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Does Bank Supervision Oversight Impact Economic Activity?

The case for the European Union

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Abstract

The role of regulation in the banking industry undeniably becomes more prominent when its flaws endanger the homeostasis of the financial system. The goal of this work project is to analyse the effects of supervisory rating shocks in real activity for the European Union and analyse the difference in response between its Northern and Southern segments. Through the construction of a proxy of the CAMELS rating, and the selection of real GDP growth rate as the measure of real activity, I address the magnitude of the shocks through the use of a vector autoregressive (VAR) model and the local projections approach.

Keywords: CAMELS ratings; vector autoregressive; local projections; supervisory rating shocks.

1. Introduction

The 2008 financial crisis displayed the severe repercussions of an ever-growing level of interdependence in the global financial system. The crash, motivated by the subprime mortgage crisis, led to numerous proposals for stricter regulation of financial institutions.

In order to meet the goal of efficient banking supervision, regulators are forced to seek to maintain an equilibrium. On the one hand, they aim to preserve a firm and efficient financial structure, protecting against systemic risk through exhaustive supervising execution. On the other hand, they acknowledge that these policies may unintendedly impact the banking sector and thus detrimentally affect the overall level of the economy.

The evaluation of the possible negative impact of banking supervision on the growth of the economies is an empirical subject. Peek & Rosengren (1995) and Peek *et al.* (2003) suggest that strengthened execution of capital requirements and regulation principles led to a decline in credit availability, which resulted in economic activity recession. Yet, posterior evidence indicates that this impact tends to be temporary, variable over time and over distinctive loan groups, suggesting that the relationship is fundamentally nonlinear.

In order to identify the impact of supervisory oversight meticulously, it is essential to monitor fluctuations in regulatory policy actions that are not connected with economic activity. Variations in supervisory standards can be linked with variations in the overall financial condition of the banking system. But if these supervisory changes are motivated by macroeconomic conditions' shocks, then it can be concluded that this connection can simply be a sign of deteriorating economy, instead of a causal connection between both.

Despite the interaction between the banking sector and real activity being a common topic of research throughout the years, rare are the studies that incorporate the role of supervisory ratings in this process. The research that approaches this topic majorly studies the impact of shocks of this nature on bank lending operations. Additionally, given that the United States of America are one of the few countries that adopt an easily quantifiable supervisory measure to

evaluate the overall financial condition of each bank, the CAMELS rating, existing research is almost in all focused on this country.

With the objective of presenting a different application of such topic, this paper studies the effects of bank supervisory shocks on real activity for the particular case of the European Union and attempts to analyse the differences between its Northern and Southern segments. With resource to dynamic macroeconometric models imposing the Choleski orthogonalization on the residual variance-covariance matrix to identify structural shocks, an analysis is conducted to infer about the impact of CAMELS ratings variations on the real GDP growth rate.

The remainder of the paper is organized as follows. Section 2 contains the relevant literature to the topic in question. Section 3 examines the data and methodology, emphasizing the construction of a CAMELS rating proxy. Section 4 displays the estimation framework. Section 5 discusses the results. And finally, section 6 provides concluding observations.

2. Literature Review

As a result of the recent financial crisis, legislators and researchers have found a revived attention in examining the soundness and well-being in the financial system, but most importantly in the banking sector. This renewed interest derives from the fresh bank failures that have incited governments and private depositors to find the wisest approach both to restrain the risk of losing their deposits but likewise to identify banks on the verge of failure. Two main reasons arise to justify supervising bank information: firstly, setbacks in the banking sector may operate as an early cautioning sign of weakening conditions in the global economy as a whole; secondly, one could perceive changes in lending behavior, as something that could affect the economy all in all (Peek *et al.*, 1999). The Federal Reserve and the Federal Deposit Insurance Corporation (FDIC) developed a rating system, known as the CAMELS framework. This framework was explicitly developed for identifying financial distress in the banking sector. The need for a rating system as such was originated from the previous unregulated view on banking

monitoring which lead to banks being bailed out with tax-payers' money, which was wanted to be avoided at all cost. Initially, the CAMELS rating system was developed in order to identify risky banks, but the usefulness of this framework has led to broader applications in research, such as detecting the soundness of the financial system or predicting bank failures.

The CAMELS ratings were used until 2009 to determine the different banks insurance costs, categorized after the ratings received (Kerstein & Kozberg, 2013). This framework has for a long time been used as a bank supervision instrument, and several researchers found that CAMELS ratings are linked with both performance and general bank soundness (Chiaramonte *et al.*, 2015). Because of the confidentiality that surrounds the ratings, researchers have tried to recreate the CAMELS ratings in order to prove their accuracy of bank failure using accounting proxies. This offsite monitoring has shown that the CAMELS rating system can, to a large extent, be replicated using proxies based on available financial information (Cole & Gunther, 1998; Roman & Sargu, 2013). Kerstein and Kozberg (2013) found that accounting-based proxies for each of the six categories of CAMELS were significantly associated with the probability of bank failure. Their research thus suggests that using accounting proxies for CAMELS ratings could help both depositors and investors to evaluate the overall well-being of the bank. Cole & Gunther (1998) found the CAMELS ratings useful but reached the conclusion that the ratings do decay rapidly. They found in their research that the official CAMELS ratings were equal or better at predicting bank failure than off-site monitoring but only if the ratings were less than six months old. If the ratings were given before that time frame, offset monitoring, like the use of financial ratios was better at predicting bank failures.

Although the interplay between the banking sector and real activity has always been subjected to a high level of research, rare are the studies that analyse the importance of regulatory roles in this process. Peek & Rosengren (1995) were amongst its pioneers. They found that preceding research documented a significant correlation between capital ratios and bank shrinkage but leave untested whether this relation was directly connected to regulatory

policy and whether it affected credit accessibility to bank-dependent borrowers. Trying to fill this gap, their findings indicate that the enormous decrease observed in the bank lending growth rate in the region of New England (USA) in the 1990s was partially motivated by the stringent execution of capital restrictions, as institutions contracted their assets to meet the newly imposed requirements. This is, given the informational and regulatory impediments that prevented the transfer of bank capital and credit across regions, their evidence suggests that New England did in fact suffer from a regulatory-induced credit crunch.

Additionally, Bizer (1993) likewise suggests that the worse the CAMELS indicator, the more negatively affected the bank's lending power. Controlling for some bank balance sheet and aggregate macroeconomic variables, he finds harsher regulatory requirements in the period between 1989 to 1992 relative to 1988, as well as an economically significant relation between CAMELS ratings and loan growth.

Peek, Rosengren, and Tootell (2003) use the portion of banks that were assigned a CAMELS 5 rating (the worst) as a tool for detecting shocks in the supply of loans. They find that the lending practices of these institutions change substantially when categorized as such.

Berger, Kyle, and Scalise (2001) through the usage of CAMELS ratings examine three problems: first, whether there was a high level of stringency in the bank supervisors' assessments during the 1989-92 credit crunch period; secondly, whether these supervisors were more lenient in the recovery period of 1993-98; thirdly and lastly, whether these alterations in the banks' regulatory policy possessed a quantifiable influence on the institution's lending practices. Their findings suggest that the level of regulatory strictness throughout the credit crunch period was higher than subsequently. Moreover, they conclude that bank lending behavior was barely influenced by the variations in the intensity of the regulatory reviews above mentioned.

Deeper into this subject, Curry *et al.* (2008), using state-level data, explore the degree to which unanticipated downgrades impact state economic conditions. They arrive at the same

conclusion as the authors above, that is, overall growth of lending is harmfully impacted when supervision becomes extremely stringent. Nevertheless, the results are time-dependent given that downgrades appear to have impacted the growth of the economy during the 1985-93 period, but not as much when controlling for the 1994-2005 wingspan. They attribute this difference to the fact that in the first period the supervisory oversight was more severe when compared to the second one.

Kiser *et al.* (2012) examine the extent to which variations in the CAMELS ratings of banks which are considered small in terms of assets (under five billion) impact their growth of lending between 2007 and 2010. Their findings suggest that banks who have been downgraded reduced their bank lending by 5 to 6 percent. Nonetheless, as well as Ramirez & Fissel (2013), an examination is not performed to evaluate the impact of those downgrades on the overall level of the economy. This leads to the investigation of Basset *et al.* (2012) who employ a measure of regulatory strictness, centered on the CAMELS framework, and a vector autoregressive application to examine if their developed model presents any effect on aggregate economic activity between 1991 and 2011. The results of the VAR model indicate a decrease of approximately 0.4 percent within one year. While this model examines the effects of regulatory strictness up to 20 quarters in advance, they conclude that the impact refrains to be statistically significant after about 4 to 5 quarters.

3. Methodology

In this section, I will detail the sample selected and briefly overview my empirical strategy to motivate my selection of different banking and macroeconomic variables.

To achieve the purpose of this research I divided the EU in two segments, North and South. The former is comprised of 15 countries, and the latter of 12 (given the severity and peculiarities of its economy during the selected time-frame, Greece was removed from the sample). A total of one hundred banks were selected to represent the 27 countries. The criteria that was followed

to assign the number of banks to each country was the asset size of each nation's banking sector. This culminated in a total of 61 banks for the North segment, and 39 for the South. The division by country is detailed in figure 1. Decisively, the criteria to select the different banks of each country was the number of total assets of each institution.

All data collected is yearly and covers the sample period from 2007 to 2017. The main focus is on the dynamic interaction between supervisory ratings and measure of real activity.

North	Assets (€ millions)	Nº of Banks for Data	South	Assets (€ millions)	Nº of Banks for Data
UK	8 884 446,00	10	France	8 331 735,00	10
Germany	7 792 700,00	10	Italy	3 924 651,00	8
Netherlands	2 465 249,00	6	Spain	2 727 870,00	6
Sweden	1 316 174,00	5	Austria	844 757,00	4
Belgium	1 101 976,00	5	Portugal	428 141,00	3
Ireland	1 075 503,00	5	Romania	94 497,00	2
Denmark	1 063 395,00	5	Cyprus	86 551,00	1
Luxembourg	1 056 182,00	5	Croatia	58 129,00	1
Finland	547 289,00	3	Bulgaria	50 867,00	1
Poland	405 835,00	2	Malta	46 264,00	1
Czech Republic	224 114,00	1	Slovenia	40 191,00	1
Slovakia	73 145,00	1	Hungary	1 174,00	1
Latvia	29 427,00	1	Greece		-
Lithuania	27 063,00	1			
Estonia	24 711,00	1			
Total	26 087 209,00	**61**	**Total**	16 634 827,00	**39**

Figure 1 – European Union Division

3.1. The CAMELS Rating

The CAMELS ratings are a point-in-time evaluation of all meaningful operational and financial factors associated to six key indicators of bank health. They are, (C) capital adequacy, (A) asset quality, (M) management capability, (E) earnings, (L) liquidity, and (S) sensitivity to market risk, therefrom CAMELS. To achieve these ratings, a combination of both financial ratios and examiner judgement is used. Although each one of these six components gets a rating from 1, the best, to 5, the worst, the overall financial health of the institution is assessed through a composite CAMELS rating. The latter is calculated by assigning the following weights to each one of the 6 components: 25% to Capital adequacy, 20% to Asset quality, 25% to Management capability, 10% to Earnings, 10% to Liquidity, and lastly, 10% to Sensitivity to

market risk. This way, the composite rating is achieved, having the exact same scale as each one of the components (1 to 5).

Consequently, an upgrade signals an improvement in the overall institution's financial condition. On the other hand, a downgrade can be interpreted as a worsened financial condition. If this decline culminates in a rating of 4 or 5, the bank's administration is obligated to take corrective action.

CAMELS ratings are assigned during an on-site bank examination that can vary in scope and purpose. The regularity of the examinations depends on the bank's health condition; therefore, they are normally conducted every 12 to 18 months, but every 6 months if they are problematic.

Finally, each bank's CAMELS rating and examination report are confidential and may not be shared with the public, even if it is on a lagged basis. This information is directly known only by the bank's senior managers and the appropriate regulatory staff. This is mainly due to the possible public's reaction to a downgrade which can lead to a bank run.

Rating Proxy

Given the confidential nature of this rating framework, I use accounting-based proxies for the CAMELS measurement. These proxies were selected based on the financial measures that the FDIC assesses to rate each one of the six components of the rating, as well as the ones the ECB examines to analyze the banking sector.

- Capital Adequacy

  Capital is an important line of defense in the event of heavy losses. This is expressly true for banks given that they operate with relatively low levels of capital relative to the size of their balance sheets.

The accounting proxy selected to represent this factor was the Tier 1 Capital Ratio. The most recent financial crisis revealed that the majority of banks had two common aspects: firstly, they possessed too little capital to absorb losses or to maintain liquidity; and secondly, they were financed with not enough equity and too much debt. Consequently, in 2010, the Basel III international capital and liquidity standards were devised, whose basis is precisely the Tier 1 capital ratio.

- Asset Quality

This is one major vital area in assessing the overall condition of a bank. The quality of the loan portfolio and the credit administration program are the main elements affecting this area. Loans characteristically encompass the majority of a bank's assets and convey the utmost amount of risk to their capital. Securities may also comprise a large share of the assets and also comprise substantial risks.

For this measure, two accounting proxies were selected. Firstly, the loan-to-asset ratio which quantifies the total loans outstanding as a percentage of total assets. The higher the ratio, the least is its liquidity and hence, the higher the risk of incurring in greater defaults. And secondly, the impaired loans ratio, calculated as the division between the total amount of impaired loans and the total amount of loans outstanding. The higher this ratio, the lower the perceived quality of the loans is. Given that it is directly connected with the perceived risk of the bank's assets, it represents a suitable proxy to measure a bank's risk.

- Management Capability

The quality of management is possibly the single most essential component in the successful operation of a bank. Management examination seeks to determine whether an institution is capable of accurately respond to financial distress. This component mirrors

the management's ability to identify, assess, sustain and supervise risks of the institution's day-to-day events.

The management component of the CAMELS rating as always been regarded as the most challenging one to measure through the use of accounting proxies due to its qualitative specification, and to acknowledge its real value, internal information is required. Given its elusiveness, this component is regularly left out by researchers in their respective investigations. Nevertheless, its widely regarded and demonstrated by these economists that this factor is best measured through unit cost. Furthermore, they also present validation proving that this "M" component is statistically significant with the composite CAMELS rating.

Subsequently, the accounting proxy used in this research is the ratio of noninterest (operating) expense to total revenue. This efficiency ratio is a quick and easy measure to draw conclusions concerning the ability of banks to transform assets into revenues. Noticeably, if the value of the ratio increases, either the bank's expenses are increasing, or its revenues decreasing.

- Earnings

The fundamental purpose, from a regulator's viewpoint, of bank's earnings, both current and accrued, is to assimilate losses and enhance capital. This factor is the primary defense against the risks of engaging in the banking business and denotes the first line of resistance against capital depletion consequential from contraction in asset value. Earnings performance should in addition allow the bank to continue competitive by delivering the means necessary to implement management's strategic initiatives.

Thus, the selected proxies to embody this component were the return on equity (ROE) and the cost-to-income ratio. ROE represents an efficiency indicator whose increasing value suggests the company is growing its ability to generate profit without needing as much

capital, and also how well a company's management is employing the shareholder's capital. The other measure, cost-to-income ratio, gives the investors a clear view of how efficiently the institution is being operated – the lower the ratio, the more profitable the bank will be.

- Liquidity

This component displays the capacity of a financial organization to both fund assets and meet financial responsibilities. Liquidity is crucial in all banks to compensate for balance sheet oscillations, provide funds for growth, and meet customer withdrawals. Banks must preserve sufficient sums of cash, liquid assets, and potential borrowing lines to meet projected and contingent liquidity demands.

The first accounting proxy selected to represent the "L" component was the current ratio, or likewise designated working capital ratio, which is calculated by the division of assets and liabilities and measures the bank's capacity to pay both short and long-term obligations. A ratio that presents itself in line with the industry average or slightly superior is commonly considered adequate. A lower than the average ratio can indicate a higher risk of default. Equally, if a bank possesses a very high ratio when compared to its competitors, it indicates an inefficient management of its assets.

The second selected proxy was the loan-to-deposit ratio. If this ratio is too high, it indicates the bank may not possess the necessary liquidity to cover any unforeseen fund requirements. Conversely, a low value suggests the bank may not be earning as much as it potentially could.

- Size, Sensitivity to Market Risk

Size is considered instead of the parameterized "S" component, sensitivity to market risk, because most researchers disregard the latter given that to calculate it, internal information from the bank is frequently necessary, since the component is reliant on the

variation of the financial assets' prices. This fact poses numerous complications in obtaining the data, and it cannot be calculated solely through accounting and financial information.

Various researches indicate size as a critical component when examining bank soundness. They argue the importance of size, especially when it concerns large institutions because they are expected to be more diversified. A fundamental element in portfolio theory is the idea that diversification decreases the risk in a bank's portfolio, hence decreasing the possibility of bank failure. Moreover, growth has been proven to affect a bank's performance negatively, and so it is in the best interest of the institution to control the impact in its performance of an increase in size.

Consequently, the selected accounting proxy was the ratio of the bank's assets to the total number of assets of the banking sector.

3.2. Measure of Real Activity

As explained above, the objective of this study focuses on the dynamic interaction between supervisory ratings and measures of real activity. This way, the measure selected for this purpose is the real GDP growth rate. The data collected for this parameter is quarterly.

4. Estimation Framework

My experimental analysis of the relationship between variations in the CAMELS indicator and the measure of real activity is divided in two sections with two distinct methods. Firstly, I conduct a study using the structural vector autoregression (VAR) approach, with which identification is achieved by imposing short-run restrictions, computed with a Cholesky decomposition of the reduced-form residuals' covariance matrix. Secondly, I conduct an application of the local projections' methodology proposed by Jordà (2005), specifically in a linear framework as a close comparison with the VAR setting.

4.1. Vector Autoregression

The standard approach to estimating vector autoregressive (VAR) models begins with an ordinary least squares estimation of the following system:

$$\boldsymbol{y_t} = \alpha + \sum_{p=1}^{P} \boldsymbol{B_p y_{t-p}} + \boldsymbol{D x_t} + \boldsymbol{u_t}, \qquad (1)$$

where $\boldsymbol{y_t}$ is the T × K matrix of dependent variables, $\boldsymbol{B_p}$ are matrices of coefficients associated with different lags up to order P, and $\boldsymbol{u_t}$ are reduced-form residuals. A popular alternative for the identification of structural shocks is the Cholesky orthogonalization of the variance-covariance matrix of $\boldsymbol{u_t}$, $\boldsymbol{B_0}$. The impulse response of $\boldsymbol{y_t}$ to structural shocks $\boldsymbol{v_t} = \boldsymbol{B_0^{-1} u_t}$ at horizon s, $\boldsymbol{\Phi_s}$, can be shown to be related to the parameters estimated in (1) by initializing $\boldsymbol{\Psi_0}$ = **I** and then obtaining their values for longer horizons through the following recursion: $\boldsymbol{\Psi_s} = \sum_{h=1}^{s} \boldsymbol{\Psi_{s-h} B_h}$ for s > 0 and where $\mathbf{B_s} = \mathbf{0}$ for s > P. Responses to the structural shocks $\mathbf{v_t}$ are simply obtained by the lower triangular matrix from the Cholesky orthogonalization of the reduced-form shocks: $\boldsymbol{\Phi_s} = \boldsymbol{\Psi_s B_0}$. Note that the VAR model of endogenous variables **y** may include a set of exogenous controls, **x**. We exclude the latter for our baseline results.

4.2. Local Projections Approach – Linear Framework

Òscar Jordà (2005) proposes an alternative method for estimating such impulse response functions (IRFs) via the local projections' methodology. A distinct advantage of this approach is the incorporation of nonlinear endogenous variable terms that can still be estimated by ordinary least squares. Its linear version is immediately comparable to the VAR setting detailed above. It entails estimating

$$\boldsymbol{y_{t+s}} = \alpha^s + \sum_{p=1}^{P} \boldsymbol{B_p^{s+1} y_{t-p}} + \boldsymbol{D^{s+1} x_t} + \boldsymbol{u_{t+s}^s} \qquad (2)$$

at alternative horizons s = 0, ..., S, where, again, the local projections model may be augmented by the presence of exogenous terms, **x**. Jordà (2005) then shows that impulse responses in the local projection framework are given by the coefficient matrices $\boldsymbol{\Psi_s = B_1^s}$ while normalizing the impact response to be, again, $\boldsymbol{\Psi_0 = I}$. As in the standard VAR case, estimating responses to structural shocks requires post-multiplying $\boldsymbol{\Psi_s}$ by a matrix that imposes such restrictions. While, in principle, one could construct $\boldsymbol{B_0^s}$ for each s, in practice, established by Jordà (2005) and Kilian & Kim (2011), only the $\boldsymbol{B_0}$ from (1) is used for this purpose.

5. Empirical Results

As stated in the beginning, the objective of this research is to evaluate the difference in reaction of the economies of the North and South of the European Union to variations in the CAMELS ratings assigned to each country's most powerful banks. To explore these results, let us divide this section in two segments: firstly, the results from the construction of the CAMELS rating, and then the differences in the empirical results delivered between the VAR and local projections' approaches.

Impulse responses depict a natural empirical objective given that they deliver the empirical regularities that authenticate theoretical models of the economy. The computation of IRF_s for a vector time series based on Jordà's methodology do not entail estimation and specification of the unknown true multivariate dynamic system itself.

The local projections approach displays several advantages: they can be estimated by simple least squares; they provide appropriate inference (individual or joint) that does not require asymptotic delta-method approximations nor numerical techniques for its calculation; they are robust to misspecification of the DGP (Data generation process); and they easily accommodate experimentation with highly nonlinear specifications that are often impractical or infeasible in a multivariate context. Given that this approach can be estimated by univariate equation

methods, it can be easily calculated with available standard regression packages and thus become a natural alternative to estimating impulse responses from VARs.

5.1. The CAMELS Rating

As explained in point 3.1, the CAMELS ratings are a point-in-time evaluation of all meaningful operational and financial elements associated to six key indicators of bank health. To achieve a proxy for this rating, an extensive examination of financial ratios was conducted, which culminated in the calculation of the composite rating. Below, in figure 2, are presented two graphs, the first regarding the Northern European Union and the second the Southern segment, where it is possible to observe the average CAMELS rating of each country for the period in examination (2007-2017).

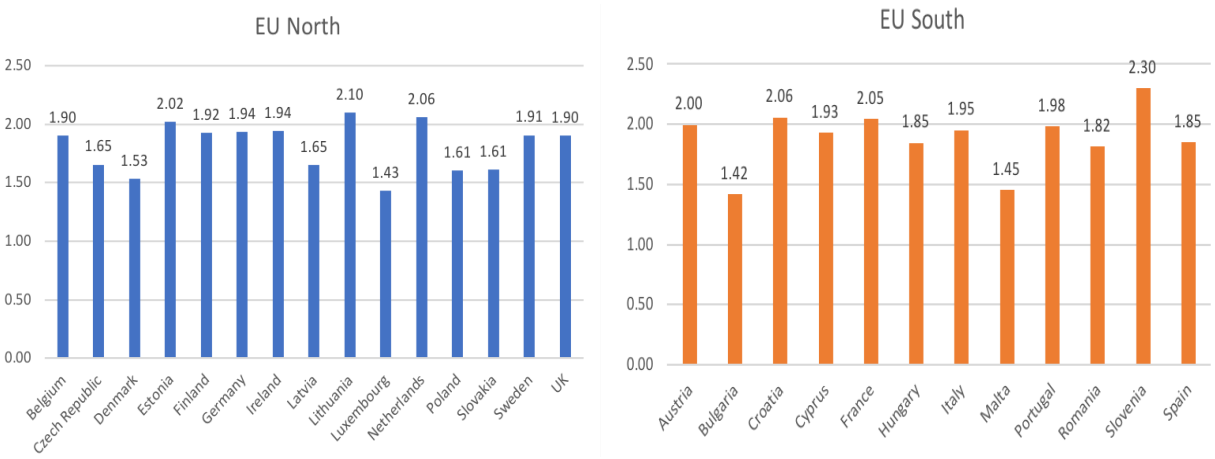

Figure 2 – Average CAMELS rating per country

The composite CAMELS rating is ultimately achieved by assigning weights to each of its 6 components, culminating in a value between 1, the best, and 5, the worst.

Observing the graphs, we can check that the for the EU North the best and worst performing countries are respectively Luxembourg, with an average rating of 1.43, and Lithuania, with 2.10. Meanwhile for the EU South they are respectively Bulgaria, with an average composite

rating of 1.42, and Slovenia, with 2.3. Moreover, it is also possible to observe that out of the 15 countries that compose the Northern segment, only three present a rating above 2.00, that is 20%. On the other hand, out of the 12 countries that compose the Southern one, five possess this characteristic.

The results presented above are expected. Given that this rating was calculated for the top banks of each country in the EU, it is predictable that the CAMELS ratings assigned to each bank is high because on one hand, the quality of the institutions in question is strong, and on the other hand, the economic situation in the EU is stable. Calculating an asset weighted average of the CAMELS rating, a value of 1.89 is reached for the Northern segment of the European Union, while the Southern portion presents 1.98. From these values we can conclude from Trautmann's interpretation (2006) that both segments display an "above average performance which means sound and relatively safe operations", given their average CAMELS rating of approximately 2.

Finally, given the main goal of this paper, taking into account this last measure, it is important to point out that the Northern segment of the EU displays, on average, a better performance than the Southern segment. Nevertheless, it is also worthwhile mentioning that the former's banking sector involves, approximately, 61% of the total assets of the sample.

5.2. VAR Impulse Response Functions vs. Local Projections

In this subsection the results from the VAR model and the Local Projections' approach where the real GDP growth is the measure of real activity, respectively regarding the Northern and Southern EU segments, are explored. Examining the IRFs for the VAR model, we can conclude that the majority of the responses follow the same pattern, namely, a unit shock in the CAMELS rating leads to an immediate decrease in the real GDP growth. This instant decrease is accentuated and is majorly followed by a large increase where it reaches a second significant peak. Finally, the shock usually seems to die out around period 10. Meanwhile, concerning the

Local Projections' approach, the pattern of the IRFs is very similar to the one of the VAR, except for the fact that the magnitude of the effects is considerably higher, and the impact of the unit shock displays a higher degree of persistence given that the impulse responses exhibit a much more lasting effect.

These conclusions come in line with the existing research which finds that the degree of the impact of supervisory rating shocks on real economic activity is small and short-lived. This is surprising to some extent given that corrective actions addressing financial weaknesses normally comprise limitations on lending and consequently would be predictable to display a greater impact on real activity.

In order to verify if there is a difference between the North and South of the EU when it comes to supervisory rating shocks, a comparison between countries of both segments is conducted based on the number of total assets of the banking sector.

Figure 3 exhibits the IRFs from the largest countries by total number of assets of the banking sector of the Northern EU segment, the United Kingdom (8.9 trillion assets €) and Germany (7.8 trillion assets €), and of the Southern segment, France (8.3 trillion assets €). From the figure it is observable that the IRFs are very similar, especially in the VAR model. Analyzing the magnitude of the response for these three countries, it is possible to conclude that the South displays a smoother response to the shock than the North of the EU given that the magnitude of the decrease in the IRF within one year amounts to approximately 0.035 for France, while for the UK and Germany it amounts to roughly 0.025 and 0.075, respectively.

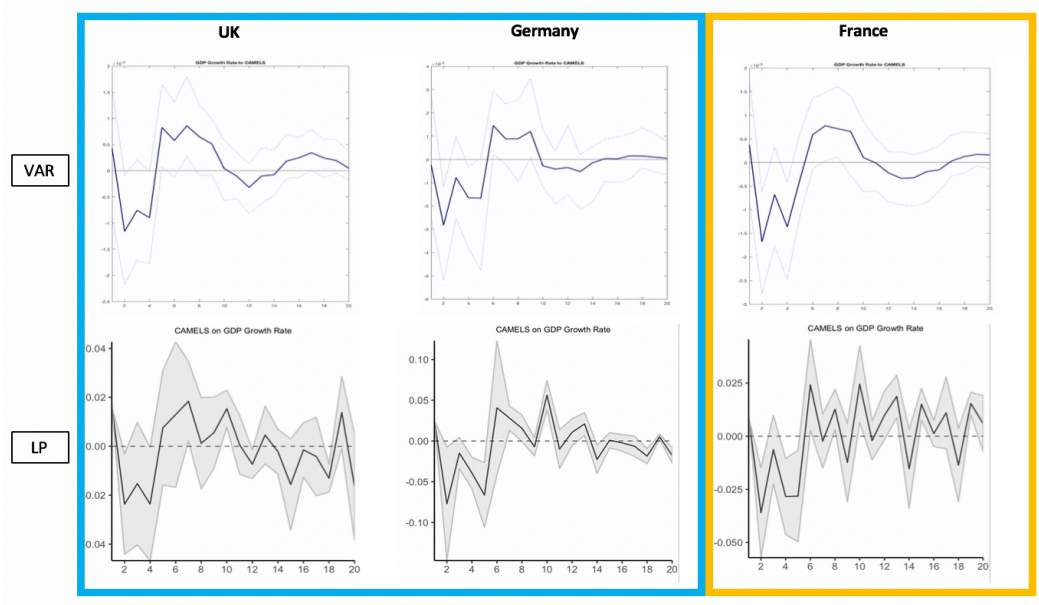

Figure 3 – VAR and Local Projections' Impulse Response Functions concerning the UK and Germany (EU North - blue) and France (EU South - orange)

Figure 4 exhibits the IRFs from the second tier of largest countries by total number of assets of the banking sector of the Northern EU segment, the Netherlands (2.5 trillion assets €), and of the Southern segment, Italy (3.9 trillion assets €) and Spain (2.7 trillion assets €). Again, when analyzing the magnitude of the response for these three countries, it is possible to conclude that the Southern segment exhibits a much smoother response to the shock than the Northern one given that the magnitude of the decrease in the IRF within one year amounts to approximately 0.03 and 0.05 for Italy and Spain, respectively, whereas for the Netherlands it amounts to roughly 0.12.

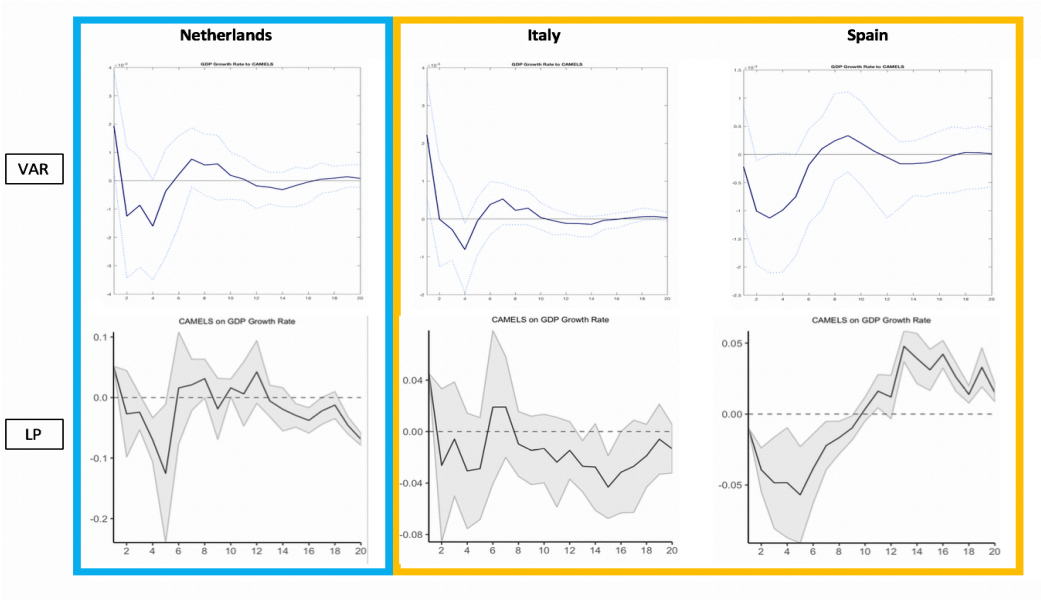

Figure 4 – VAR and Local Projections' Impulse Response Functions concerning the Netherlands (EU North - blue) as well as Italy and Spain (EU South - orange)

Finally, through figure 5 it is possible to create two additional comparisons. When contrasting the IRFs for Finland (0.55 trillion assets €) to the ones of Portugal (0.43 trillion assets €), and the IRFs of Estonia (25 billion assets €) to the ones of Slovenia (40 billion assets €), the same conclusion holds, i.e., the Northern subsection of the EU displays a much smoother response to the supervisory rating shock than the Southern subset. Within one year of the shock the degree of the decline in the IRF amounts to 0.1 for Finland when compared to approximately 0.065 for Portugal, and it amounts to 0.075 for Estonia when contrasted to just 0.035 for Slovenia.

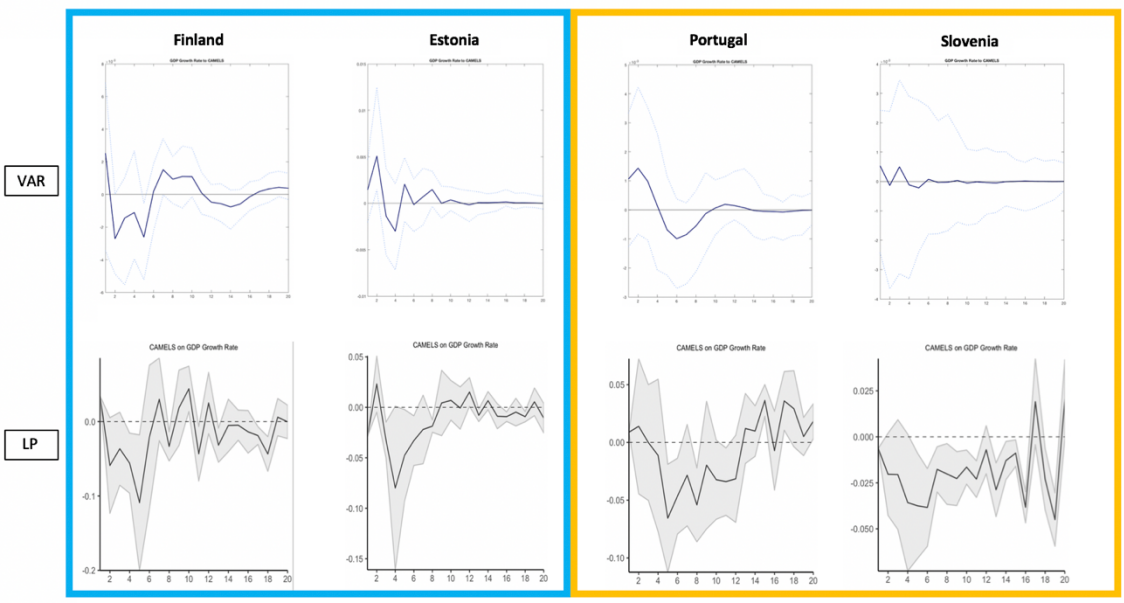

Figure 5 – VAR and Local Projections' Impulse Response Functions concerning Finland and Estonia (EU North - blue), as well as Portugal and Slovenia (EU South - orange)

6. Conclusion

This work project evaluates the degree to which bank supervisory shocks, defined as unexpected variations in the CAMELS ratings, impacts real economic activity, namely the real GDP growth rate. The investigation of this hypothesis is conducted for the specific case of the EU using a large bank level dataset covering the wingspan between 2007 and 2017 and attempts to analyze the differences in response to these shocks displayed by the North and South of this monetary union.

The results of the construction of a proxy for the CAMELS rating indicates a very good overall financial condition of the top institutions of the EU which is more than expected given both the magnitude of these institutions and the current economic situation that surrounds the EU. Furthermore, the evidence displayed by the impulse response analysis conducted through a vector autoregressive model and the local projections approach, indicates that the responses of real activity to one-unit shock in the supervisory rating are visibly smaller and smoother for the Southern segment of the EU in relation to the Northern one, when a comparison between countries with similar number of total assets in the banking sector is put in practice.

Further research that may be conducted on this topic for the specific case of the EU should allow for asymmetric as well as nonlinear effects to be present, i.e., evaluate separately the effects of downgrades and upgrades in the supervisory rating on real activity. Although existing research is scarce concerning this topic, its evidence indicates that the impact is greater for downgrades than it is for upgrades. For example, it finds that downgrades lead to a decline in real GDP growth and an increase in unemployment, while upgrades do not produce statistically significant changes in these variables.

7. References

[1] Barker, David, and David Holdsworth. 1993. “The causes of bank failures in the 1980s”. *Federak Reserve Bank of New York*.

[2] Bassett, William, Mary Chosak, John Driscoll, and Egon Zakrajsek. 2014. “Changes in Bank Lending Standards and the Macroeconomy”. *Journal of Monetary Economics*, 62 (2), 23–40.

[3] Bassett, William, Seung-Jung Lee, and Thomas Spiller. 2012. “Estimating Changes in Supervisory Standards and Their Economic Effects”. *Journal of Banking & Finance*, 55, 21-43.

[4] Berger, Allen, Margaret Kyle, and Joseph Scalise. 2001. “Did U.S. Bank Supervision Get Tougher During the Credit Crunch? Did They Get Easier During the Banking Boom? Did it Matter for Lending? Prudential Supervision: What Works and What Doesn’t?”. *Prudential Supervision: What Works and What Doesn’t?* University of Chicago Press.

[5] Curry, Timothy J., Gary S. Fissel, and Carlos D. Ramirez. 2008. “The Impact of Bank Supervision on Loan Growth”. *The North American Journal of Economics and Finance*, 19 (2), 113–134.

[6] Derviz, Alexis, and Jiri Podpiera. 2008. “Predicting bank CAMELS and S&P ratings: The case of the Czech Republic”. *Emerging Markets Finance and Trade*, 44 (1): 117-130.

[7] Hirtle, Beverly, and Jose Lopez. 1999. “Supervisory Information and the Frequency of Bank Examinations”. *Federal Reserve Bank of New York Economic Policy Review*, 5 (1), 1–19.

[8] Hwa, Vivian, Pavel Kapinos, and Carlos Ramirez. 2016. “Does Regulatory Bank Oversight Impact Economic Activity? A Local Projections Approach”. *Federal Deposit Insurance Corporation Center for Financial Research*.

[9] Jorda, Oscar. 2005. “Estimation and Inference of Impulse Responses by Local Projections”. *American Economic Review*, 95 (1), 161–182.

[10] Kilian, Lutz, and Yun Jung Kim. 2011. “How Reliable Are Local Projections Estimators of Impulse Responses?”. *Review of Economics and Statistics*, 93 (4), 1460–1466.

[11] Kiser, Elizabeth, Robin Prager, and Jason Scott. 2012. “Supervisor Ratings and the Contraction of Bank Lending to Small Businesses”. *Federal Reserve Board Finance and Economics,* Discussion Series No. 2012-59.

[12] Krainer, John, and Jose Lopez. 2009. “Do Supervisory Rating Standards Change Over Time?”. *Federal Reserve Bank of San Francisco Economic Review*, 13–24.

[13] Roman, Angela, and Alina Camelia Sargu. 2013. “Analysing the Financial Soundness of the Commercial Banks in Romania: An Approach based on the Camels Framework.” *Procedia Economics and Finance,* 6: 703-712.

[14] Rostami, Malihe. 2015. “CAMELS' Analysis in Banking Industry”. *Global Journal of Engineering Science and Research Management*, 2 (11): 10-26.

[15] Peek, Joseph, and Eric Rosengren. 1995. “Bank regulation and the credit crunch”. *Journal of Banking & Finance*, 19 (3-4): 679-692.

[16] Peek, Joseph, Eric Rosengren, and Geoffrey Tootell. 2003. “Identifying the Macroeconomic Effect of Loan Supply Shocks”. *Journal of Money, Credit and Banking*, 35: 931-946.

[17] Hamilton, James. 1994. *Time Series Analysis.* Princeton University Press.

[18] Enders, Walters. 2015. *Applied Econometric Time Series*. University of Alabama.

8. Appendix

EU - North	Banks
Denmark	Danske Bank A/S Nykredit Realkredit A/S Realkredit Danmark A/S TOTALKREDIT A/S Nordea Kredit Realkreditaktieselskab
Netherlands	ING Bank NV Cooperative Rabobank UA ABN AMRO Bank NV De Volksbank NV NIBC Bank NV F. van Lanschot Bankiers NV
UK	HSBC Holdings Barclay's PLC Royal Bank of Scotland Lloyds Banking Group Standard Chartered PLC Santander UK Nationwide Building Society Co-Operative Bank Close Brothers Coventry Building Society
Sweden	Nordnet SEB Bank Svenska Handelsbanken AB Swedbank AB Avanza Bank
Ireland	Allied Irish Bank Bank of Ireland Ulster Bank Ireland Permanent TBS EBS d.a.c
Latvia	SEB Banka
Lithuania	Luminor AB
Estonia	LHV Pank
Belgium	Argenta BNP Paribas Fortis Belfius KBC ING België – ING België
Germany	Deutsche Bank Commerzbank KFW Bankgruppe DZ Bank HypoVereinsbank (UniCredit Bank AG) Deutsche Postbank AG Bayerische Landesbank (BayernLB) Landesbank Hessen-Thüringen (Helaba) Norddeutsche Landesbank (Nord/LB) NRW Bank
Slovakia	Slovenska Sporitelna (Erste Bank)
Poland	PKO BP Bank Pekao
Luxembourg	Deutsche Bank Luxembourg S.A. Intesa Sanpaolo Bank Luxembourg Banque et Caisse d'Epargne de l'Etat (BCEE) Société Générale Bank & Trust BGL BNP Paribas
Finland	OP Corporate Bank PLC Nordea Bank Aktia Savings Bank
Czech Republic	CSOB

EU - South	Banks
Italy	Unicredit SpA Intesa Sanpaolo Iccrea Banca Banco BPM Banca Monte dei Paschi UBI Banca Mediolanum Banca BPER Banca
Malta	Bank of Valletta
Portugal	Caixa Geral de Depósitos Banco Santander Totta S.A. Banco Comercial Portugues
France	BNP Paribas SA Credit Agricole Groupe Credit Mutuel-CIC BPCE Societe Generale Credit du Nord AXA Banque La Banque Postale Credit Cooperatif Natixis
Spain	Banco Santander Banco Bilbao Vizcaya Argentaria, S.A. (BBVA CaixaBank Banco de Sabadell Bankia Bankinter
Croatia	Privredna Banka (PBZ)
Greece	-
Bulgaria	UniCredit Bulban
Romania	Banca Transilvania Banca Comerciala Romana (BCR)
Slovenia	NOVA LJUBLJANSKA BANKA D.D.
Cyprus	Bank of Cyprus
Hungary	OTP Bank
Austria	Erste Group Bank RZB Group UniCredit Bank Austria AG BAWAG P.S.K.

Figure 6 – Banks selection by country

- Capital Adequacy

Tier 1 Capital Ratio	CAMELS Rating
>=5	1
4,5-5	2
3,5-<4,5	3
3-<3,5	4
<3	5

- Asset Quality

Loan / Asset (%)	CAMELS Rating
0,5 - 0,6	1
<0,5 and >0,6 - <0,7	2
0,7 - 0,8	3
0,8 - 0,9	4
0,9 - 1	5

- Management Capability

RATIO OF NONINTEREST (OPERATING) EXPENSE TO TOTAL REVENUE	CAMELS Rating
<=25	1
30-26	2
38-31	3
45-39	4
>=45	5

- Earnings

ROE	CAMELS Rating
>=9	1
7-<9	2
5-<7	3
2-<5	4
<2	5

C / I Ratio	CAMELS Rating
<=35	1
35-50	2
50-65	3
65-80	4
>80	5

- Liquidity

Current Ratio (Assets/Liabilities)	CAMELS Rating
<70	1
70-90	2
>90-95	3
>95-97,5	4
>97,5-100	5

LOAN-TO-DEPOSIT RATIO	CAMELS Rating
70-85	1
<70	2
>85-100	3
>100-115	4
>115	5

- Size

TOTAL ASSETS / TOTAL ASSETS OF THE BANKING SECTOR	CAMELS Rating
0-10	1
10-20	2
20-30	3
30-40	4
>40	5

Figure 7 – Individual CAMELS indicators' scale

EU North	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average
Belgium	1,71	2,24	2,07	1,86	1,98	1,93	1,83	1,81	1,78	1,98	1,76	1,90
Czech Republic	1,70	1,90	1,45	1,70	1,65	1,55	1,55	1,55	1,65	1,75	1,75	1,65
Denmark	1,33	1,50	1,59	1,65	1,65	1,65	1,63	1,55	1,49	1,42	1,37	1,53
Estonia	1,90	2,40	2,10	2,40	2,35	2,40	1,90	1,85	1,80	1,55	1,55	2,02
Finland	1,83	2,15	1,85	1,92	2,02	1,92	1,92	1,88	1,82	1,90	1,95	1,92
Germany	1,78	2,14	1,90	1,87	1,94	1,91	1,95	1,97	1,93	1,98	1,96	1,94
Ireland	1,65	2,05	2,04	2,09	1,91	2,20	2,12	1,82	1,85	1,75	1,86	1,94
Latvia	1,10	1,65	1,30	2,35	1,05	1,65	1,95	2,05	1,75	1,65	1,65	1,65
Lithuania	1,80	2,00	1,45	2,50	2,00	2,05	2,35	2,30	2,05	2,00	2,55	2,10
Luxembourg	1,46	1,61	1,44	1,39	1,42	1,40	1,46	1,33	1,31	1,38	1,51	1,43
Netherlands	2,13	2,25	2,18	2,08	2,08	2,05	2,05	1,97	2,01	2,03	1,88	2,06
Poland	1,60	1,65	1,58	1,50	1,50	1,65	1,65	1,65	1,78	1,58	1,55	1,61
Slovakia	1,65	1,60	1,80	1,40	1,30	1,25	1,30	1,65	1,75	2,00	2,05	1,61
Sweden	1,91	1,94	2,04	2,15	2,07	2,07	1,87	1,80	1,67	1,74	1,71	1,91
UK	1,62	1,97	1,80	1,80	1,92	2,01	1,98	1,98	2,02	1,94	1,88	1,90

Country	Number of Banks	Assets (€ millions)	Nº of Banks for Data	Weights	CAMELS	Weighted Average
UK	355	8 884 446,00	10	34,06%	1,90	0,65
Germany	1,702	7 792 700,00	10	29,87%	1,94	0,58
Netherlands	96	2 465 249,00	6	9,45%	2,06	0,19
Sweden	153	1 316 174,00	5	5,05%	1,91	0,10
Belgium	92	1 101 976,00	5	4,22%	1,90	0,08
Ireland	370	1 075 503,00	5	4,12%	1,94	0,08
Denmark	110	1 063 395,00	5	4,08%	1,53	0,06
Luxembourg	141	1 056 182,00	5	4,05%	1,43	0,06
Finland	279	547 289,00	3	2,10%	1,92	0,04
Poland	664	405 835,00	2	1,56%	1,61	0,02
Czech Republic	56	224 114,00	1	0,86%	1,65	0,01
Slovakia	29	73 145,00	1	0,28%	1,61	0,00
Latvia	57	29 427,00	1	0,11%	1,65	0,00
Lithuania	88	27 063,00	1	0,10%	2,10	0,00
Estonia	38	24 711,00	1	0,09%	2,02	0,00
						1,89

EU South	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average
Austria	1,98	1,96	2,03	1,99	2,04	2,06	2,06	2,04	1,98	1,94	1,90	2,00
Bulgaria	1,25	1,60	1,60	1,60	1,60	1,60	1,65	1,40	1,30	1,00	1,00	1,42
Croatia	1,95	2,05	2,05	2,05	2,10	2,05	2,10	1,95	2,40	2,00	1,95	2,06
Cyprus	1,75	1,85	1,80	1,85	1,95	3,00	2,15	1,75	1,75	1,60	1,80	1,93
France	1,89	2,17	2,05	1,96	2,06	2,15	2,09	2,08	2,04	2,11	1,95	2,05
Hungary	1,90	1,85	1,85	1,85	1,85	2,05	1,85	2,00	1,50	1,80	1,80	1,85
Italy	1,73	2,03	2,08	1,98	1,99	1,93	1,92	1,96	1,94	1,98	1,95	1,95
Malta	1,35	1,60	1,35	1,35	1,60	1,35	1,35	1,35	1,45	1,55	1,70	1,45
Portugal	1,92	1,95	2,07	2,10	2,08	1,97	2,15	1,95	1,90	1,87	1,83	1,98
Romania	1,98	1,83	1,93	2,05	2,00	2,13	1,73	1,50	1,55	1,70	1,60	1,82
Slovenia	2,35	2,40	2,50	2,40	2,40	2,30	2,55	2,10	2,10	2,20	2,00	2,30
Spain	1,71	1,76	1,64	1,84	1,88	1,97	1,93	1,93	1,94	1,88	1,89	1,85

Country	Number of Banks	Assets (€ millions)	Nº of Banks for Data	Weights	CAMELS	Weighted Average
France	445	8 331 735,00	10	50,09%	2,05	1,03
Italy	611	3 924 651,00	8	23,59%	1,95	0,46
Spain	207	2 727 870,00	6	16,40%	1,85	0,30
Austria	615	844 757,00	4	5,08%	2,00	0,10
Portugal	145	428 141,00	3	2,57%	1,98	0,05
Romania	37	94 497,00	2	0,57%	1,82	0,01
Cyprus	54	86 551,00	1	0,52%	1,93	0,01
Croatia	32	58 129,00	1	0,35%	2,06	0,01
Bulgaria	27	50 867,00	1	0,31%	1,42	0,00
Malta	27	46 264,00	1	0,28%	1,45	0,00
Slovenia	19	40 191,00	1	0,24%	2,30	0,01
Hungary	109	1 174,00	1	0,01%	1,85	0,00
						1,98

Figure 8 – Weighted average CAMELS rating based on the total number of assets of each country's banking sector

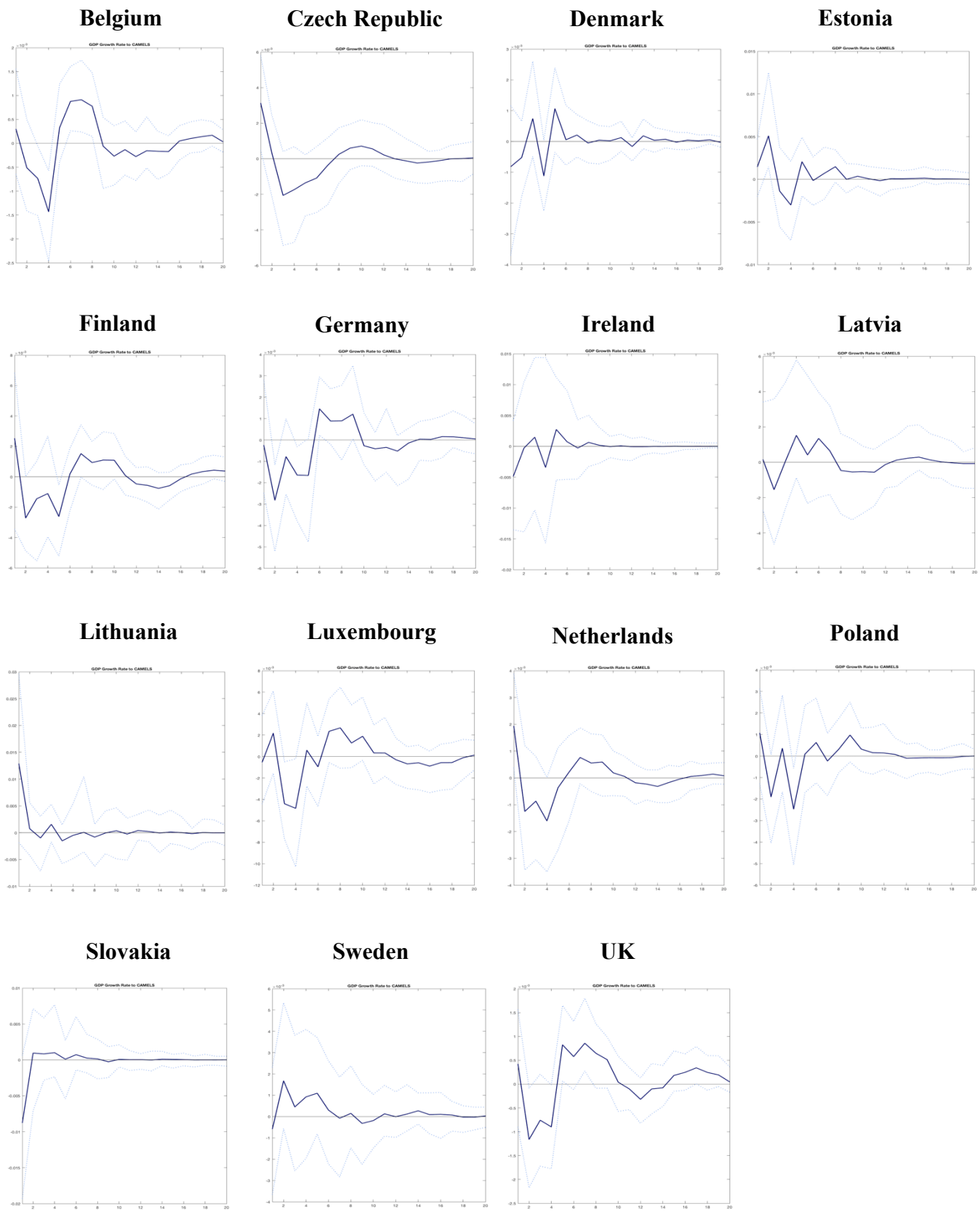

Figure 9 – VAR model IRFs – EU North

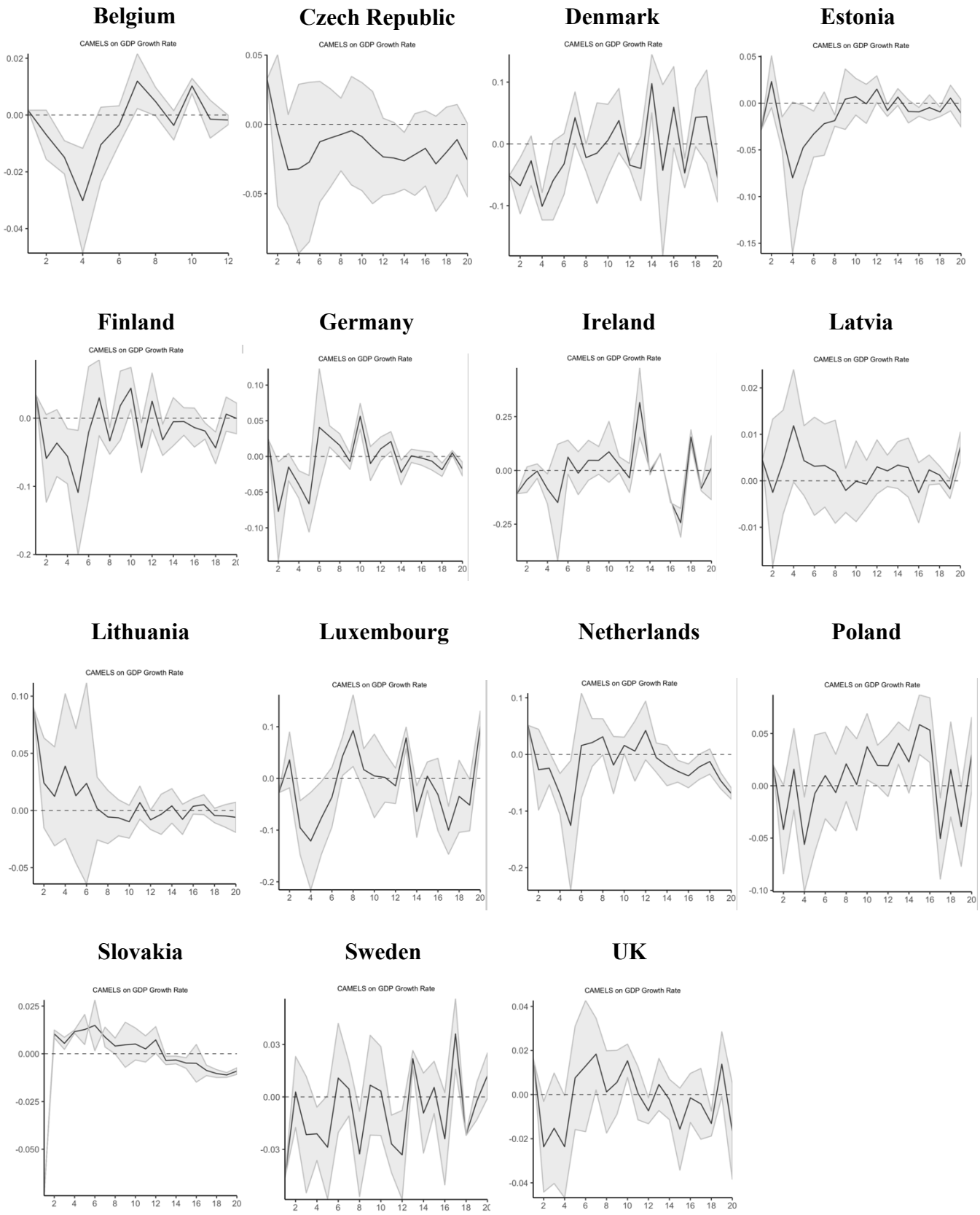

Figure 10 – Local Projections IRFs – EU North

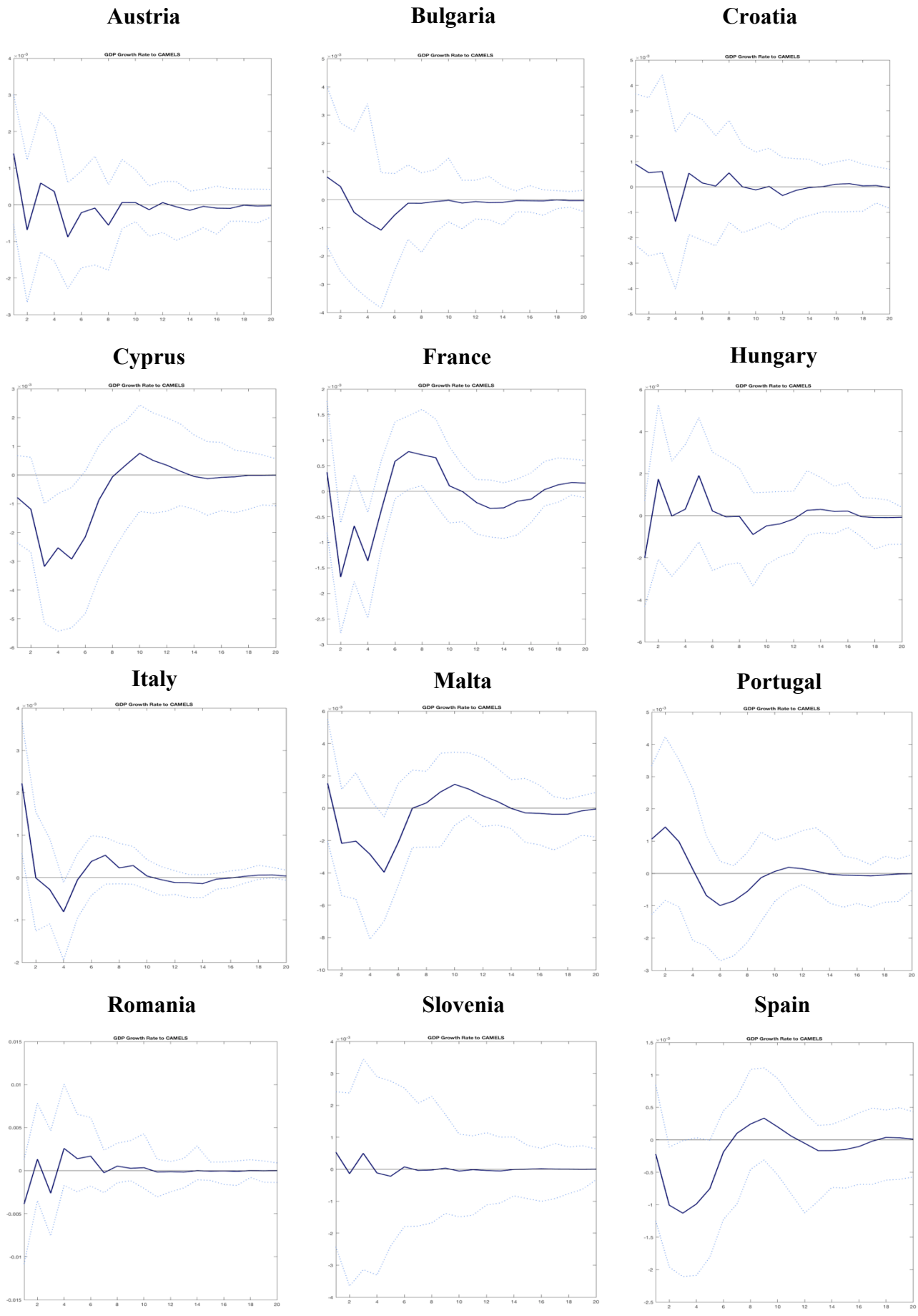

Figure 11 – VAR model IRFs – EU South

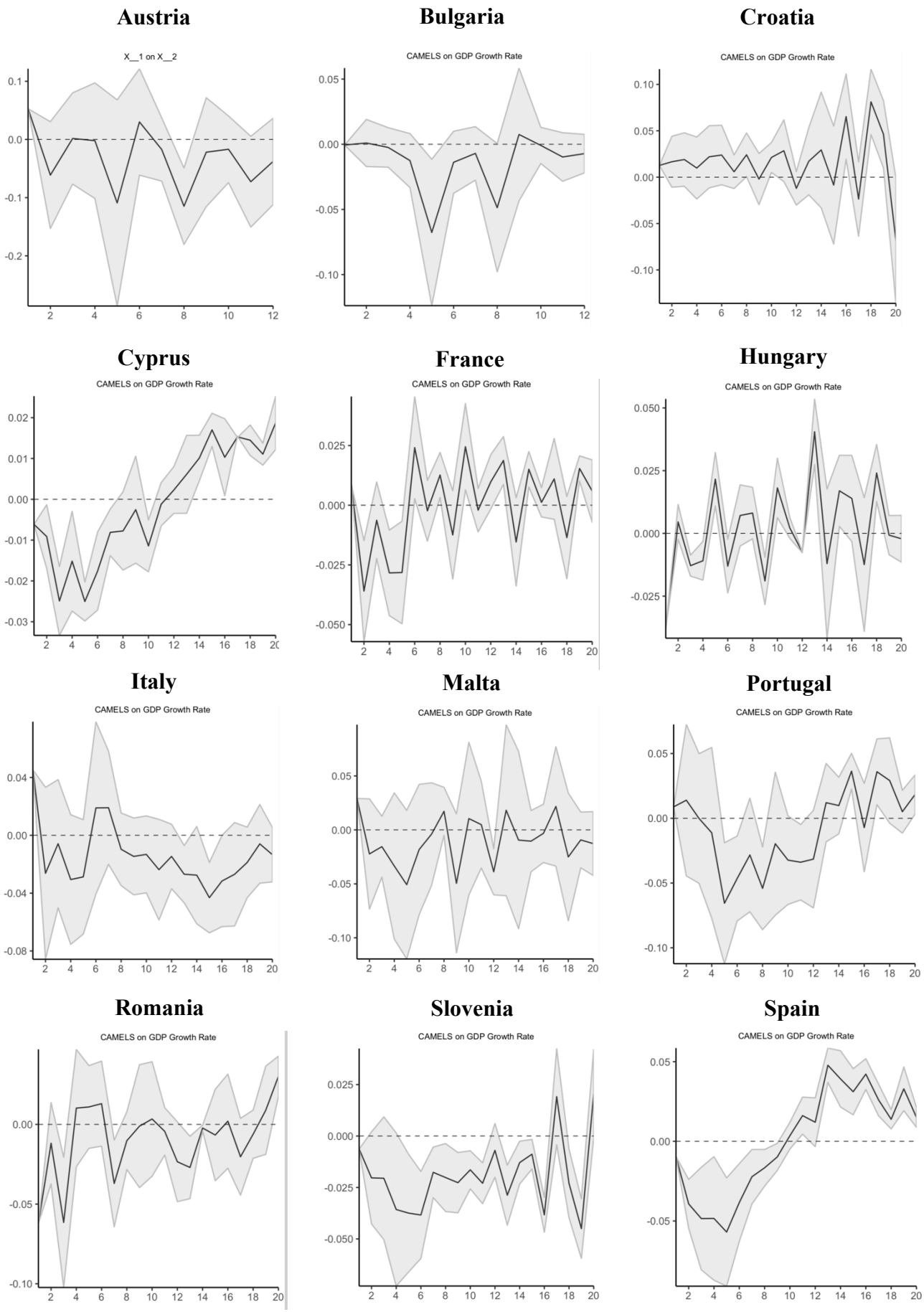

Figure 12 – Local Projections IRFs – EU South