiency, and financial flows, it is possible that unobserved, time-invariant likely that time-invariant factors influence outcomes. A fixed effects model is therefore appropriate, as it controls for these latent country-specific factors and enables identification of within-country changes over time. This allows the analysis to isolate the effects of evolving capital market integration on allocative efficiency, controlling for country fixed effects and risk aversion.

Having computed all the necessary variables, I conduct three fixed effects models to test the effect of capital market integration on capital market efficiency. The first model regresses IHS transformed efficiency on the unlogged capital market integration index. The second model regresses untransformed capital allocative efficiency on the log-transformed integration index. The third model is a log-log model, regressing IHS transformed efficiency on log transformed integration index. In all three models, the IHS transformed risk aversion is added as a control variable. Risk aversion is also IHS transformed to transform the distance across observations, and to ease the interpretability of the model. Moreover, an interaction effect between capital market integration and risk aversion is added. This is done on the expectation that investors in more risk-averse countries may be less willing to engage in cross-border financial flows, either by limiting foreign investments or by being more reluctant to accept external financing, thereby weakening the degree of capital market integration and potentially dampening the transmission of international stocks. Finally, a country-level dummy for each country is added to control for the fixed country effects. The log-log fixed effects regression model is displayed in equation 2. For space conservation purposes, only the equation of model 3 is shown below; the equations of model 1 and 2 can be found in Appendix B.

Equation 2. Equation of the estimated model 3

$$\begin{aligned}
 &IHS(Efficiency)_{ict} \\
 &= \alpha + \beta_1 \log(Integration)_{it} + \beta_2 IHS(Risk\ aversion)_{it} \\
 &+ \beta_3 \log(Integration) * IHS(Risk\ aversion)_{it} + Country + \varepsilon
 \end{aligned}$$

In Equation 2, IHS efficiency is the inverse hyperbolic sine (IHS) transformed efficiency indicator, log integration is the natural logarithm of the capital market integration index, IHS risk aversion is the IHS

transformed risk aversion index, integration * risk aversion is the interaction effect between the two, and country is a dummy variable for each EU country in the model (17).

Chapter 5 – Results

Running the regression already described in Equation 2, I present the results and analysis of below in Table 4.

Table 4. Results of fixed effects models

	Model 1: IHS efficiency	Model 2: Un-transformed efficiency	Model 3: IHS efficiency
(Intercept)	0.357 (0.255)	0.914 (0.600)	0.649* (0.273)
Integration index	0.069 (0.082)		
IHS risk aversion	−0.028 (0.062)	−0.210 (0.160)	−0.127 ⁺ (0.073)
Integration index * IHS risk aversion	−0.043 ⁺ (0.022)		
Log integration index		0.550 ⁺ (0.287)	0.367** (0.131)
Log integration index * IHS risk aversion		−0.100 (0.113)	−0.088 ⁺ (0.051)
Country dummy fixed effects	Yes	Yes	Yes
Num. Obs.	306	306	306
R^2	0.046	0.028	0.062
F-statistic	0.718	0.436	1.002
Residual SE	1.089	2.371	1.079

Notes: Standard errors in parentheses.

⁺ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 indicates three models run on the same regression equation already presented, with one minor caveat: the use of the log transformation is alternated in the three models. Model 1 uses the raw, rather than log, integration index, but uses the IHS transformed efficiency indicator; model 2 uses the raw, rather than IHS transformed, efficiency indicator; model 3 uses the IHS transformed efficiency indicator, and the log transformed integration index.

Taking model 1, only the interaction effect between integration and risk aversion is marginally statistically significant, at the 10% level. Standard errors remain very similar to the all-logged model 3, but the F-statistic is significantly lower, an indication of reduced model fit. The possible reason for this is the keeping of the integration index in raw form, since it can increase the influence of highly integrated countries, such as Luxembourg, Ireland, or the Netherlands. Results from robustness and influence tests

show that applying the log transformations in model 3 significantly reduces the influence of these countries to workable levels. Cook's distance, leverage and DFFITS influence test results are nearly halved when going between model 1 and model 3 – meaning that we get a more balanced, externally and internally valid model when we have both efficiency and integration indicators.

Logging all three variables somewhat complicates the interpretation of the output coefficients, but they still remain interpretable. Given that model 3 provides the best results, lowest standard error, highest error, and least influence of outlier countries, the interpretation is focused on model 3, the results of which are in Table 5 below. To make the coefficients of the IHS transformed variables interpretable, I transform them back according to Norton (2022) into marginal effects (ME in Table 5).

Table 5. Results of model 3 transformed from IHS to regular units

Variable	Back-transformed marginal effects (ME)	Std. Error	ME per 1%	p-value
(Intercept)	16.7262**	5.9953	NA	0.0053
Log integration index	8.0600**	2.8338	0.0806**	0.0045
IHS risk aversion	-1.3588*	0.6108	-0.0136*	0.0261
Log integration index * IHS risk aversion	-1.3551***	0.3901	-0.0136***	0.0005
Country fixed effects	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses.

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

According to model 3, a 1% increase in the integration index is associated with a 0.0806 percent increase in efficiency, an effect statistically significant at the 99% level. This interpretation of efficiency is permitted by it being elasticity. Accordingly, a 10% increase in the integration index is associated with a 0.806 percent increase in allocative efficiency. In other words, if a country becomes 10% more integrated into European capital markets, it will experience a 0.806 percent increase in allocative efficiency. This then means that if a sector in that country were to increase its value added by 1 euro, an additional approximately 0.806 percent would be invested in that sector.

A 1% higher risk aversion is associated with -0.0136 percent lower allocative efficiency, holding all other variables constant. Such an effect is also statistically significant at the 99% level. A 10% increase in risk aversion is thereby associated with a -0.136 percent lower allocative efficiency. Finally, there is also an interaction effect of risk aversion on capital market integration. The interaction effect indicates that for

every 1% increase in risk aversion, the positive effect of capital market integration on allocative efficiency decreases by approximately 0.0136 percent. Accordingly, 10% higher risk aversion is associated with 0.136% lower capital allocative efficiency.

There is an increase in the standard error of the marginal effects of risk aversion, but this comes as a result of applying Norton's (2022) IHS retransformation back to interpretable figures. Due to the nonlinearity of the back-transformation and the use of Duan's smearing estimate, the standard errors increase, which can be the reason why the p-values have jumped to such high levels of significance of 99 and 95 percent. Nevertheless, we can fall back on the statistical significance estimates of the original IHS transformed model, which still indicates that integration, risk aversion and the interaction effect are significant at the 95% and 90% level.

It may be difficult to interpret what an increase or decrease in the integration index means in practical terms, given that the composite index itself is unitless. By itself, it does not indicate what policymakers and others should target to increase capital market integration and thereby increase the efficiency of capital markets. For that reason, Table 6 below breaks down the integration index across the indicators that were used to calculate the index in the first place. It shows how, for example, an increase of 10% in the loans borrowed by national financial institutions from other EU country counterparties, holding all other five indicators making up the index constant, will increase the integration index by 1.93%. Accordingly, this integration index increase of 1.93% will correspond to a 0.0201 euro increase in allocative efficiency.

Table 6. Impact of each PCA component on integration index and capital allocative efficiency

PCA Component	10% Change in component	% Increase in integration index	Change in allocative efficiency (η)
EU counterparty deposits held domestically	10%	1.54%	0.124
Loans lent to EU counterparties	10%	1.16%	0.0939
Debt securities bought by EU counterparties	10%	1.64%	0.132
Loans borrowed from EU counterparties	10%	1.93%	0.155
More loans received than EU average	10%	1.11%	0.0894
More debt securities issued than EU average	10%	0.735%	0.0593

Simulated impact of 10% increases in PCA components on integration and allocative efficiency

There are several implications here for policymakers. The first is that in order to get a 1% increase in integration, the values of the underlying PCA components have to increase considerably. For example, a 10% increase in debt securities bought by foreign investors as a percent of GDP is not an easy task. A 1%

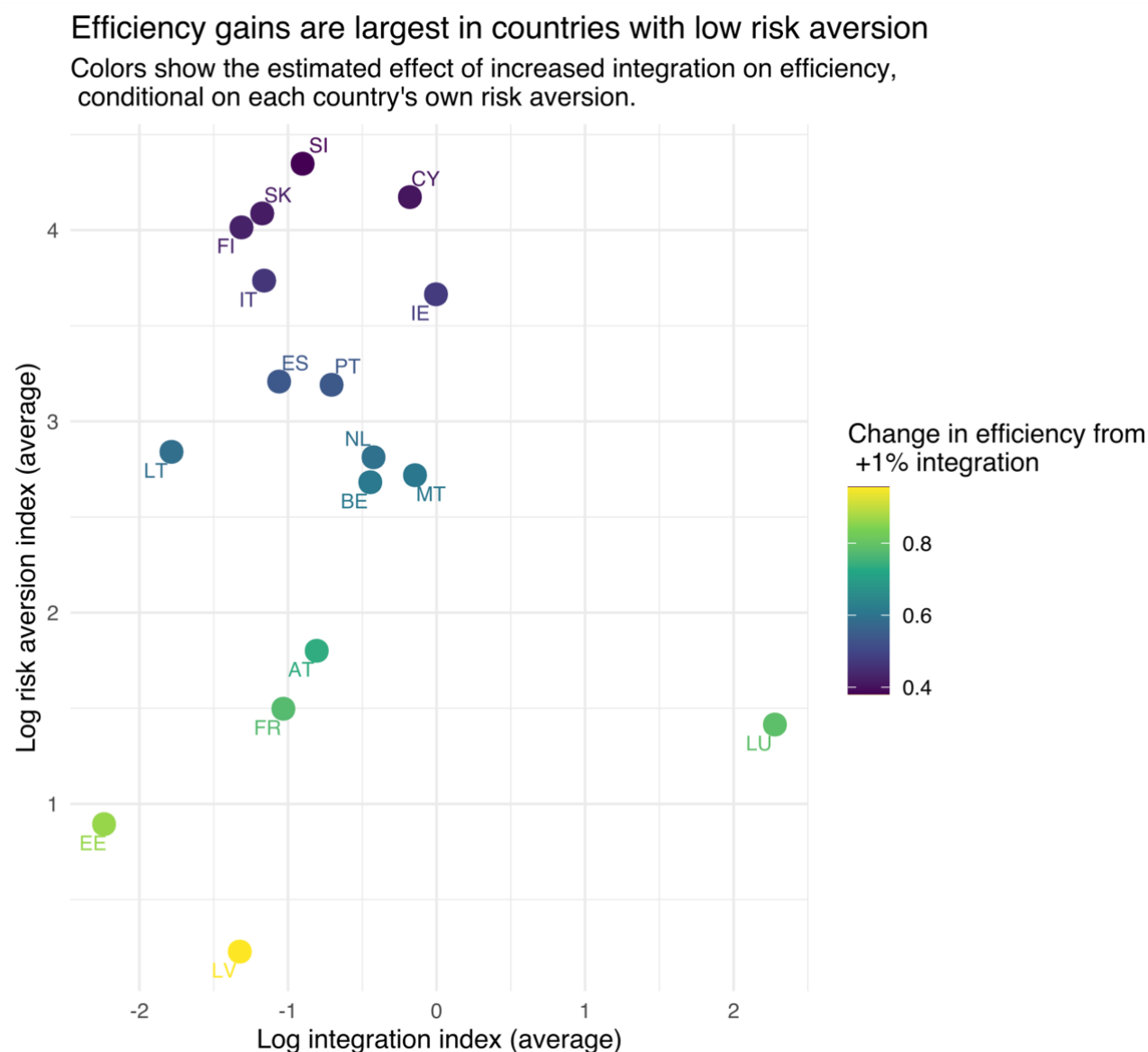
increase in the integration index should not be treated as such a small increase as it may seem. The second implication is that cross-border lending has a particularly large impact on capital allocative efficiency. Incentivizing domestic businesses to borrow from financial institutions in other EU countries will increase capital market integration with other EU countries the most and correspondingly lead to the largest improvement of the workings of capital markets. Putting this simply in example, if national policymakers in Croatia wanted to integrate more into EU markets, the most effective way is to support borrowing by Croatian businesses from financial institutions in Germany, Spain, Slovenia, Estonia, or any other Eurozone country.

The second implication of this for policymakers, more implicitly, is that financial development also increases integration and thereby allocative efficiency. Debt securities are the second most impactful indicator on the integration index – a 10% increase in the number of debt securities bought by other EU counterparties is followed by an increase of the integration index by 1.64% (holding all other five indicators constant). Such a 1.64% increase is associated with a 0.0170 percent increase in allocative efficiency. What is implied here is that a country becomes more integrated into Eurozone capital markets if that country's business decides to borrow by issuing corporate bonds, and these bonds are bought by investors from other Eurozone countries.

The first possible reason why this increases allocative efficiency is that inter-European investors may bring capital to sectors of the economy that domestic investors have overlooked or find too risky to invest in; perhaps because domestic investors are too small to invest in certain sectors without exposing themselves to excessive risk. This brings the second possible reason why increasing debt securities owned by other European investors increases allocative efficiency: higher risk sharing across investors, more able to bear the risk. Multi-million-euro projects may be too large solely for the domestic investors of Estonia, who would like to invest in the project, but cannot afford to bear e.g. 30% of the risk; bringing in inter-European investors from Finland, Italy, Latvia or any other can help reduce the risk of financing the project itself. Targeting different components of the capital market integration index, therefore, may bring about integration and efficiency gain faster than others.

To finish, I analyze how these effects look across the countries analyzed in the Eurozone, specifically looking at risk aversion at the country's level. In general, the efficiency of capital markets increases the most in less risk-averse countries, when capital market integration increases. Comparably, more risk-averse countries experience smaller gains from capital market integration on their capital allocative efficiency. This finding is shown in Figure 2.

Figure 2. Marginal effects of integration on efficiency, conditional on each country's level of risk aversion



The findings are three-fold. First, capital market integration does increase the efficiency of capital markets at the national level of Eurozone countries. Second, risk aversion decreases capital market allocative efficiency. Third, risk aversion also dampens the effect of integration—countries with higher

investor risk aversion experience smaller efficiency gains from capital market integration compared to less risk-averse countries.

Chapter 6 – Discussion

The implications of these findings are threefold. First, the pursuit towards capital market integration should be accelerated, because each member state of the Eurozone stands to gain from it, regardless of its economic size or status of integration. Second, risk aversion should be targeted more directly by policymakers to increase capital market integration. Third, countries that are in the best positions to increase their capital allocative efficiency through capital market integration, conditional on their levels of risk aversion, should accelerate their integration efforts, not only to realize their potential gains, but also to innovate the best practices of how to form a capital market union across a range of member states with varying economies, business practices, languages and cultures.

First, capital market integration is a useful project for Europe and is worth the opportunity cost. Therefore, the move towards it must be not only accelerated in the policy and legal circles, but also by individual businesses. Already, there is a sizeable push from European fintech startups (Revolut, Scalable Capital, Trade Republic to name just a few) to provide citizens across Europe with the comfortable options of investing in European and global capital markets. These companies may have some useful insights for policy circles on what further can be done to bring Eurozone capital markets closer and increase their overall efficiency.

Second, the finding that risk aversion decreases the efficiency of European capital markets indicates that it should be more directly targeted by policymakers as a barrier to European capital market integration. More research on risk aversion is necessary to understand what determines the levels of risk aversion across countries. Accordingly, policymakers should target the root causes of risk aversion – such as low financial literacy, cultural uncertainty avoidance, and lack of trust in cross-border markets – through education, behavioral nudges, and stronger investor protections. Empirical studies show that financial knowledge and prior investment experience significantly reduce risk aversion (van Rooij et al. 2011), while cultural attitudes toward uncertainty also shape investment behavior across countries (Guiso et al. 2006). Therefore,

building an investment culture through targeted incentives, harmonized regulations, and pan-European investor education is essential to lowering risk aversion and advancing capital market integration.

Third, countries that stand to gain the most from capital market integration, conditional on their risk aversion, such as Latvia, Estonia, France, Austria, Luxembourg, and others, should accelerate their integration efforts. They should do this for two reasons. First, doing so would increase the efficiency of their national capital markets. Given that efficiency of capital markets is associated with economic growth, better working capital markets would allow them to boost economic growth potential – a result that could then lead to higher tax revenues, higher fiscal capacity and higher productivity, a result quite necessary for many European countries facing increasing fiscal deficits and low fiscal capacity in a time of need. Second, by pressing further in integration ahead of other member states, these mentioned could discover new practices that foster capital market integration. For example, institutions (public or private) in these listed countries could create programs that help individuals apply for bank loans in other Eurozone countries or support companies in issuing debt securities to Eurozone investors. For firms in the Baltic states for example, it is difficult to issue debt securities due to the lack of a unified legal framework, inconsistent national regulations, and the absence of best practice guidelines, especially for issues falling below the EU Prospectus Regulation threshold (Tocelovska & Eglite 2021)

There are several limitations of this thesis that should be noted. The heavy use of transformed and composite variables means that the results of the thesis are conditional on these specific variables. The six indicators chosen for the integration index have been backed up by the literature; nevertheless, other variables were also available. The critique of why this variable was included and why this variable was not can always be said. The answer to this is that a composite indicator is good if it fulfills three functions: measures what it is intended to measure; is easily interpretable and understandable; and does so with the fewest number of parts. The integration index measure has fit the general pattern of capital market integration documented by the European Central Bank. It can also be broken down into its parts for policymakers, academics, and other readers to see which parts of integration to target (Table 6). Finally, it contains six indicators, a number neither too big nor too small to successfully accomplish what has been mentioned in the latter two sentences.

The establishment of causality should also be briefly noted. While this study identifies robust associations between integration, capital allocative efficiency, and risk aversion, it does not claim definitive causality. Fixed effects mitigate many confounding factors, but some risks of reverse causality and omitted variable bias remain inherent to the observational design. Establishing causality would require a different empirical strategy, such as natural experiments, instrumental variables or difference-in-difference approaches, which lie beyond the scope of this thesis. Nonetheless, the findings offer valuable insights into the relationships of integration and efficiency and provide a strong empirical foundation for future research aiming to deepen the understanding of how investors behave under merging capital markets.

Future research could explore the causes of risk aversion across Eurozone countries. This thesis has not made any comments on the reasons for the variation of risk aversion across the Eurozone countries, so much as to say that this variation means that some countries are more willing to jump on the opportunities that European capital market integration provides. The reasons why investors in some more risk-averse countries may not want to jump on those opportunities may very well be justified or unjustified. But the finding of this thesis remains that risk aversion strongly moderates the efficiency gains that come from integration. To increase the efficiency of European capital markets, policymakers need to understand why that risk aversion exists, whether it's useful or not, if not useful, how to decrease it, and if useful, how to optimize capital market flows conditional on it. Either way, more research on risk aversion is needed.

Chapter 7 – Conclusion

This thesis examined whether Eurozone capital market integration improves capital allocative efficiency and whether this effect is moderated by investor risk aversion. Using a panel dataset of 17 Eurozone countries from 2005 to 2024, the analysis finds that greater integration significantly enhances efficiency, allowing capital to flow more effectively into sectors with increasing value-added. However, this positive effect is dampened in countries with higher investor risk aversion, underscoring that integration alone is not sufficient: psychological, cultural, and institutional barriers continue to constrain capital flows.

Policy implications are twofold. First, capital market integration should be paired with efforts to reduce investor risk aversion. This requires policies that promote financial literacy, foster trust in cross-

border markets, and build a stronger investment culture. Measures such as behavioral nudges, harmonized investor protection, and simplified access to pan-European investment products can encourage more Europeans to allocate capital efficiently. Second, not all forms of integration matter equally. The findings show that cross-border borrowing, and foreign ownership of corporate debt securities have the strongest effects on efficiency. Policymakers should prioritize these channels, for example, by simplifying the issuance of corporate bonds or supporting cross-border loan applications. Finally, countries with lower levels of risk aversion currently stand to gain the most from integration. These countries should take the lead in piloting cross-border investment tools and sharing institutional innovations. Future research should investigate the roots of risk aversion and evaluate when and how it can be constructively addressed.

In general, the EU capital markets project is shown to have a significant effect on the workings of European capital markets. By focusing on the incentives for people, businesses, and countries to engage with their fellow Europeans, Europe can increase the size of its capital markets and thereby raise the competitiveness and innovation of its economy. The crucial element is the courage to take the opportunities of a closer Europe.

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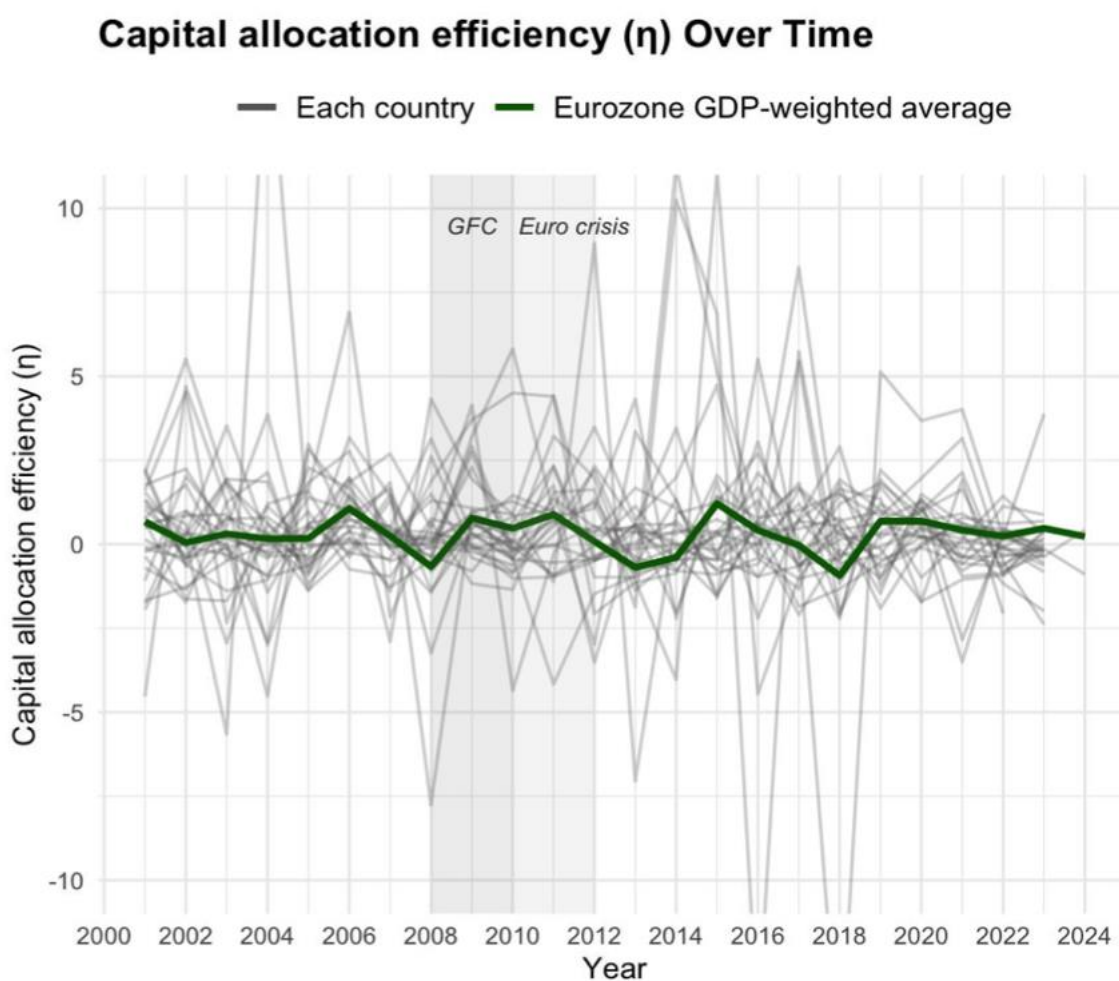
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Appendix A

Table 7: Weights of the PCA for computing the capital integration index

PCA Component	Variable Name in Model	PC1 Weight
EU counterparty deposits held domestically	pct_gdp_mean_Deposit	0.346
Loans lent to EU counterparties	pct_gdp_mean_Loans	0.334
Debt securities bought by EU counterparties	debtsec_GDP	0.435
Loans borrowed from EU counterparties	loans_GDP	0.440
More loans received than EU average	received_loans_gap_wEU	0.440
More debt securities issued than EU average	received_debtsecurityinvestment_gap_wEU	0.438

Figure 3: Capital allocative efficiency over time (2000-2024)

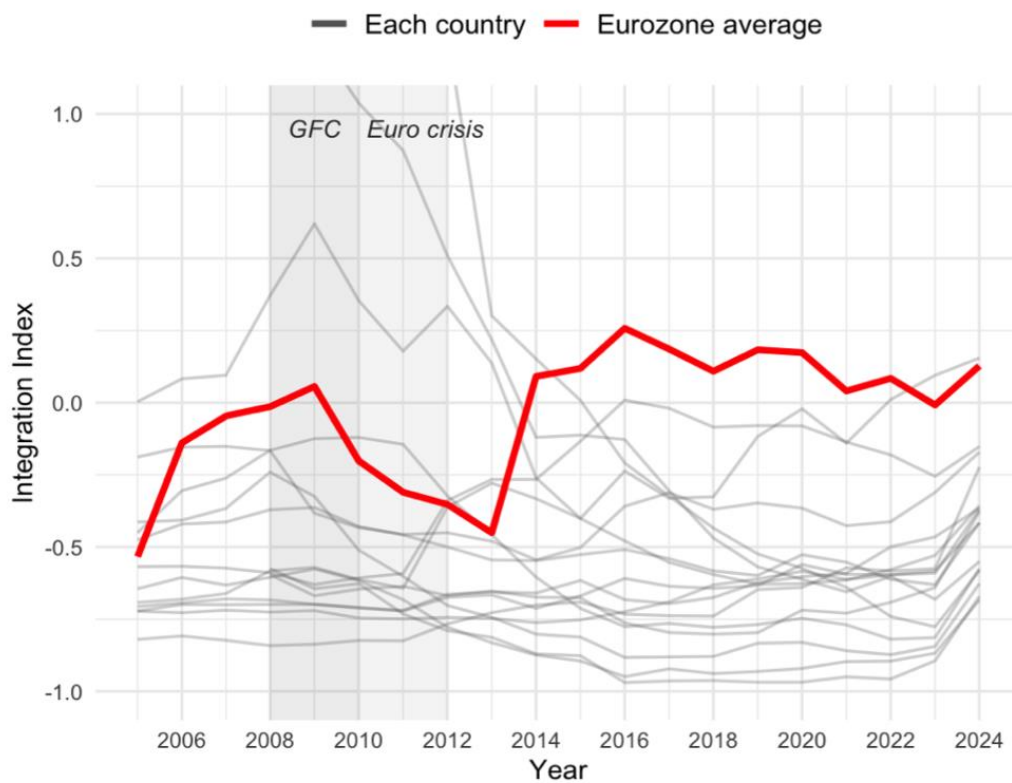


Source: Eurostat data

Figure 4: Capital market integration over time (2005-2024)

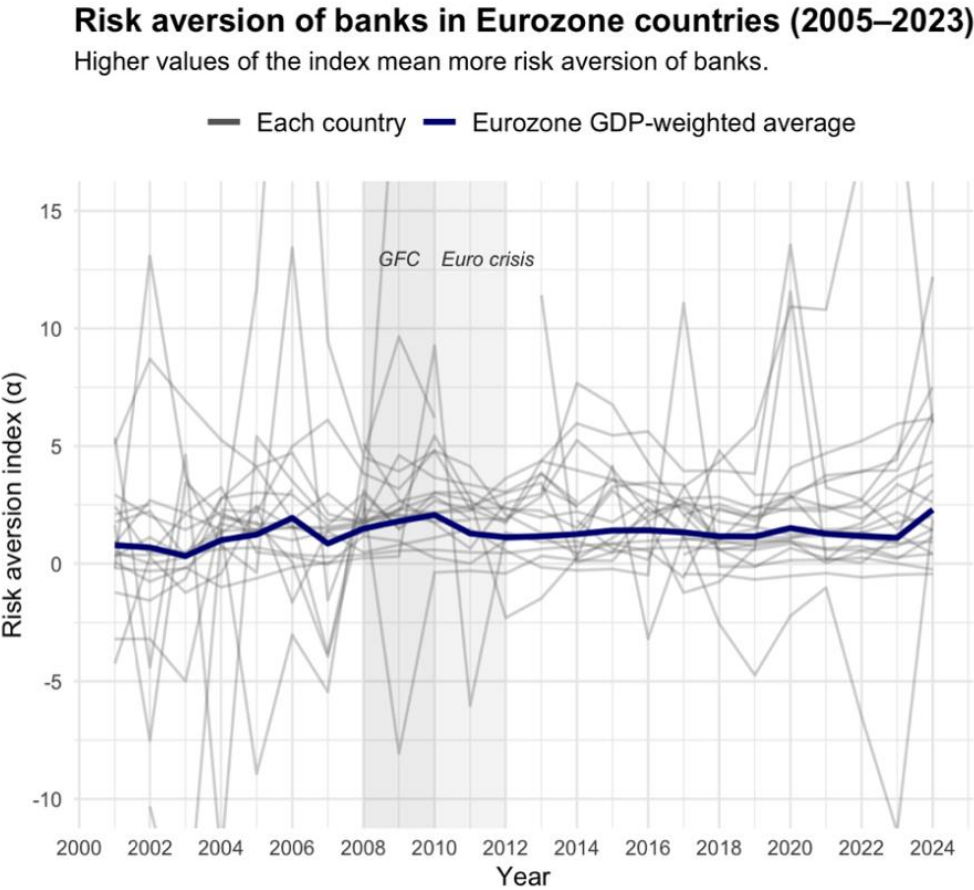
Capital Market Integration Over Time (2005–2023)

Higher index value indicates more capital market integration.



Source: European Central Bank data

Figure 5: Risk aversion of banks in Eurozone countries over time (2000-2024)



Source: S&P Capital IQ data

Appendix B

Equation 3. Model 1, using the un-logged capital market integration index

$IHS(Efficiency)_{ict}$

$$\begin{aligned} &= \alpha + \beta_1(Integration)_{it} + \beta_2 IHS(Risk\ aversion)_{it} \\ &+ \beta_3 \log(Integration) * IHS(Risk\ aversion)_{it} + Country + \varepsilon \end{aligned}$$

Equation 4. Model 2, using the un-logged efficiency indicator

$Efficiency_{ict} = \alpha + \beta_1 \log(Integration)_{it} + \beta_2 IHS(Risk\ aversion)_{it}$

$$+ \beta_3 \log(Integration) * IHS(Risk\ aversion)_{it} + Country + \varepsilon$$