Who did it? A European Detective Story
Was it Real, Financial, Monetary and/or Institutional?
Tracking growth in the Euro Area with an atheroretical tool.

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Abstract

Euro area countries have experienced profound economic, financial and institutional changes – as well as diverse shocks -- over the last three decades. GDP growth has been very volatile, and very uneven, across countries. Which factors played a role in stirring growth and/or reducing it? We assemble a large set of real, financial, monetary and institutional variables covering the period between 1990Q1-2016Q4. The Weighted-Average Least Squares (WALS) method provides us with clues about the variables to select. We then apply several techniques -- such as a heterogeneous Panel Error Correction model, VARs and others -- to quantify various determinants of growth in the short and long run. Hence, we assemble an atheorethical tool that enables to track growth performance and growth determinants across a large set of countries. The main outcomes stress the important positive role for long-run growth of institutional reforms overall and for the periphery in specific and it is a robust result across specifications and setups. An improvement in competitiveness matters for growth in the overall euro area in the long-run as well as a decline in sovereign and systemic stress. The debt over GDP influences negatively growth for the periphery only in the short-run. Property prices and equity prices have a significant impact only in the short-run, while the loans to NFCs affect positively core euro area and especially Germany. An increase in global GDP also supports growth.

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Non-technical summary

Euro area countries have experienced profound economic, financial and institutional changes – as well as diverse shocks -- over the last three decades. GDP growth has been very volatile, and very uneven, across countries. Which factors played a role in stirring growth and/or reducing it? We assemble a large set of real, financial, monetary and institutional variables covering the period between 1990Q1-2016Q4. The Weighted-Average Least Squares (WALS) method provides us with clues about the variables to select. We then apply several techniques -- such as a heterogeneous Panel Error Correction model, VARs and others -- to quantify various determinants of growth in the short and long run. Hence, we assemble an atheorethical tool that enables to track growth performance and growth determinants across a large set of countries.

Our main findings are that institutional reforms support long-run growth for all countries, and in particular, in the periphery. This finding is robust across specifications and setups. We also find that an improvement in competitiveness matters for growth in the long-run. A decline in systemic stress is also associated with growth. An increase in global GDP is also positive for growth, generally in the medium-run.

How about public finance impact on growth? The debt over GDP influences negatively growth for the periphery but only in the short-run. This is less clear by using the VARs and it is in line with the lack of consensus in the literature about the impact of public debt on economic growth. Surprisingly, the deficit plays no role. Instead, higher sovereign stress is associated with lower growth. How about monetary policy? Prior to the zero lower bound, higher monetary policy rates are associated with growth. This relations turns past the ZLB and when using the shadow rate that capture exceptional standard and non-standard monetary policies. How about the financial cycle? The equity price cycle affects positively GDP growth only pre-crisis and only in the very short-run, while the loans to NFCs had a positive impact for core euro area and especially for Germany.

Our results need to be seen as preliminary. Correlations and associations are no-causations. Evidence in this paper needs to be corroborated by model-based analysis. We cover a very intense and mutating period in European economic, financial, monetary and institutional history. For some of the countries in the sample there were switches in policy regimes. Thus, much remains to be done in future research. In the econometrics, a possible further contribution may include the use of a Global VAR. For the factors, the role of EU funds could also be taken into account. This possible determinant is here not included yet because of a (still) limited availability in its time-dimension. Similarly it is for the new euro area governance and the SSM.

1. Introduction and motivation

Our aim is to provide an atheoretical tool to track fluctuations and differences in growth among euro area countries since 1990. We focus on euro area countries because they: were bound by the process of European economic and monetary integration that started in the 1970s; experienced nominal convergence along the Maastricht convergence criteria; and have shared a single currency and monetary policy, and faced the same nominal exchange rate since 1999. Upon the launch of the euro, money markets and sovereign bond markets rapidly converged. Thus, several forces narrowed differences across countries, i.e., a catching-up process. Or to be more precise a three layered economic, financial and institutional convergence process.

At the same time, euro area countries have also experienced diverse shocks: some slow moving and some fast, some exogenous and some endogenous to the euro area. At the risk of oversimplifying, since 1990 we have witnessed, amongst others:

- Last nominal exchange rate gyrations during 1992-1993;
- Burst of the Dot-Com Bubble and September 11;
- Great Moderation and a broad financial cycle spurred by globalization, financial innovation and securitization;
- a Financial Turmoil starting in August 2007, Global Financial Crisis starting in September 2008 and followed by the Great Recession;
- latter exacerbated euro area imbalances prompting Sovereign Debt Crisis (May 2010) with break-up risks (acute until Summer 2012 and the announcement of OMT); and
- Period of low inflation with risks of deflation.

The ECB implemented exceptional standard and non-standard monetary policies since the start of the financial crisis. Moreover, there were institutional reforms throughout the crisis, and we witnessed an enhanced pace of structural reforms. Hence, what do we see in terms of growth dynamic over last 3 decades? Which factors played a role in stirring growth and/or reducing it? Were they real, financial, monetary and/or institutional? For now, ours is a broad brush detective story.

We make use of several techniques to select the relevant factors, which may have influenced growth based on the events above. Then we apply a heterogeneous panel Error Correction Model (ECM) to quantify their contributions to growth in the short and long run and then a panel VAR for a subset of determinants. The main outcomes stress the important positive role for long-run growth of institutional reforms overall and for the periphery in specific and it is a robust result across specifications and setups. An improvement in competitiveness seems to matter for growth in the euro area in the long-run as well as a decline in sovereign and systemic stress. The first effect is also rather persistent over time. A decrease in systemic stress matters even more for growth. The debt over GDP influences negatively growth for the periphery only in the short-run. The equity price cycle affects positively GDP growth only pre-crisis and in short-run, while the loans to NFCs had a

positive impact especially for Germany in a longer perspective. An increase in global GDP is also positive for growth.

The paper is organised as follows. **Section 2** provides some stylised facts and **Section 3** a literature review. There we describe diverse studies investigating the dynamics of growth and determinants of real convergence. **Section 4** describes our set of data. Several authors have also investigates business cycles and financial cycles across European countries: we bring these into our framework. A feature of this paper is that we are the first to include an index of institutional integration as well as a composite index of systemic stress. In **Section 5** we describe the selection of variables for our analysis by using different techniques. **Section 6** presents the econometric diagnostics. **Section 7** shows the main results and presents various robustness checks, including the panel VAR analysis and country-by-country VARs. **Section 8** concludes.

2. Stylised facts

We start with some stylised facts about GDP growth rates and growth volatilities across the euro area, over the last three decades. We focus on the founders of the euro area, but have to narrow down the data panel to 9 euro area countries for the period 1990Q1-2016Q4. The countries are: Belgium, Germany, Spain, Finland, France, Italy, Luxembourg, the Netherlands and Portugal. The reason is that we rely on the database from the ESCB WGEM team on real and financial cycles, based on ECB, BIS and national data sources. The data for the other euro area countries are either not included in this database – e.g., Austria and Ireland -- or have very limited time-dimension (Greece and new member states).

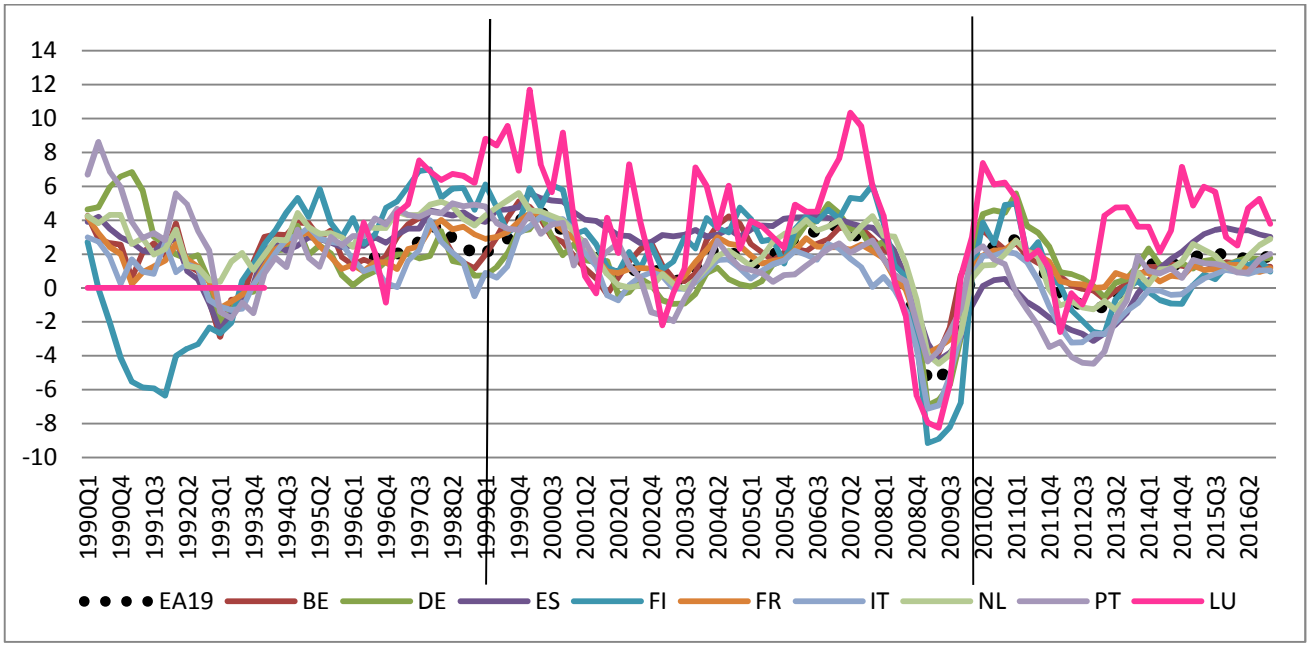
The countries in the euro area have indeed experienced different growth rates across the considered period (1990-2016). This is clearly shown in both our nine considered member states (Figure A) and it is even more so for the entire euro area (this includes new member states). Not only growth rates are heterogeneous across countries but also they differ depending on the time sub-samples, i.e. until 1999 (launch of the euro), before the Global Financial Crisis (GFC) in 2008 and before/after the sovereign debt crisis in the second half of 2010.

The core countries had high growth rates before the launch of the euro. This is especially true for Finland in the 90s, in which the country changed trade partners and most of its industrial policies after the collapse of the USSR. From the mid-2000s, Germany has experienced the most rapid increase in GDP, thanks to many structural reforms under Schröder´s government period. Later on, the euro area core has recovered faster and then stabilise at around 2%. Luxembourg is instead an outlier, having a very volatile and generally higher GDP growth over the period.

Within the periphery group, Italy has a stagnating GDP growth since the beginning of the 90s and the weakest recovery after the GFC and sovereign crisis (Papadia, 2017). Spain on the other hand had a boom period lasting a decade, from mid-90a to mid-00s fuelled by reforms and an increase in the magnitude of the credit cycle (Comunale, 2017b). Overall, the drop in growth for the periphery was less substantial during 2008-2009. Only after 2014, we can see a further increasing growth trend for periphery as well.

We expect therefore differences in the changes of growth rates and in their volatilities over time. We also show that indeed in Table A, dividing the sample in different periods.

Figure A: Growth rates of euro area countries and EA 19[5]



Note: These are the real growth rate compared to the same quarter of previous year.

Not only the growth rates themselves performed differently, but we can see also specific paths in the second moments. Here below the evolution of volatilities over time and countries (Table A). Finland and Luxembourg experienced the higher volatilities especially before the introduction of the euro, and this is in line with the findings shown in Figure A. France, Italy and Belgium seem more stable. The largest volatilities are found if we include the Global Financial Crisis (2008Q3-2013Q4), as expected. There is an overall decrease in volatility between pre-crisis years and the period after the sovereign debt crisis in all the considered members (in red in Table A).

Table A: Volatilities of euro area countries over time

	EA19	BE	DE	ES	FI	FR	IT	LU	NL	PT
1990Q1-2016Q4	3.5	2.7	5.0	5.6	13.0	2.2	4.2	14.4	4.1	6.7
1990Q1-1998Q4	**0.5**	**2.5**	**4.0**	**2.8**	**17.6**	**1.7**	**1.9**	**6.4**	**1.6**	**5.4**
1999Q1-2007Q2	1.3	1.7	2.7	0.6	2.1	1.1	1.6	10.5	2.9	2.7
2008Q3-2013Q4	5.6	3.6	11.9	2.0	16.7	3.4	7.1	20.6	4.1	5.2
2014Q1-2016Q4	0.1	0.0	0.1	1.0	0.8	0.1	0.3	2.1	0.6	0.2

Note: the volatility is here defined as the standard deviation (squared). The EA19 is the aggregate of 19 member states, which includes new member states, and the data start in 1996Q1 (source: OECD).

[5] Luxembourg is an outlier. We also performed our baselines without it as a robustness check.

In this paper, we would like to explain these differences across country groups and time sub-sample. In order to do so we analyse which are the main determinants, both in the short and long run, behind the heterogeneous paths of GDP growth in the last decades.

3. Literature review

Our study is at the intersection of a rich literature on growth models as well as the determinants of real convergence. An initial group of studies follows the Solow exogenous growth model (Solow (1956)). This model explains differences in growth rates between countries with differences in the endowed stocks of physical capital. The Solow model postulates that if preferences and institutional features are identical across countries (ceteris paribus), a high expected return on investment in capital-scarce countries encourages capital to flow to the less endowed countries. The rise in investment causes the capital-scarce countries to grow at a faster pace thus slowly converging towards the level of income of the capital rich countries. This is often referred to as unconditional convergence and is evidenced by the catching-up phenomenon (β-convergence).

In the case of European countries, the empirical evidence for β-convergence based on the Solow growth model is mixed. Barro and Sala-i-Martin (1992) find evidence support catching-up for a sample of European countries, although the speed is low and the path uneven. The limits of this approach lies, amongst others, in the reliance on identical preferences and institutions across countries. There is also no reflection on economic policies (Diaz del Hoyo et al. (2017)). Alcidi et al (2018) show a "tale of two speeds": with overall income convergence over last 15 years, but with large diverging internal patterns.

Another group of studies endogenises technological change through increased returns to production factors or by generating innovation in its own right. Uzawa (1963) and Lucas (1988) include investment in human capital. Instead, Romer (1986) recognizes that country may become more prosperous if they allocate more resources to innovation. Borsi and Metiu (2013) use a neoclassical growth model augmented by endogenous technological progress, and find no evidence of overall real GDP per capita convergence for the EU27 in the period 1970-2010. However, they identify "convergence clubs" or clusters. The endogenous growth models permit policymakers to implement growth-enhancing strategies to target TFP, education, innovation and technological progress, thereby boosting economic growth and facilitating convergence (see Diaz del Hoyo et al. (2017) for a survey).

A third group of studies explains cross-country differences in per capita growth with differences between institutions and governance (see North (1990)). Property rights, as well as other economic institutions, are seen as crucial in fostering investment and growth. Institutions are the rules of the game of societies and they shape economic incentives (North and Thomas (1973)). Countries with strong institutions encouraging innovation will experience higher factor accumulation, a more efficient resource allocation, and growth. Hence, long-term growth requires strong institutions (Easterly and Levine 1997). Barro (1996) finds a non-linear relationship between growth and democracy and political freedom. Political instability is shown to be detrimental to growth (Hall and Jones 1999). Mauro (1995) looks at corruption, red tape, the efficiency of the judicial system, and political stability.

The Worldwide Governance Indicators enable richer cross country comparisons (see Aixala and Fabro (2008)). There is a positive correlation with country's initial level of income and good initial governance (Han, Khan and Zhuang (2014)). Countries with stronger institutions and better governance grow faster in the long-term than their counterparts. To sum up, we include several of the above variables in our exercise.

4. Data description

We consider several possible factors which may have influenced GDP growth in euro area countries in the short and in the long-run. This analysis tries to include real, financial, monetary and institutional factors in order to explain GDP growth in euro area, various sub-sample as well as pre- and post-crisis. This section describes these variables in details, while a summary table is also provided in the Appendix, for the reader's convenience. As already explained in Section 2, our data covers a panel of 9 euro area countries for the period 1990Q1-2016Q4, for a total of max 972 observations.[6]

The **real GDP growth** data for the countries as well as the real and financial cycles come from the database of the above-mentioned ESCB WGEM team (see ECB, 2018). The real GDP growth series are extended by using IMF IFS data (interpolated by using cubic spline). For the aggregate euro area 19 we used data from OECD.

For the **financial variables** we use several measures of the financial cycle based on credit, house prices and equity prices. They overlap of course but are not identical. The cycles are based on data from real GDP (YER), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), equity price indices (EQP), nominal long-term rates (LTN). The real GDP, equity price indices and the nominal long-term rates are from ECB Statistical Data Warehouse (SDW) while the other data are from BIS and extended by using national sources. The cycles have been computed by using the band-pass filter á la Christiano and Fitzgerald (2003) with 8-80 quarters as lower-upper bounds. We follow the previous studies by Drehmann et al. (2012) and Aikman et al. (2015) and use a so-called band-pass filter to extract the cycles. We also make use of a new set of within-country synchronicity indices between real and financial cycles from Comunale (2017b). These measures capture whether positive and negative cyclical phases coincide, regardless of their amplitudes (see Mink et al. 2012 for the cross-country analysis). Each index results in a value of either 1 or -1, where 1 means that the cycles are perfectly synchronized at time t and therefore they have the same sign (either positive or negative). A value of -1 indicates instead that the cycles have opposite signs. We look at all the country-pairs from the cycles described above.

In the set of **real variables**, we include fiscal variables, such as (seasonally adjusted) fiscal deficit and debt over GDP, and a proxy for price competitiveness represented by the growth rate of the REER *vis-à-vis* 41 partners and deflated by CPI. All these series are from Eurostat. Lastly we make use to global GDP growth in the robustness checks, to look at possible global/spillover effects on growth in the euro area countries. These data are from IMF-IFS in million nominal USD. The

[6] The data for the cycles and the synchronicity measures are not publicy available but they can be replicated by using the series and filers as explained in this section and in the Table in the Appendix.

rates of growth are taken year-on-year in percentage. We consider 42 countries, including other advanced economies and emerging markets.[7]

For the **monetary factor**, with the ECB policy rate constrained by the zero lower bound (ZLB) over a significant portion of the sample under investigation, we use shadow interest rates of Wu and Xia (2016) to represent both conventional and unconventional monetary policy actions.[8] These series by Wu and Xia (2016) are augmented by EONIA rates for the periods before 2004 from ECB SDW and pre-1992 country-specific short term interest rates from national sources. The proposal of having a shadow rate has intuitive appeal because when it is positive it equals the actual short-term rate, but the shadow rate is free to evolve to negative levels after the actual short-term rate becomes constrained by the ZLB. A lower shadow rate signals a further use of unconventional monetary policy measures. We decided to apply the specific Wu and Xia (2016) shadow rate because has been already widely used in the literature and it is constantly updated. Moreover, if we use a simple VAR with GDP and inflation adding several different shadow rates, the results of the transmissions are very much alike.[9]

We also include a **European Index of Regional Institutional Integration** (EURII), which maps developments in European integration for 6 euro area founding members on the basis of a monthly dataset from Dorrucci et al. (2015) extended to include 2016. The data are taken at quarterly frequency by averaging the monthly series. This index is common across all the countries and it is time-varying. This index represents a novelty in this type of studies.[10]

We finally also include indicators **for sovereign and systemic stress**, especially important for the last 10 years of data. We have the country-specific Composite Indicator of Sovereign Stress (SOVCISS)[11] and the common Composite Indicator of Systemic Stress (CISS) as computed by Holló at al. (2012). Both are taken from ECB SDW. The SOVCISS is at monthly frequency and averaged into quarterly. The CISS is at daily frequency and we make use of the quarterly averages. The SOVCISS combines the short and long-end yield curve information including spreads, volatilities and bid-ask spreads to come out with an index for stress in sovereign bond markets. CISS instead is an indicator which uses information from equity, bonds, exchange rate volatilities, banks and payments systems and weights more when the stress has been found in several markets at the same time.

[7] The 9 euro area countries are included. This makes our variable somehow suitable to account for possible spillover effects.

[8] The Wu and Xia (2016) shadow rates are based on an analytical representation for bond prices in a multifactor shadow rate term structure model (SRTSM). The minimum rate set as 25 basis points. Among its advantages, we can see that it is easy to compare with normal rates, it can be applied directly to discrete-time data and it is not based on simulated methods. Moreover, the approximation is free of any numerical error associated with simulation methods and numerical integration. However, they depend on: the specification of the shadow/ZLB model and the data and method used for estimation.

[9] Results based on shadow rates series described in Comunale and Striaukas (2017). The results are available on request. There are other shadow rates or methods used in the literature in order to capture the unconventional monetary policy phase. However, all have pros and cons and there is no consensus on the best to be used (see Comunale and Striaukas, 2017).

[10] An illustrative chart with the subcomponents of the EURII index is provided in the Appendix (A.3.).

[11] See Garcia-de-Andoain and Kremer (2017) for more details.

5. Selection of variables

Given our atheoretical approach to the analysis, we first test for the relevance of each of our regressors in explaining GDP growth (over the short- and long-term). We use methods that combine information taken from parameters of each model using weighted average of conditional estimates. This incorporates the uncertainty we have of models and of estimations together. We apply as a preferred way to do so, the Weighted-Average Least Squares (WALS) method by Magnus et al. (2010) and Magnus and De Luca (2016). This is a more flexible approach and reduces the computational burden compared to other methods, especially when we include synchronicity indices.[12] This method combines Bayesian weights with frequentist, i.e. (constraint) least squares, estimations. Thereafter, the Bayesian Model Averaging (BMA) method, which relies fully on Bayesian weights and estimates, has been applied as a robustness-check.

We have to stress, however, that these methodologies apply in a context of static linear regressions models and they do not take into account the possible heterogeneity across units and short and long –term effects separately. Moreover, stationarity in the data is not required. The presence of the above-mentioned factors may well be crucial in our analysis. This is anyways, in our opinion, a worthwhile initial screening check, keeping in mind the above *caveats*.

As reported by Magnus et al. (2010), we can consider as a rough guideline for "robustness" of a regressor, if it does have a value posterior inclusion probability (pip) of 0.5 (Raftery, 1995) in the BMA, corresponding approximately with an absolute t-ratio of abs(t)=1 (Masanjala and Papageorgiou, 2008) for instance in WALS. Initially we opt for a more restrictive case for BMA, adding only regressors for which the pip is close to one (minimum of 0.8). If pip is exactly equal to one, the regressor needs to be included by probability one. In case of WALS, only t values greater than 1.5 in absolute terms are included. The tables reporting the results are available in the Appendix in Table A.2 and A.3 for WALS and BMA respectively. The final selection of the variables for the baseline, i.e. the ones that should be included for both methods, is in Table A.4.

Starting with WALS (Table A.2 in Appendix), the regressors to be included together with the lagged value of the dependent variable (GDP growth) are: CISS, SOVCISS, REER growth, debt over GDP, the shadow rates, the EURII, the cycles of equity and house prices, credit to NFCs (and the one on total credit), and the synchronicity between long term rates and loan to households and to loan to NFCs. If we do not include the lagged GDP growth, we find that other synchronicity indices could be also one of the factors to take into account. Among the cycles, the business cycle seems to capture what was given by the lagged GDP growth in the previous specification.

If we apply the BMA (Table A.3) and then compute the posterior inclusion probability (pip), including among the regressors the lag of GDP growth, it is clear that debt, CISS, REER growth and the institutional index EURII should be included, together with equity price cycle. Given that these Bayesian techniques are designed for static panels, we applied the BMA also without any lag of the dependent variable. In this case, debt over GDP, REER growth, both CISS and SOVCISS, shadow rates and the institutional index should be included in the model. Among the cycles, the real one

[12] We make use of the codes in Stata by De Luca and Magnus (2011). An application of WALS for growth equation can be found for instance in Magnus et al. (2010) or in Owoundi (2016).

capture what the lagged GDP growth was adding before, moreover credit to NFCs and house prices may play a role. Lastly we added the synchonicity indices, only between real GDP cycle and financial cycles. We exclude synchronicity between financial measures at this stage because of the computational burden of BMA technique. However if we include only the synchronicity indices between long term rates and loan to households and to loan to NFCs, which are the only one resulted to be important in the WALS case, they turn out to be not key for growth using the BMA. The only index that seems to matter is the one between real GDP and equity prices, but only if the lagged value of real GDP is not included.

Summing up, by means of what overlaps in the WALS and the BMA techniques (Table A.4 in the Appendix), we can have some robust factors which need to be added as regressors: debt over GDP, CISS and SOVCISS, REER growth, the EURII and shadow rates. Among the cycles, we will add the cycles for house prices and loan to NFCs and lastly one representative for synchronicity, i.e. the one between long term rates and loan to households.[13] This is our baseline setup. Our alternative baseline is without the synchronicity measure, which is not captured in BMA. This results in an especially robust set of factors, which is in line with the findings in Magnus et al. (2010). One clear cut is that, by using either of these techniques, the fiscal deficit should not be included and only some specific financial cycles.

6. Econometric diagnostics and setup

For the regression about the growth factors, we tested for cross-sectional dependence (CSD), non-stationarity and also cointegration. The panel in its baseline experiences CSD,[14] therefore in order to properly test for the presence of unit roots, we use a second generation test by Pesaran (2003). Our dynamic panel cannot reject non-stationarity for some of the series or even fully accept the null of non-stationarity for all the series in some cases (CISS index, cycles, shadow rates and institutional index). [15]

For the cointegration, we apply an error-correction-based panel cointegration test, i.e. the Westerlund (2007) test. This method does work in case of panel data with cross-sectional dependence. One drawback is that we cannot check for our full baseline given the limitation to 6 regressors. By using the cycles one-by-one, we do reject the null hypothesis of no-cointegration for of at least one of the cross-sectional units. Same applies for the baseline without cycles or synchronicity indices.[16]

On the basis of these findings, we reparametrized our setup from an Autoregressive Distributed Lag (ARDL) form (equation 1) into a panel error correction model (PECM), as shown in equation

[13] The results when the synchronicity between long term rates and loan to NFCs is included are very robust with respect to the selected baseline. Same holds if both the synchronicities are added together. These are all available on request.
[14] We applied the test in Pesaran (2004). The results for our baselines strongly reject independence: Pesaran's test of cross sectional independence = 17.695, Pr = 0.0000 (with synchronicity index) and Pesaran's test of cross sectional independence = 17.903, Pr = 0.0000 (without).
[15] Null hypothesis assumes that all series are non-stationary. This t-test is also based on Augmented Dickey-Fuller statistics as IPS (2003) but it is augmented with the cross section averages of lagged levels and first-differences of the individual series (CADF statistics). More details on the tests can be found in the Appendix (A.5).
[16] For the baseline without any cycle or synchronicity index we always reject the null of non-cointegration at 5%. The details about the tests' results are available on request.

(2).[17] Another reason for the choice of the PECM is also that this framework allows us to study both the short-term and the long-term influence of factors on growth. In this case, the estimators we can use are 3, namely the Mean Group (MG), the Pooled Mean Group (PMG) and the Dynamic Fixed Effects (DFE). The MG estimator is the only one that gives heterogeneous coefficients in both the short and long-run analysis and we decide to use it to keep the information coming from the heterogeneity of our sample.[18]

$$GDPG_{i,t} = \beta_{1i} GDPG_{i,t-1} + \beta_{2i} X_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\Delta GDPG_{i,t} = \phi_i \left(GDPG_{i,t-1} - \theta'_{0i} - \theta'_{1i} X_{i,t-1} \right) + \delta^{'*}_{11i} \Delta X_{i,t} + \mu_i + \varepsilon_{i,t} \quad (2)$$

The coefficients ϕ and $(\phi \cdot \theta)$ capture the long-run effects, while the coefficients δ correspond to the impact of the variables in the short-run. The X is the vector of the factors taken into account. Based on these results in section 4, the list for the baseline vector of factors is provided and includes: debt over GDP, CISS and SOVCISS, REER growth, the EURII and shadow rates together with the cycles for equity prices, house prices and loan to NFCs and synchronicity between real GDP and equity prices.

In one of the checks, we also provide a simple panel VAR model as the following in equation (3) to look at our results with having an endogenous structure (see Canova and Ciccarelli, 2013). This is not meant to add any causality but only to take into account the possible endogeneity among our variables of interest.

$$Y_{i,t} = A_{0i}(t) + A_i(l) Y_{i,t-1} + u_{i,t} \quad (3)$$

where $Y_{i,t}$ is the vector of our variables described in the preferred identification scheme (see Section 6.3). We compact into $A_{0i}(t)$ all the deterministic components of the data (constants, seasonal dummies and deterministic polynomial in time) if present. $A_i(l)$ are polynomials in the lag operators and $u_{i,t}$ are the identically and independently distributed errors. Lags of all endogenous variables of all units enter the model for *i*, i.e. we allow for "dynamic interdependencies".[19]

7. Results

7.1. Main results with ECM

[17] The number of lags has been selected based on the Schwarz's Bayesian information criterion (SBIC). This method has been proven giving more accurate outcomes for quarterly data series also in case of small samples for VARs and Vector ECMs (Ivanov and Kilian, 2005). We implemented this criterion country by country. Only for some countries the SBIC criterion would have chosen 2 lags. We applied in our setups only one lag for the overall panel to keep a higher degree of freedom. The number of regressors with both one and two lags in the ECM is also too high to be estimated by the Mean Group. If we use only the second lag, the results are robust with respect to our baseline in Table 1.

[18] The results with the DFE are also available on request. The estimated coefficients are very robust with respect to the ones estimated by applying the MG.

[19] When the global GDP growth is included, also a VARX model is applied, with the new variable taken as exogenous.

The comparison between the two baselines by using the ECM and with or without the synchronicity between real GDP and equity prices is in Table 1. We reported only in this case both homogeneous coefficients and heterogeneous ones as a comparison for the baselines.

We also look at two sub-groups, defined in a very simple way as euro area "core" (BE, DE, FI, FR, LU, NL) and "periphery" (ES, IT, PT) and if the difference in the coefficients is significantly non-zero. We show hereafter only our preferred estimator, which keeps the heterogeneity within the samples. The homogeneous case is available on request.

Then we look at the differences with the pre-crisis periods, comparing the whole sample with data up to 2010Q1 (European sovereign debt crisis).[20] The results are reported in Table 3. In this case, we did not split the samples into core and periphery because we have too few observations.

[Insert Tables 1-3 around here]

The main outcomes stress the important positive role for long-run growth of institutional reforms before and after the crisis and for the periphery overall. This finding is very robust across specifications. Instead, in the short run we do see a negative impact only prior to the crisis.

In the long-run also an improvement in competitiveness seems to matter as well as a decline in sovereign and systemic stress.[21] The link between competitiveness and growth in the EU has been found in the literature and our results are in line with these studies. Results of Gala and Lucinda (2006)[22] and Rodrik (2008)[23] indicate that a real depreciation, i.e. increase in competitiveness, is associated with higher GDP growth. Comunale (2017a) find that the REER misalignments associated with foreign capital inflows in the EU were a further cause of declining GDP, in a long-run perspective, while they played no role in the short run. Indeed situations of protracted or recurrent REER misalignments have been associated with lower economic growth mostly over the medium and long run in the literature (Edwards 2000). It is good to stress that, as reported in Berg and Miao (2010), the REER is not a policy instrument, but mainly a result of policy actions and externalities. So, the direction of funding the appropriate, more productive sectors can increase competitiveness and then long-run growth (Comunale, 2017a).

The debt over GDP influences negatively growth for the periphery only in the short-run (and this drives the same results for the entire sample). This is somehow in line with the general empirical literature on the relationship between public debt and economic growth, which is far from being conclusive on this issue (Panizza and Presbitero, 2013, 2014 and Mika and Zumer, 2017). A similar conclusion can be found in Kempa and Khan (2017), who shown that debt shocks exert no significant impact on the growth dynamics across the euro zone. Lastly, Gómez-Puig and Sosvilla-

[20] The results for the data until 2008Q3 are available on request. In a nutshell, the factors seem to matter mostly only in the short run and equity prices and competitiveness are key. The sample from 2010Q2 to 2016Q4 also lack of degree of freedom in the time series to perform an error correction model in a proper way, so we compare the pre-crisis rather with the entire sample.

[21] An increase in REER and REER growth means a decrease in competitiveness and vice versa.

[22] This paper studies the link between REER and growth by using a dynamic panel data analysis with GMM techniques, for 58 countries in 1960-1999.

[23] Rodrik (2008) estimate the results for a panel of 184 countries in the period 1950-2004.

Rivero (2016) stress the difference of the impact depending on euro area countries and the time span considered.

The equity price cycle affects positively GDP growth just pre-crisis, when some countries experienced a substantial increase in the magnitude of the positive side of the cycle. This affected growth only in the very short-run and it did not have a persistent effect on the overall performance. The loan to NFCs instead could have had a positive role for growth in the long-run and especially for the core countries. For the periphery we do not see any significant impact of these loans on GDP growth. This result may depend on how the funding have been used in the different economies, i.e. for more productive or less-productive sectors. As reported in Hassan et al. (2017) the differences in the efficient allocations of funds could have mattered. In Italy the credit is allocated less efficiently than in France and Germany.

The monetary policy, proxied by the short-term rates until the ZLB and then the shadow rates,[24] has a very different impact in the short and long-run, as well as pre- and post-crisis. There was a strong co-movement between EONIA (in levels) and GDP growth before the rate reached the ZLB. Afterwards, a lower shadow rate signals a further use of unconventional monetary policy measures. As Figure 1 shows, then the two paths diverge. This causes the coefficient to be positive and significant in the long-run (or not significant after 2010) while in the short-run, when we use the changes, we do experience a negative effect when the sample is split and in most of the robustness checks (explained later in Section 6.2). The sign is as expected over the period, because monetary policy is set endogenously: when GDP rises, interest are set to go up. In fact in the early part of the sample/chart below GDP leads interest rates. Stagnation after Great Recession gives the reason for the monetary policy stance to react to the situation. From the sovereign debt crisis the transmission mechanism broke down and monetary policy has been most accommodating (to increasing degrees). In 2013 there is a decoupling of the shadow rate from GDP growth and the shadow rate captures the unconventional monetary policy. A lower shadow rate signals a further use of unconventional monetary policy measures.

[Insert Figure 1 around here]

7.1.1. Factor analysis

We thus calculated the contributions of each of the factors in determining changes in the growth rates during the years before 2010 and then from 2010 to 2016. These two periods are chosen to stress possible differences in the contribution between before and after the sovereign debt crisis and in order to have a clearer idea of the magnitudes. We do so by using the long run coefficients in the baseline without the synchronicity (Table 1, Column 7) multiplied by the difference in the factors in the considered period.[25] Lastly, the REER growth has been recalculated here to the reader convenience and an increase means a better competitiveness performance. Lastly the impact of the short-term interest rates could be somehow counterintuitive. This is because the coefficients are for the whole period positive and only after the ZLB a more accommodative monetary policy means a decrease in the shadow rate. Again for reader's convenience, the sign is here reversed in the analysis

[24] We use pre-1992 country-specific short term interest rates and then EONIA.
[25] This is because the index is always equal to 1 or -1.

for 2010 onwards. The results for the two periods are provided respectively in Figure A.1 and A.2 in the Appendix.

The institutional factor is again the main one pushing higher GDP growth. The contribution is bigger in magnitude in the first period, given the major advancement in EMU design between the 90s to the 2000s, however the positive contribution for increase in GDP growth is very evident also after the sovereign debt crisis. In the latter periods we also see a decrease in the CISS, which capture systemic stress, and this has had a positive influence for growth. To a lesser extent we see in 2016 a positive contribution to growth of a decrease in the sovereign stress indicator. Lastly, we can see an increase in price competitiveness between 2010 and 2016, which helped growth. The role of cycles is mostly negative but small in relative terms.

7.2.Robustness checks for ECM

We run a simpler setup with only debt over GDP, sovereign CISS, institutional index, interest rates and looking at the differences between a general measure of real and of financial cycle from total credit. Then we also added the fiscal deficit, to go deeper into the fiscal side of growth, which we expect being crucial after the sovereign debt crisis. The positive and significant role for the institutional index is here confirmed in almost all the checks. This gives a very robust factor that helps growth in the more long run perspective. The interest rate affects again positively growth and an increase of debt to GDP ratio negatively affects growth mostly in the long run and in some cases curbs it in the short run as well. The fiscal deficit does not have a clear role on influencing growth in the short run, while we find a significant negative effect only in some cases in the long run. Lastly, as expected, the real cycle has a major role in driving the GDP growth in the short run, however in the long run the impact is not robust across specification.

Then, we perform the baseline estimations for the sample without Luxembourg, which experienced higher volatility of growth rates than the other member states and has some series limited in their time dimension (see stylized facts). The positive impact of European institutional reforms in the long-run is confirmed as well as the ones of competitiveness (REER growth) and short-term interest rates. The only significant difference is in the role of the property price cycle for growth in the short run, which is more substantial if we drop Luxembourg from the sample.[26]

Having checked for the presence of cross-sectional dependence (CSD) in our panel, we add, as a further determinant, a measure of global GDP growth.[27] This is, econometrically, in order to "purify" our panel as this should take out a part of the common factor and therefore substantially reduce the (strong part of) cross-sectional dependence.[28] Economically, this variable is useful to check for a possible transmission of an increase in global GDP to European growth. The main result is once

[26] The outcomes for the sample without Luxembourg is available on request.

[27] We also check for the importance of global GDP growth with WALS and this method confirmed that the variable could be indeed included.

[28] This approach is similar to the one in Comunale (2017a). This method is inspired by Solberger (2011), which only adds an omitted variable, constant in the cross-section, forcing exogenous common factor dependence; simply demeaning the dependent variable would be unsatisfactory.

again robust: the institutional index is crucial in the long-run. Moreover, the global GDP growth seems to affect positively euro area GDP growth in the short-run.

Lastly, we applied a different way to split the sample, not based on level of debt or sovereign stress (core vs. periphery) but rather on low vs. high volatilities of growth in the whole period (see Table A). The first group is composed by Belgium, Germany, France, Italy and the Netherlands. The high growth volatility group includes the other four countries, namely: Spain, Finland, Luxembourg and Portugal. The results are in Appendix (Table A.6). With this alternative way of dividing the sample, the coefficients for the institutional index and REER growth are very similar and extremely robust in comparison with the baseline for the entire sample (Table 1). When we had core vs. periphery (Table 2) they mattered more for the latter group of countries. This means that institutional reforms at EU level and competitiveness may be more substantial factors in affecting growth for countries with higher debt or more affected by the sovereign crisis. SOVCISS, the country-specific index of stress in sovereign bond markets, has a negative impact on growth in the short-run when growth volatility is high. However it impacts negatively growth in the long run for countries with lower volatilities in GDP growth.

7.3.A panel VAR analysis of growth determinants

As a further check, we provide a panel VAR (see Section 5) identified by a simple Cholesky scheme and by using a GMM-style estimator as in Albrigo and Love (2015).[29] This is not meant to add any causality but only to take into account the possible endogeneity among our variables of interest. We have 10 main determinants overall: debt over GDP, CISS and SOVCISS, REER growth, the EURII and shadow rates together with the cycles for equity prices, house prices and loan to NFCs and synchronicity between real GDP and equity prices. For the panel VAR, firstly we identify shocks for the GDP growth and for 5 out of 10 determinants and namely debt over GDP, SOVCISS,[30] REER growth, the shadow rates and one of the financial cycles. For the latter we use the cycle on loan to NFCs, which is the only one significant in our baseline setup with the Error Correction Model.

We firstly identify the shocks via Cholesky as in equation (4) (from the most exogenous variable to the most endogenous at time t) without taking into account the important institutional changes.

$$Y_t = (short\ term\ i_t, loans\ to\ NFC_t\ , debt_t\ ,\ sovciss_t\ ,\ reer\ growth_t\ ,\ GDP\ growth_t)' \quad (4)$$

We have the short-term interest rates as we start with a monetary policy action, which can have direct impact on contemporaneous variables. The rates affect loans to NFCs, as the boom/bust cycle in credit market, has been also influenced by interest rates and the further accommodation unconventional measures to deal with the possibility of credit crunch. The level of debt to GDP can be also influenced by the interest rates can influence the debt level and the debt and rates can play a role in the SOVCISS, i.e. the sovereign stress indicator may be due to all the factors above. We also use CISS instead in a further check, resulting important from the Error Correction Model analysis. CISS is instead common across units. Hence, the REER growth, as in Comunale (2017a), can affect

[29] In this case the coefficients are homogeneous. The confidence bands are set at 68% and we consider one-unit shocks.
[30] This is mainly because SOVCISS is country-specific and possibly more relevant for both core and periphery.

GDP growth and it can be influenced by financial flows as in the Dutch Disease literature; moreover stress and sovereign debt can also affect competitiveness negatively as shown in Checherita-Westphal, and Rother (2010).[31] Then the last variable is GDP growth. This in t+1 will then influence the interest rate as in a sort of Taylor Rule.

As a further check we include the EURII as a common factor for the euro area as in equation (5) and we use a longer horizon to look at the impact in the long-run (5 years) rather than in the short/medium-run. We expect this variable to have a positive impact in the long-run as previously shown by the panel ECM. We keep the structure limited to 6 variables, because of data limitation and we decide to use SOVCISS to proxy also for fiscal and debt issues related to the sovereign debt crisis. In the ordering in Cholesky this goes after a change in the SOVCISS indicator of sovereign stress, as it could respond to a change in it.[32] The competitiveness could be then affected also by a change in the EURII via its impact in the exchange rates.

$$Y_t = (short\ term\ i_t, loans\ to\ NFC_t\ ,\ sovciss_t\ , eurii_t,\ reer\ growth_t\ ,\ GDP\ growth_t)' \quad (5)$$

We will describe only the impulse responses to each shock for GDP growth, which is the main goal of this paper. If we do not add the institutional factor, in the long-run the effects on growth are non-significant in most of the cases, giving another reason why it is important to include such reforms in an analysis of growth.[33] The horizon is set then at 2 years, to look at the medium horizon for Figure 2, which follows the IRFs to equation (4). We also use CISS instead in a further check (Figure 3). Lastly, Figure 4 has also EURII, the institutional index among the variables, as described in equation (5), and the horizon is 5 years.

[Insert Figures 2-4 around here]

In all the above-mentioned specifications, the impact of REER on growth is negative as expected, i.e. an increase in competitiveness is indeed a boost for growth in the euro area and it has a very persistent effect over time, in line with the outcomes in Comunale (2017a). An increase in sovereign stress (Figure 2) can bring a decrement in growth but this negative impact is even bigger in magnitude in case of an increase in systemic stress (Figure 3) or when institutional changes are considered (Figure 4).

Monetary policy – including both standard and non-standard measures -- affect growth contemporaneously in the baseline identification in equation (5). The effect at impact is indeed negative as expected, becoming insignificant or very small and positive after 1 year and a half. The effect is negligible in case of other setups without the EURII institutional index and CISS (Figure 3). We made a further check having instead interest rates reacting to change in GDP growth at time t and with GDP growth as the most exogenous variable. Monetary policy is set endogenously: when GDP

[31] The channels through which government debt has been found to have an impact on the economic growth rate are: (i) private saving; (ii) public investment; (iii) total factor productivity (TFP) and (iv) sovereign long-term nominal and real interest rates. From a policy perspective, the results in Checherita-Westphal, and Rother (2010) provide additional arguments for debt reduction to support longer-term economic growth prospects.

[32] The IRFs of growth by using only debt over GDP without SOVCISS are not significant for any of the variables. However the path is comparable with the other specification in equation (5) and sensitivity analysis.

[33] The results for the 5 years horizon for the specification in equation (4) are available on request.

rises, interest are set to go up. The rate indeed react positively at a change in growth and institutional changes still have a positive impact.

The institutional index EURII in the baseline setup at equation (5) has a negative impact on growth only in the short run (up to 1 year), while in the long run is always positive and significant. This is consistent with our results in the panel ECM section (see Table 1). We also provide a sensitivity analysis for the specification with EURII (Figure 4) in which the order of variables in Cholesky starts with an excessive credit and then monetary policy, sovereign stress and institutional changes react. The results are robust: institutional changes always matter in the long-run and support GDP growth. If we start from SOVCISS instead, in case we want to start the process from the sovereign debt weakness perspective, the results are confirmed once again and institutional reforms do matter.[34]

Lastly, as for the panel ECM, we add as a further determinant, a measure of global GDP growth.[35] This is also to look at a foreign/global push factor which may affect growth in our countries of interest. This variable is taken as exogenous first, claiming that single euro area countries count only for a minor part of global GDP,[36] and then we use it as an endogenous variable. In the latter case global GDP growth is, among the variables, the most exogenous one in the identification (see equation (5)). In these checks, the results are very robust with respect to the previous ones in Table 4. In the latter robustness check, it is worth noting that an increase in global GDP could bring in the medium-long run positive effects in euro area member states. One of the possible channels is via an increase in domestic demand for European products and services.

7.3.1. Country by country VAR

Ultimately, we want to look and account for all the country-specific information we have from each of the 9 countries and we apply our VAR identification with EURII index (as in equation (5)) country by country.[37] The lags in this case are specifically selected by SBIC criteria and normally are one or two depending on the considered country (see footnote 16). We focus here first on the impact of a positive shock in institutional EU reforms on GDP growth. In case of Germany, Italy, the Netherlands and France the impact is negative in the short-run then it becomes positive later on starting at around 3 years from the impact and it lasts for 2-3 years. For Belgium and Luxembourg we do not see almost any effect of EURII changes on GDP growth.[38] For Finland the response of growth to a positive shock in EU institution reforms is only positive in the short-run then turns mainly negative in the medium-run and not significant after 2 years from the shock. Interestingly in Spain and Portugal, we don't see any negative impact in the short-run of the institutional EU index and the long-run positive impact is bigger in magnitude and way more persistent over time. Overall, in the countries that we call periphery the impact of EU institutional changes is positive and it is so especially in the medium-long run.

[34] The results for the sensitivity checks are available on request.
[35] This variable can also be seen as a very simple proxy for the global real cycle.
[36] Therefore we have a panel VARX model.
[37] This has been done with the *caveat* that for each country we have a maximum of around 60 observations. We applied small-sample degrees-of-freedom adjustments. The results are available on request for all the considered shocks on GDP growth.
[38] It is only slightly positive in the very short-run (up to 1 year from impact).

Another important factor, which is robust in affecting growth over our specifications, is REER growth, i.e. the competitiveness component. We then look at the country-specific impulse responses of growth to a shock in REER. A positive shock in REER means an increase in this rate and so a decrease in competitiveness and we expect a negative sign in the impulse responses. The response of growth behaves exactly like this in the medium-long run in case of Italy and Spain and in the short-run for Luxembourg and Portugal. Only in the Netherlands the effect is basically the opposite, while for the other countries it is not significant. Summing up, in a country specific setup, the impact of competitiveness is less as a clear cut.

Then, we also look at impact of a positive shock to SOVCISS or to loans to NFCs on growth in each euro area member state. The first one is expected to be negative overall being SOVCISS a measure of sovereign stress. SOVCISS has indeed a big and persistent negative effect on growth in the periphery. This is also true for the Netherlands and in the short-run in Finland and Luxembourg. An increase in loans to NFCs could help growth if the resources are better allocated to more productive sectors and industries, while it could be even reducing growth otherwise (Hassan et al., 2017). As for a shock in loans to NFCs, this has a very positive impact in both short and long run only in case of Germany, while for France, Italy, Spain, and surprisingly in the Netherlands and Finland, is very negative and persistent.

Lastly, global GDP growth has a positive impact for most of the countries (exceptions are Spain and the Netherlands); however the timing seems to be different across countries. For Germany an increase in global GDP growth has a significant effect up to 1 year, while for Belgium, France, Italy, Portugal and Finland the impact is in a more medium run perspective.

8. Final remarks

Over the last three decades, euro area countries have experienced profound economic, financial and institutional changes, plus diverse shocks. Growth has been very volatile, and almost missing, in some countries. In this study we have assembled a rich panel to find which factors played a more important role in stirring growth, and/or reducing it in the short- versus long-term and pre- versus post crisis.

After excluding several variables with no bearing on growth, we apply a series of time series techniques for large panels of heterogeneous data. Our main findings are that institutional reforms support long-run growth for all countries, and in particular, in the periphery. This finding is robust across specifications and setups. We also find that an improvement in competitiveness matters for growth in the long-run. A decline in systemic stress is also associated with growth. An increase in global GDP is also positive for growth, generally in the medium-run.

How about public finance impact on growth? The debt over GDP influences negatively growth for the periphery but only in the short-run. This is less clear by using the VARs and it is in line with the lack of consensus in the literature about the impact of public debt on economic growth. Surprisingly, the deficit plays no role. Instead, higher sovereign stress is associated with lower growth. How about monetary policy? Prior to the zero lower bound, higher monetary policy rates

are associated with growth. This relations turns past the ZLB and when using the shadow rate that capture exceptional standard and non-standard monetary policies. How about the financial cycle? The equity price cycle affects positively GDP growth only pre-crisis and only in the very short-run, while the loans to NFCs had a positive impact for core euro area and especially for Germany.

Our results need to be seen as preliminary. Correlations and associations are no-causations. Evidence in this paper needs to be corroborated by model-based analysis. We cover a very intense and mutating period in European economic, financial, monetary and institutional history. For some of the countries in the sample there were switches in policy regimes. Thus, much remains to be done in future research. In the econometrics, a possible further contribution may include the use of a Global VAR. For the factors, the role of EU funds could also be taken into account. This possible determinant is here not included yet because of a (still) limited availability in its time-dimension. Similarly it is for the new euro area governance and the SSM.

Bibliography

Abrigo, M.R.M. and I. Love, (2015), “Estimation of panel vector autoregression in Stata: A package of programs”, University of Hawai`i at Manoa (USA), working paper.

Aikman, D., A. G. Haldane and B. D. Nelson (2015). "Curbing the credit cycle", *The Economic Journal* 125: 1072-1109.

Aixala, J. and Fabro, G. (2008), “Does the impact of institutional quality on economic growth depend on initial income level?”, *Economic Affairs*, Vol. 28, No 3, pp. 45-49.

Alcidi C., J. Núñez Ferrer, M. Di Salvo, R.Musmeci, and M. Pilati (2018) “Income Convergence in the EU: A tale of two speeds”. CEPS Comments, January.

Arbia, G., Battisti, M. and Di Vaio, G. (2010), “Institutions and Geography: Empirical Test of Spatial Growth Models for European Regions”, *Economic Modelling*, Vol. 27, No 1, January, pp. 12-21.

Balassa, B. (1964), “The Purchasing Power Parity Doctrine: A Reappraisal”, *Journal of Political Economy*, Vol. 72, No 6, pp. 584-596.

Barro, R.J. and Sala-i-Martin, X. (1991), “Convergence across states and regions”, *Brooking Papers on Economic Activity*, Vol. 22, pp. 107-182.

Barro, R.J. and Sala-i-Martin, X. (1992), “Convergence”, *Journal of Political Economy*, Vol. 100, No 2, pp. 223-251.

Baumol, W.J. and Wolff, E.N. (1988), “Productivity Growth, Convergence, and Welfare: Reply”, *American Economic Review*, Vol. 78, No 5, pp. 1155-1159.

Borio, C., Disyatat, P. and Juselius, M. (2017), “Rethinking potential output: Embedding information about the financial cycle”, *Oxford Economic Papers*, Vol. 69, No 3, July, pp. 655-677.

Boyle, G.E. and McCarthy, T.G. (1997), “A simple measure of β-convergence”, *Oxford Bulletin of Economics and Statistics*, Vol. 59, No 2, pp. 257-264.

Buti, M. and Turrini, A. (2015), “Three waves of convergence. Can Eurozone countries start growing together again?”, *Vox.EU*, 17 April.

Checherita-Westphal, C. & Rother, P., (2010)."The impact of high and growing government debt on economic growth: an empirical investigation for the euro area," Working Paper Series 1237, European Central Bank.

Christiano, L. and Fitzgerald, T.J. (2003) "The band-pass filter", *International Economic Review*, 44, 435-65.

Canova, F. and M. Ciccarelli, (2013), “Panel Vector Autoregressive Models: A Survey” in VAR Models in Macroeconomics – New Developments and Applications: Essays in Honor of Christopher A. Sims. 2013, 205-246

Comunale, M. and J. Striaukas, (2017). "Unconventional monetary policy: interest rates and low inflation. A review of literature and methods", Centre for Applied Macroeconomic Analysis (CAMA), Australian National University, WP series 29/2017.

Comunale, M. (2017a), “Dutch disease, real effective exchange rate misalignments and their effect on GDP growth in EU”, *Journal of International Money and Finance*, Volume 73, Part B, May 2017, Pages 350-370

Comunale, M., (2017b), “Synchronicity of Real and Financial Cycles and Structural Characteristics in EU Countries”. CEIS Working Paper No. 414.

Crespo Cuaresma, J., Ritzberger-Grünwald, D. and Silgoner, M.A. (2008), “Growth convergence and EU membership”, *Applied Economics*, Vol. 40, No 5, pp. 643-656.

Cristina, F. and Garcia Perea, P. (2015), “The impact of the euro on euro area GDP per capita”, Banco de España Working Paper No 1530.

De Luca, G. & J. R. Magnus, (2011). "Bayesian model averaging and weighted-average least squares: Equivariance, stability, and numerical issues," *Stata Journal*, StataCorp LP, vol. 11(4), pages 518-544, December.

Diaz del Hoyo, JL, E.Dorrucci, F. Ferdinand Heinz, and S. Muzikarova (2017) “Real convergence in the euro area: a long-term perspective”, *Occasional Paper Series*, No 203, ECB.

Dorrucci, E., Ioannou, D., Mongelli, F. and Terzi, A. (2015), “The four unions ‘PIE’ on the Monetary Union ‘CHERRY’: A new index of European Institutional Integration”, *Occasional Paper Series*, No 160, ECB.

Drehmann, M., C. Borio and K. Tsatsaronis (2012). "Characterising the financial cycle: don’t lose sight of the medium term!", Bank for International Settlements, Working Paper No. 380.

ECB (2018), WGEM team on Real and Financial Cycles. “Real and financial cycles in EU countries: Stylised facts and modelling implications”. *ECB Occasional Paper Series* No. 205

ECB (2017a), “The importance of firm heterogeneity for competitiveness in the European Union”, *Economic Bulletin*, Issue 2, March.

ECB (2017b), “The slowdown in euro area productivity since the crisis in a global context”, *Economic Bulletin*, Issue 3, May.

ECB (2016), “Increasing resilience and long-term growth: the importance of sound institutions and economic structures for euro area countries and EMU”, *Economic Bulletin*, Issue 5, pp. 76-96.

ECB (2015a), “Real convergence in the euro area: evidence, theory and policy implications”, *Economic Bulletin*, Issue 5, pp. 30-45.

ECB (2015b), “Progress with structural reforms across the euro area and their possible impacts”, *Economic Bulletin*, Issue 2, pp. 59-71.

ECB (2007), “Determinants of growth in the EU Member States of Central and Eastern Europe”, *Monthly Bulletin*, May.

Edwards, S., (2000). “Exchange Rates in Emerging Economies: What do We Know? What do We Need to Know?” *In A. Krueger, ed., Economic Policy Reform: The Second Stage. London: University of Chicago Press*.

European Commission (2014), “The drivers of total factor productivity in catching-up economies”, *Quarterly report on the euro area*, Vol. 13, No 1, April, pp. 7-19.

European Commission (2013), “Catching-up processes in the euro area”, *Quarterly report on the euro area*, Vol. 12, No 1, March, pp. 7-18.

Gala, P. and Lucinda, C. R. (2006), “Exchange Rate Misalignment and Growth: Old and New Econometric Evidence”. *Revista Economia*, p.165-87.

Garcia-de-Andoain, C. & Kremer, M. (2017). “Beyond spreads: Measuring sovereign market stress in the euro area”, *Economics Letters*, Volume 159, October 2017, Pages 153-156

Gómez-Puig, M. and Sosvilla-Rivero, S., (2016). “Debt-Growth Linkages in EMU Across Countries and Time Horizons”, Instituto Complutense de Estudios Internacionales, Universidad Complutense de Madrid, WP 02/16.

Han, X., Khan, H. and Zhuang, J. (2014), “Do governance indicators explain development performance? A cross-country analysis”, *Economics Working Paper Series*, No 417, Asian Development Bank.

Hassan, F., di Mauro, F. & Ottaviano, G. I.P. (2017)."Banks credit and productivity growth," Working Paper Series 2008, European Central Bank.

Holló, D. & Kremer, M. & Lo Duca, M. (2012). "CISS - a composite indicator of systemic stress in the financial system," Working Paper Series 1426, European Central Bank.

IMF (2017), “Real income convergence in the euro area”, Euro Area Policies, Selected Issues, *IMF Country Report*, No 17/236, pp. 4-14.

Ivanov V. & Kilian L., (2005)."A Practitioner's Guide to Lag Order Selection For VAR Impulse Response Analysis," *Studies in Nonlinear Dynamics & Econometrics*, De Gruyter, vol. 9(1), pages 1-36, March.

Kempa, B. and N. S. Khan, (2017), “Spillover effects of debt and growth in the euro area: Evidence from a GVAR model”, *International Review of Economics & Finance*, Volume 49, May 2017, Pages 102-111

Magnus, J.R., O. Powell, and P. Präufer. (2010). A Comparison of Two Model Averaging Techniques with an Application to Growth Empirics. *Journal of Econometrics*, 154: 139{153.

Magnus, J. R., and De Luca, G. (2016). “Weighted-average least squares (WALS): A survey”. *Journal of Economic Surveys* 30: 117{148.

Masanjala, W., and C. Papageorgiou. (2008). “Rough and Lonely Road to Prosperity: A Reexamination of the Sources of Growth in Africa Using Bayesian Model Averaging”. *Journal of Applied Econometrics*, 23: 671{682.

Mauro, P. (1995), “Corruption and growth”, *Quarterly Journal of Economics*, Vol. 110, No 3, pp. 681-712.

Mika, A. & Zumer, T., (2017)."Indebtedness in the EU: a drag or a catalyst for growth?,"Working Paper Series 2118, European Central Bank.

Milano, V. and Reichlin, P. (2017), “Risk sharing across the euro area: The role of public institutions”, *Vox.EU*, 23 January.

Mink, M., Jacobs, J.P.A.M. and de Haan, J., (2012), "Measuring coherence of output gaps with an application to the euro area," *Oxford Economic Papers*, Oxford University Press, vol. 64(2), pages 217-236, April.

Owoundi, F., (2016). "Do exchange rate misalignments really affect economic growth? The case of Sub-Saharan African countries," *International Economics*, Elsevier, vol. 145(C), pages 92-110.

Panizza, H., and Presbitero, A. F. (2013). "Public debt and economic growth in advanced economies: A survey". *Swiss Journal of Economics and Statistics*, 149, 175–204.

Panizza, H., and Presbitero, A. F. (2014). "Public debt and economic growth: Is there a causal effect?", *Journal of Macroeconomics*, 41, 21–41.

Papadia, F., (2017). "Italian economic growth and the Euro", Bruegel Blog post, July 26, 2017. http://bruegel.org/2017/07/italian-economic-growth-and-the-euro/

Pesaran, M. H., (2003), "A Simple Panel Unit Root Test in the Presence of Cross Section Dependence", CambridgeWorking Papers in Economics 0346, Faculty of Economics (DAE), University of Cambridge.

Pesaran, M. H., (2004) "General Diagnostic Tests for Cross Section Dependence in Panels" CESifo Working Paper Series No. 1229; IZA Discussion Paper No. 1240.

Raftery, A.E. (1995). "Bayesian Model Selection in Social Research". *Sociological Methodology* 25: 111{163.

Rodrik, D. (2008), "The Real Exchange Rate and Economic Growth," *Brookings Papers on Economic Activity*, Fall 2008.

Solberger, M. (2011)."Demeaning the data in panel-cointegration models to control for cross-sectional dependencies".*Economics Letters*, 110(3), 252-254.

Sondermann, D. (2012), "Productivity in the euro area: any evidence of convergence?", *Working Paper Series*, No 1431, ECB, April.

Solow, R. (1956), "A contribution to the theory of economic growth", *Quarterly Journal of Economics*, Vol. 70, No 1, pp. 65-94.

Westerlund, J. (2007). "Testing for error correction in panel data". *Oxford Bulletin of Economics and Statistics*, 69(6), 709-748.

Wu, J. C. and Xia, F. D., (2016). "Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound ", *Journal of Money, Credit and Banking*, Vol. 48, No. 2-3 (March-April 2016)

Annex: Tables and figures

Table 1: Baseline results with WALS and BMA selection

	WALS baseline				BMA baseline			
	dfe		mg		dfe		mg	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	ec	SR	ec	SR	ec	SR	ec	SR
short-run								
ec		-0.342***		-0.501***		-0.342***		-0.493***
		(0.0293)		(0.0521)		(0.0292)		(0.0534)
D.EURII		0.347***		0.0585		0.352***		0.0751
		(0.103)		(0.141)		(0.103)		(0.140)
D.debt/GDP		-0.0511*		-0.0691**		-0.0490*		-0.0712**
		(0.0267)		(0.0323)		(0.0267)		(0.0280)
D.ciss		0.0206**		0.0285		0.0213**		0.0328
		(0.00838)		(0.0206)		(0.00835)		(0.0214)
D.sovciss		0.0252***		0.0414***		0.0245***		0.0373***
		(0.00894)		(0.0116)		(0.00893)		(0.00954)
D.reergr		0.0238		0.0884		0.0256		0.0838
		(0.0426)		(0.0963)		(0.0425)		(0.0968)
D.ST rates		0.329**		0.0575		0.341**		0.0419
		(0.151)		(0.163)		(0.151)		(0.193)
D.eqp_cycle		0.0607***		0.0612		0.0612***		0.0595
		(0.0113)		(0.0463)		(0.0113)		(0.0428)
D.rpp_cycle		0.0306		0.413*		0.0333		0.361
		(0.0562)		(0.226)		(0.0560)		(0.222)
D.lnf_cycle		-0.0259		-0.108		-0.0141		-0.111
		(0.0538)		(0.307)		(0.0533)		(0.317)
D.ltn_lhh		0.000387		2.73e-05				
		(0.000739)		(0.000837)				
Constant		-0.0447**		-0.137**		-0.0415**		-0.147**
		(0.0201)		(0.0662)		(0.0200)		(0.0733)

long-run								
EURII	0.209**		0.523***		0.194**		0.528***	
	(0.0826)		(0.121)		(0.0823)		(0.135)	
Debt/GDP	0.0134		-0.0391		0.0133		-0.0249	
	(0.0175)		(0.0810)		(0.0175)		(0.0747)	
ciss	-0.0321**		-0.0703		-0.0354**		-0.0761	
	(0.0160)		(0.0497)		(0.0158)		(0.0507)	
sovciss	-0.0360***		-0.0378		-0.0343***		-0.0280	
	(0.0124)		(0.0422)		(0.0123)		(0.0467)	
reergr	-0.603***		-0.509***		-0.615***		-0.473***	
	(0.184)		(0.121)		(0.183)		(0.116)	
ST rates	0.945***		1.098**		0.918***		1.092**	
	(0.261)		(0.446)		(0.260)		(0.481)	
eqp_cycle	-0.00719		-0.0114		-0.00750		-0.0129	
	(0.00961)		(0.0176)		(0.00961)		(0.0190)	
rpp_cycle	0.0533**		0.160		0.0448*		0.103	
	(0.0247)		(0.223)		(0.0241)		(0.203)	
lnf_cycle	-0.0639*		0.239*		-0.0569		0.282*	
	(0.0361)		(0.133)		(0.0358)		(0.145)	
ltn_lhh	-0.00257		-0.00243					
	(0.00161)		(0.00196)					
Observations	535	535	535	535	535	535	535	535

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: dfe is the estimator for homogeneous coefficients, while mg stands for the heterogeneous setup. The latter is our preferred estimator and shaded in grey. The cycles are based on data from real GDP (YER), equity price indices (EQP), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), nominal long-term rates (LTN). The synchronicities are based on cycle's pairs. EURII is the European Index of Regional Institutional Integration.

Table 2: Baseline results with WALS and BMA selection for core and periphery

	core		periphery		core		periphery	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	ec	SR	ec	SR	ec	SR	ec	SR
short run								
ec		-0.581***		-0.341***		-0.564***		-0.352***
		(0.0496)		(0.0341)		(0.0602)		(0.0356)
D.EURII		0.0889		-0.00235		0.108		0.00966
		(0.216)		(0.0378)		(0.215)		(0.0231)
D.debt/GDP		-0.0770		-0.0532*		-0.0787*		-0.0561**
		(0.0481)		(0.0274)		(0.0412)		(0.0268)
D.ciss		0.0375		0.0107***		0.0449		0.00876***
		(0.0311)		(0.00132)		(0.0318)		(0.00155)
D.sovciss		0.0485***		0.0272***		0.0411***		0.0297***
		(0.0171)		(0.00245)		(0.0144)		(0.00278)
D.reergr		0.140		-0.0152		0.130		-0.00889
		(0.134)		(0.116)		(0.137)		(0.112)
D.ST rates		0.0677		0.0371		0.0283		0.0689
		(0.244)		(0.146)		(0.284)		(0.207)
D.eqp_cycle		0.0690		0.0455		0.0715		0.0355
		(0.0699)		(0.0333)		(0.0648)		(0.0241)
D.rpp_cycle		0.452		0.336		0.344		0.395*
		(0.334)		(0.231)		(0.329)		(0.229)
D.lnf_cycle		0.0775		-0.479		0.0589		-0.452
		(0.378)		(0.558)		(0.413)		(0.517)
D.ltn_lhh		0.000356		-0.000630				
		(0.00117)		(0.00112)				
Constant		-0.145		-0.123**		-0.155		-0.133**
		(0.0998)		(0.0508)		(0.111)		(0.0569)
long run								
EURII	0.442***		0.684**		0.428***		0.728**	
	(0.115)		(0.300)		(0.126)		(0.333)	
Debt/GDP	-0.0509		-0.0155		-0.0281		-0.0184	
	(0.123)		(0.0488)		(0.114)		(0.0390)	

ciss	-0.0619		-0.0870***		-0.0760		-0.0763***	
	(0.0758)		(0.0254)		(0.0777)		(0.0237)	
sovciss	-0.00382		-0.106*		0.0138		-0.112*	
	(0.0537)		(0.0588)		(0.0581)		(0.0631)	
reergr	-0.431***		-0.665***		-0.385***		-0.649***	
	(0.136)		(0.254)		(0.141)		(0.196)	
ST rates	1.072*		1.150**		1.042		1.192**	
	(0.642)		(0.569)		(0.712)		(0.486)	
eqp_cycle	-0.00976		-0.0147		-0.00615		-0.0265	
	(0.0219)		(0.0364)		(0.0242)		(0.0359)	
rpp_cycle	0.166		0.148		0.0867		0.135	
	(0.340)		(0.127)		(0.311)		(0.107)	
lnf_cycle	0.255**		0.209		0.303**		0.239	
	(0.112)		(0.384)		(0.131)		(0.405)	
ltn_lhh	-0.00417*		0.00104					
	(0.00222)		(0.00348)					
Observations	357	357	178	178	357	357	178	178

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The cycles are based on data from real GDP (YER), equity price indices (EQP), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), nominal long-term rates (LTN). The synchronicities are based on cycle's pairs. EURII is the European Index of Regional Institutional Integration.

Table 3: Baseline results with data until 2010Q1

VARIABLES	(1) ec	(2) SR	(3) ec	(4) SR
short run				
ec		-0.692***		-0.628***
		(0.0868)		(0.0740)
D.EURII		-0.763***		-0.606***
		(0.264)		(0.235)
D.debt/GDP		-0.249*		-0.236*
		(0.134)		(0.134)
D.ciss		0.0217		0.0381*
		(0.0215)		(0.0205)
D.sovciss		0.0220		0.0328*
		(0.0356)		(0.0194)
D.reergr		0.203		0.155
		(0.131)		(0.132)
D.ST rates		-0.804***		-0.439*
		(0.213)		(0.234)
D.eqp_cycle		0.308**		0.119*
		(0.146)		(0.0615)
D.rpp_cycle		0.219		0.864**
		(0.591)		(0.431)
D.lnf_cycle		-0.275		-0.0613
		(0.555)		(0.566)
D.ltn_lhh		0.00145		
		(0.000968)		
Constant		-0.422***		-0.381**
		(0.160)		(0.152)
long run				
EURII	0.983***		0.861***	
	(0.270)		(0.302)	
Debt/GDP	0.124		0.141	
	(0.115)		(0.162)	
ciss	-0.0839		-0.109	
	(0.0673)		(0.0668)	
sovciss	0.0920		0.0417	
	(0.0946)		(0.0474)	
reergr	-0.658***		-0.534***	
	(0.222)		(0.205)	
ST rates	2.184***		1.555***	
	(0.809)		(0.536)	
eqp_cycle	0.00745		-0.0216	
	(0.0348)		(0.0422)	
rpp_cycle	-0.226		0.0853	
	(0.527)		(0.289)	
lnf_cycle	0.334		0.602**	
	(0.233)		(0.253)	
ltn_lhh	-0.00688			
	(0.00492)			
Observations	333	333	333	333

Note: The cycles are based on data from real GDP (YER), equity price indices (EQP), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), nominal long-term rates (LTN). The synchronicities are based on cycle's pairs. EURII is the European Index of Regional Institutional Integration.

Figure 1: GDP growth and EONIA/shadow rates (level and change) for the aggregate euro area between 1999 and 2017

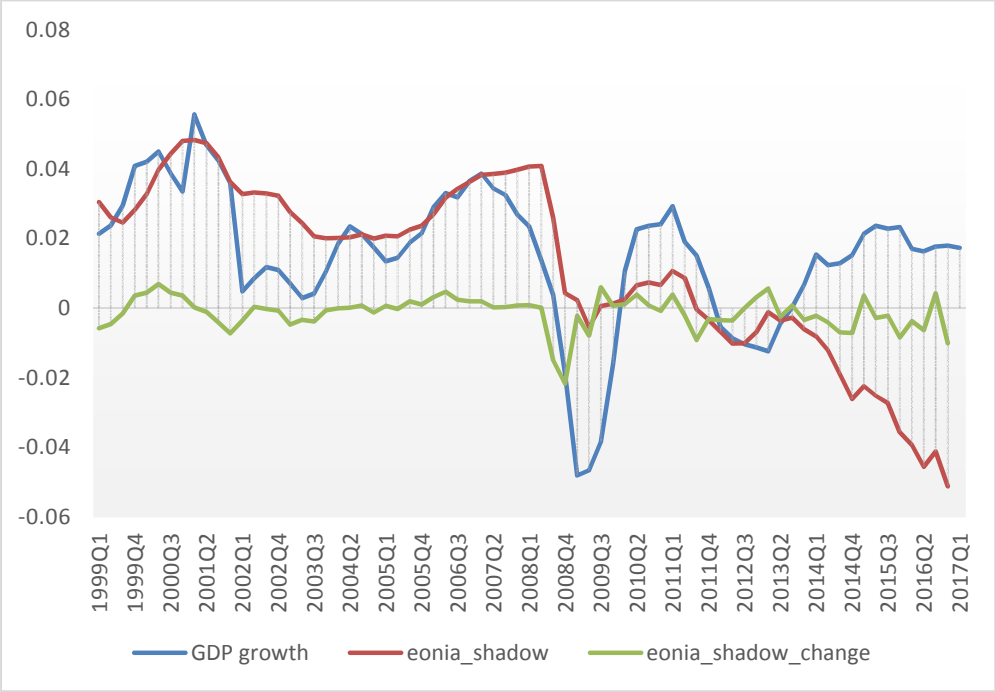


Figure 2: IRFs with SOVCISS

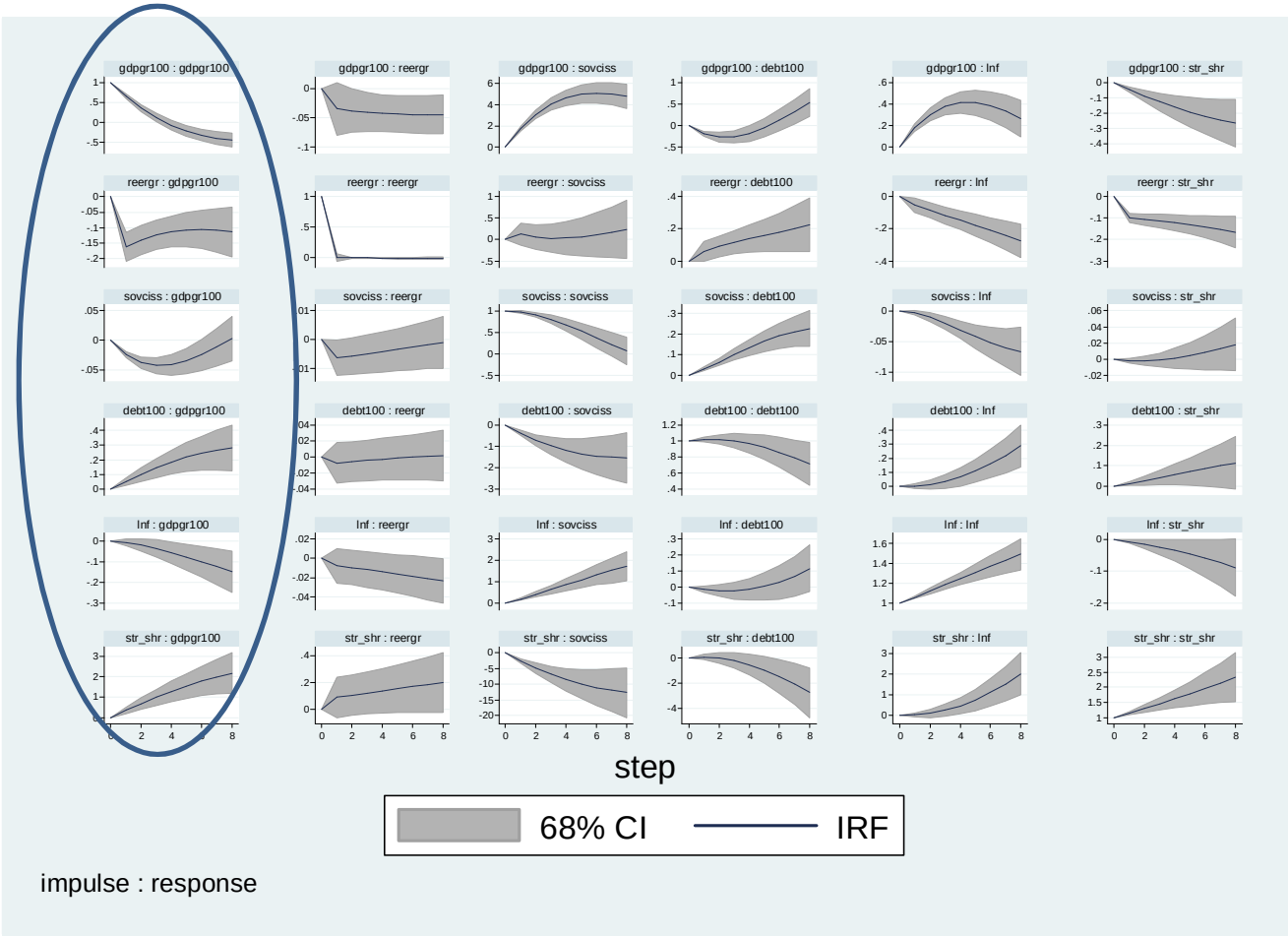


Figure 3: IRFs with CISS

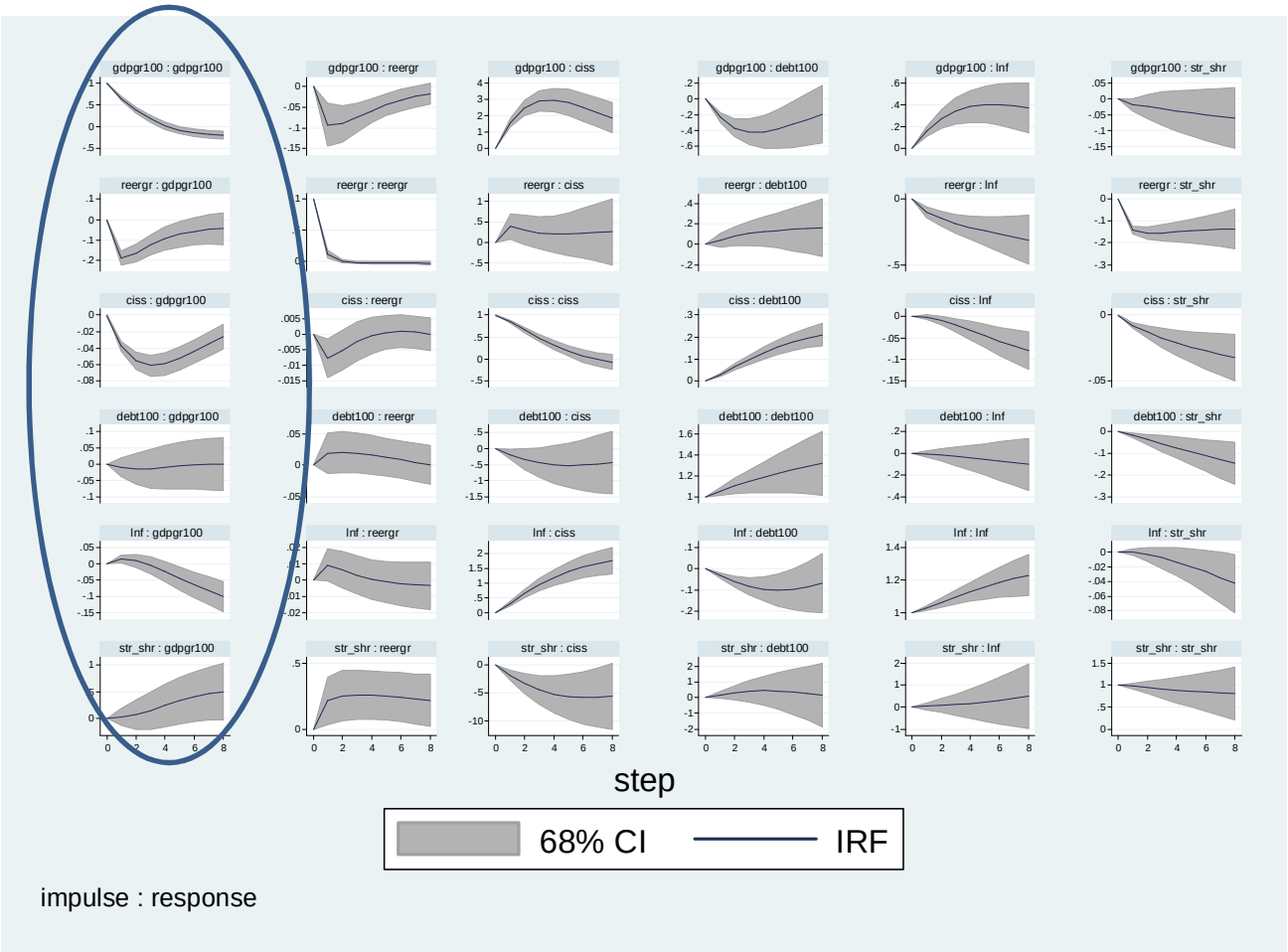
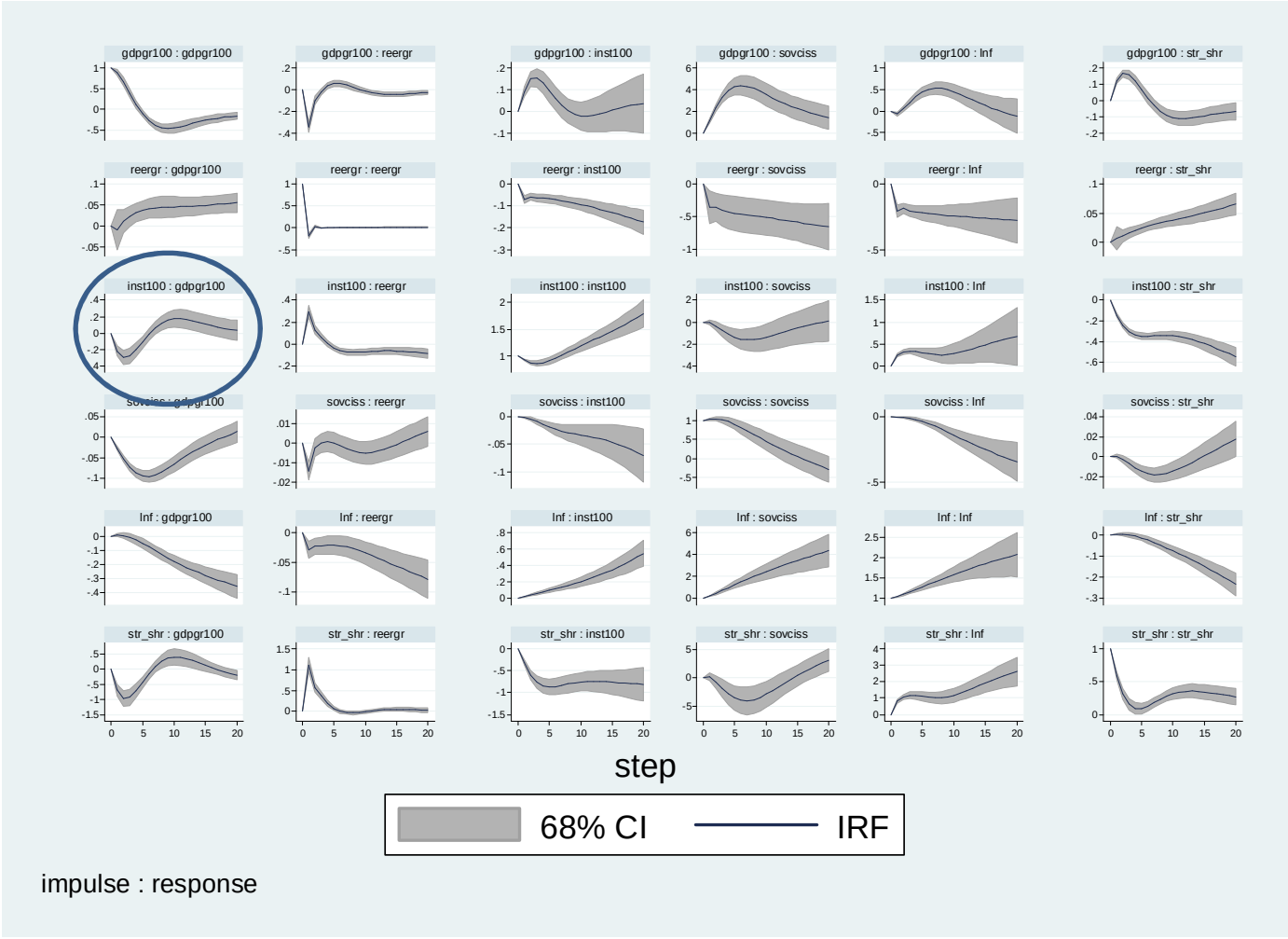


Figure 4: IRFs with EURII



Appendix:

A.1. Data description and sources

Variable	Description	Source
dependent variable:		
gdpgr	real GDP growth	ESCB WGEM team, IMF IFS
regressors:		
cycles:		
yer_ cycle	business cycle, from real GDP	ESCB WGEM team, ECB SDW
ltn_cycle	cycle nominal long-term rates	ESCB WGEM team, ECB SDW
eqp_cycle	cycle equity price indices	ESCB WGEM team, ECB SDW
lhh_cycle	cycle real credit to households	ESCB WGEM team, BIS and national sources
lnf_cycle	cycle real credit to non-financial corporations	ESCB WGEM team, BIS and national sources
rpp_cycle	cycle property prices	ESCB WGEM team, BIS and national sources
tcn_cycle	cycle real total credit to private non-financial sector	ESCB WGEM team, BIS and national sources
synchronicity measures:		
ltn_lhh	synchronisation cycle nominal long-term rates and real credit to households	Comunale (2017b)
all the cycles combinations	cycles pairs (dummy equal 1 when same sign)	Comunale (2017b)
real variables:		
Fiscal deficit	seasonally adjusted fiscal deficit	Eurostat
Debt/GDP	debt over GDP	Eurostat
reergr	growth rate of the REER vis-à-vis 41 partners and deflated by CPI	Eurostat

monetary factors:		
eonia_shadow	Monthly data --> averaged to quarterly From 2004Q4 shadow rates from Wu and Xia for EA only. When ZLB not binding=EONIA	Eonia (ECB SDW) Shadow rates (Wu and Xia, updated)
ST rates	pre-1992 country-specific short term interest rates, then EONIA and shadow rates	short-term rates from LIFT report
institutional factors:		
EURII	European Index of Regional Institutional Integration	Dorrucci et al. (2015) updated
sovereign and systemic stress:		
ciss	Composite Indicator of Systemic Stress - Daily data --> averaged to quarterly	ECB SDW
sovciss	Composite Indicator of Sovereign Stress (SovCISS)	ECB SDW

A.2. Selection of variables: WALS

	(t)	(t)
L.GDP growth	20.45	
Fiscal deficit	-0.91	0.79
Debt/GDP	-3.73	-6.64
REER growth	-5.52	-5.32
ciss	-5.49	-2.39
sovciss	-1.99	-3.83
ST rates	2.11	7.34
EURII institutional index	2.33	8.15
eqp_cycle	1.66	1.30
ltn_cycle	-0.59	-1.05
yer_cycle	0.31	3.62
lhh_cycle	0.88	-0.83
lnf_cycle	-2.04	-4.33
rpp_cycle	2.23	3.82
tcn_cycle	-1.19	-2.18
Synchronicities		
eqp_ltn	0.69	0.85
eqp_yer	-1.02	-3.69
eqp_lhh	0.61	0.86
eqp_lnf	-0.39	0.53
eqp_rpp	0.58	-0.7
eqp_tcn	0.96	1.21
ltn_yer	0.69	0.97
ltn_lhh	-1.76	-1.02
ltn_lnf	1.62	-0.02
ltn_rpp	-0.13	-0.86
ltn_tcn	0.15	1.42
yer_lhh	0.31	-0.03
yer_lnf	-0.19	0.73
yer_rpp	-0.19	0.7
yer_tcn	-1.44	-1.61
lhh_lnf	-0.53	0.01
lhh_rpp	0.3	0.72
lhh_tcn	-0.39	-1.91
lnf_rpp	1.39	0.27
lnf_tcn	0.47	0.78
rpp_tcn	0.89	1.65

Note: the more restrictive inclusion rule is: abs(t)>1.5 (dark green). In the literature is normally as abs(t)>1 (light green). The cycles are based on data from real GDP (YER), equity price indices (EQP), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), nominal long-term rates (LTN). The synchronicities are based on cycle's pairs.

A.3. Selection of variables: BMA

	pip	pip	pip	pip	pip	pip	pip
L.GDP growth	1.0		1.0		1.0	1.0	
Fiscal deficit	0.1	0.1	0.1	0.7	0.1	0.1	0.1
Debt/GDP	0.9	1.0	0.8	1.0	0.8	0.9	1.0
REER growth	1.0	1.0	1.0	1.0	1.0	1.0	1.0
ciss	1.0	1.0	1.0	1.0	1.0	1.0	1.0
sovciss	0.2	1.0	0.3	1.0	0.3	0.2	1.0
ST rates	0.1	1.0	0.3	1.0	0.3	0.1	1.0
EURII institutional index	0.1	1.0	0.1	1.0	0.1	0.1	1.0
eqp_cycle	0.8	0.1				0.8	0.1
ltn_cycle	0.1	0.2				0.1	0.2
yer_cycle	0.1	1.0				0.1	1.0
lhh_cycle	0.1	0.1				0.1	0.1
lnf_cycle	0.1	1.0				0.1	1.0
rpp_cycle	0.2	1.0				0.2	1.0
tcn_cycle	0.1	0.1				0.1	0.1
Synchronicities							
eqp_yer			0.1	1.0			
ltn_yer			0.1	0.1			
yer_lhh			0.1	0.1			
yer_lnf			0.0	0.6			
yer_rpp			0.0	0.1			
yer_tcn			0.0	0.1			
ltn_lhh					0.1	0.1	0.0
ltn_lnf					0.1	0.1	0.1

Note: If the posterior inclusion probability (pip) is exactly equal to one, the regressor needs to be included by probability one (dark green). A less restrictive rule of ours takes pip>0.8. The cycles are based on data from real GDP (YER), equity price indices (EQP), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), nominal long-term rates (LTN). The synchronicities are based on cycle's pairs.

A.4. Comparison and selection of baseline

	BMA		WALS	
	pip	pip	(t)	(t)
L.GDP growth	1.0		20.45	
Fiscal deficit	0.1	0.1	-0.91	0.79
Debt/GDP	0.9	1.0	-3.73	-6.64
REER growth	1.0	1.0	-5.52	-5.32
ciss	1.0	1.0	-5.49	-2.39
sovciss	0.2	1.0	-1.99	-3.83
ST rates	0.1	1.0	2.11	7.34
EURII institutional index	0.1	1.0	2.33	8.15
eqp_cycle	0.8	0.1	1.66	1.30
ltn_cycle	0.1	0.2	-0.59	-1.05
yer_cycle	0.1	1.0	0.31	3.62
lhh_cycle	0.1	0.1	0.88	-0.83
lnf_cycle	0.1	1.0	-2.04	-4.33
rpp_cycle	0.2	1.0	2.23	3.82
tcn_cycle	0.1	0.1	-1.19	-2.18
ltn_lhh	0.1	0.0	-1.76	-1.02
ltn_lnf	0.1	0.1	1.62	-0.02

Note: The cycles are based on data from real GDP (YER), equity price indices (EQP), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), nominal long-term rates (LTN). The synchronicities are based on cycle's pairs.

A.5. Unit root test in case of CSD - CIPS/CADF 2nd generation test

Variables	Z[t-bar]	P-value
GDP growth (+1 lag)	-6.011	0.000
EURII institutional index*	14.667	1.000
Debt/GDP*	-0.771	0.220
CISS*	14.473	1.000
SOVCISS	-3.378	0.000
REER growth	-14.538	0.000
ST rates and shadow rates*	0.898	0.815
Equity prices cycle*	1.367	0.914
House prices cycle*	-0.573	0.283
Credit to NFCs cycle*	2.738	0.997
Synchronicity credit HH and rates*	-7.883	0.000

Note: Null hypothesis assumes that all series are non-stationary, the alternative is that some series are stationary. 1 lag has been imposed for the dependent variable. This t-test is also based on Augmented Dickey-Fuller statistics as IPS (2003) but it is augmented with the cross section averages of lagged levels and first-differences of the individual series (CADF statistics)[39]. ***means non-stationarity for all series (cannot reject the null or we do accept the null).**

[39]The command in Stata is called -*pescadf*- and it has been built by Piotr Lewandowski, Warsaw School of Economics, Institute for Structural Research. The results for the tests for GDP growth are in line with Comunale (2017a).

A.6 Low vs. high volatility of growth

VARIABLES	(1) ec	(2) SR	(3) ec	(4) SR
Short-run				
ec		-0.492***		-0.512***
		(0.0572)		(0.104)
D.EURII		-0.0217		0.159
		(0.0490)		(0.331)
D.debt/GDP		-0.0512		-0.0915**
		(0.0499)		(0.0426)
D.ciss		0.00226		0.0614
		(0.0171)		(0.0375)
D.sovciss		0.0269**		0.0595***
		(0.0115)		(0.0197)
D.reergr		0.0549		0.130
		(0.0399)		(0.228)
D.ST rates		0.0435		0.0750
		(0.275)		(0.180)
D.eqp_cycle		0.111**		-0.000887
		(0.0497)		(0.0802)
D.rpp_cycle		0.276		0.584
		(0.296)		(0.379)
D.lnf_cycle		-0.236		0.0518
		(0.573)		(0.0323)
D.ltn_lhh		0.000636		-0.000734
		(0.000946)		(0.00154)
Constant		-0.146		-0.126**
		(0.117)		(0.0567)
Long-run				
EURII	0.524***		0.522**	
	(0.120)		(0.253)	
Debt/GDP	-0.0849		0.0181	
	(0.128)		(0.0994)	
ciss	0.00635		-0.166***	
	(0.0565)		(0.0631)	
sovciss	-0.0735*		0.00697	
	(0.0391)		(0.0832)	
reergr	-0.538***		-0.473***	
	(0.187)		(0.170)	
ST rates	1.555**		0.527**	
	(0.755)		(0.216)	
eqp_cycle	-0.0225		0.00249	
	(0.0222)		(0.0305)	
rpp_cycle	0.229		0.0743	
	(0.395)		(0.181)	
lnf_cycle	0.178		0.317	
	(0.146)		(0.258)	
ltn_lhh	-0.00372		-0.000825	
	(0.00301)		(0.00252)	
Observations	295	295	240	240

Figure A.1. Factor analysis until 2010

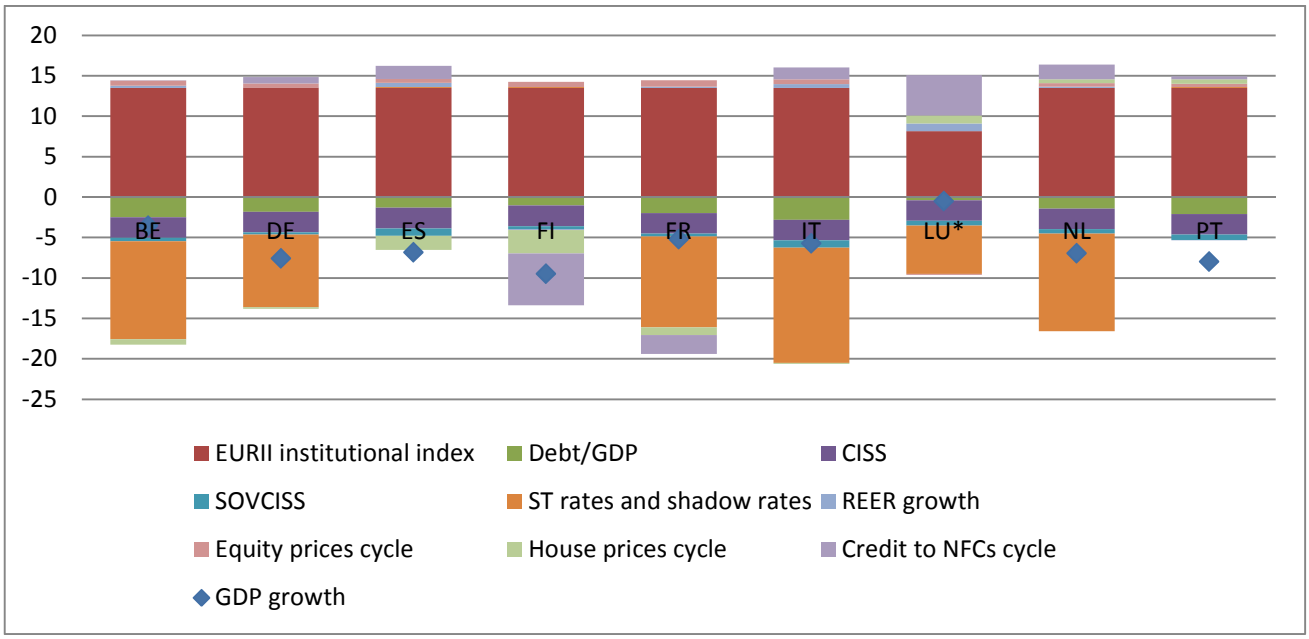
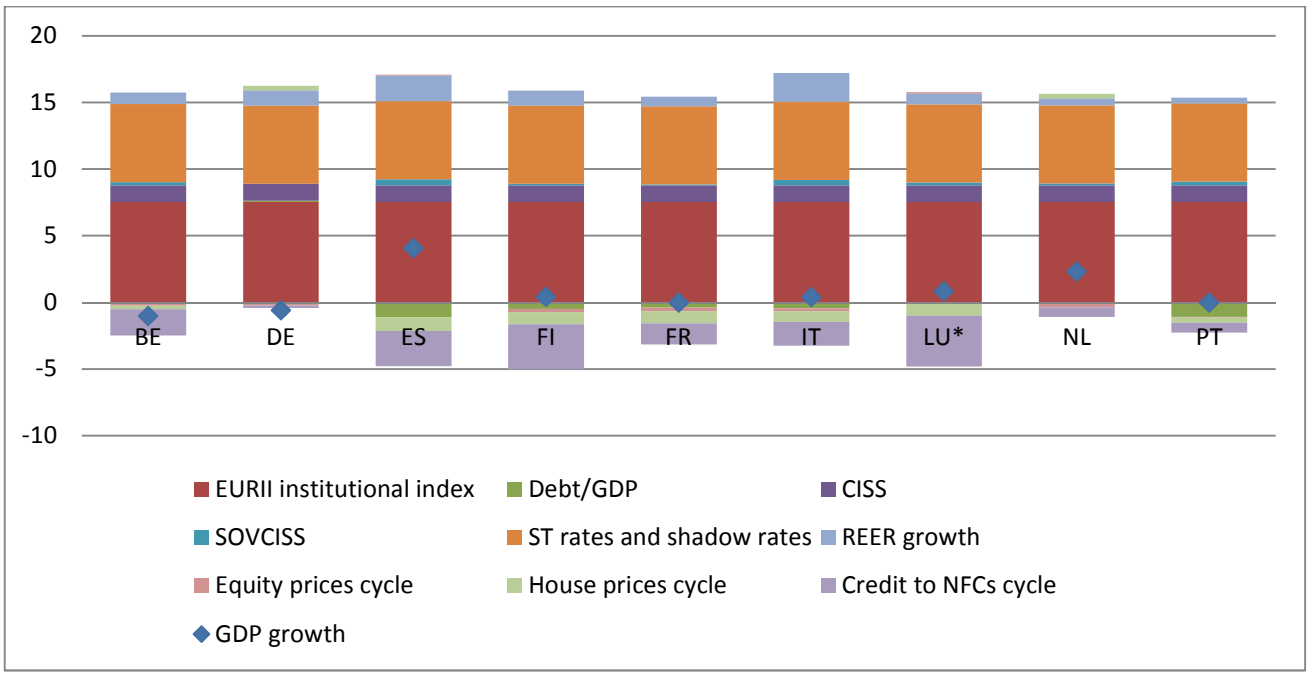
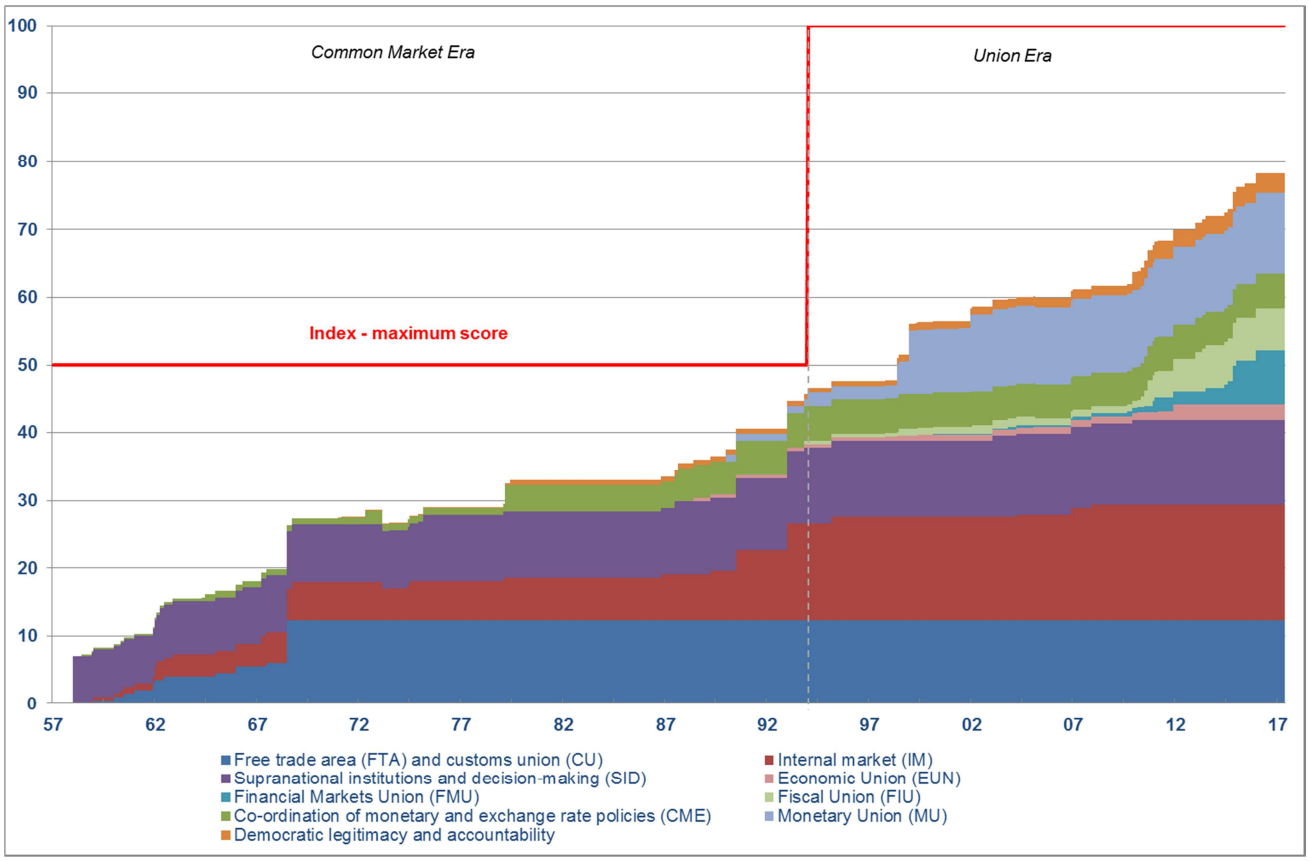


Figure A.2. Factor analysis from 2010 to 2016



Note: The data for Luxembourg (LU*) are only from 1996Q1.

Figure A.3. The EURII index



Source: authors' updated series from Dorrucci et al. (2015).