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Tracking growth in the euro area subject to a dimensionality problem

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Abstract

We investigate which variables have supported growth in the euro area over the last 30 years. This is a challenging task due to dimensionality problems: a large set of potential determinants, limited data, and the prospect that some variables could be non-stationary. We assemble a set of 35 real, financial, monetary, and institutional variables for nine of the original euro area countries covering the period between 1990Q1 and 2016Q4. Using the Weighted-Average Least Squares method, we gather clues about which variables to select. We quantify the impact of various determinants of growth in the short and long runs. Our main finding is the positive and robust role of EU institutional integration on long-term growth for all countries in the sample. 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. Debt over GDP negatively influences growth for the periphery, but only in the short run. Property and equity prices have a significant impact only in the short run, whereas the loans to non-financial corporations positively affect the core euro area. An increase in global GDP also supports growth in the euro area.

JEL: C23, E40, F33, F43
Keywords: euro area, GDP growth, monetary policy, fiscal policy, institutional integration, institutional reforms, systemic stress.

Non-technical summary

Euro area countries have undergone rapid changes and diverse shocks over the last 30 years. Our aim is to investigate which factors have consistently supported growth over a tumultuous period. This is done in three separate parts. First, we assemble a set of 35 real, financial, monetary, and institutional variables for all euro area countries over the whole sample period. Second, to investigate which factors are among the most relevant to explain GDP growth during these three decades we deploy several econometric techniques and statistical methods. Third, we then apply some additional econometric methods to disentangle short- and long-term effects, identify spillover and alert us of possible endogeneity issues.

In the first part of the paper, we collect a set of variables which have a bearing on growth. This search is not trivial and in future extensions of our approach more variables can be added. We start including a set of real variables that are normally found in the literature to matter for growth, i.e. fiscal variables and REER, as a proxy for price competitiveness. Monetary policy is taken into account by using shadow rates, which allow us to include both standard and unconventional monetary policy actions. Then we look at some financial cycles in credit, house prices and equity prices and their co-movements with the business cycles. This is to disentangle the link between real and financial sides of the economy. Sovereign and systemic (mainly financial) stress indices are also added to control for crises periods and global factors. The global linkages and spillovers are further investigated by including world GDP. Lastly, we make use of an index of EU Institutional Integration (EURII). This, we believe, might have been impactful in the last decades contributing to increase trade, investments, capital and labor mobility and innovation, helping the overall convergence within members. The impact, however, might have been asymmetrical across countries.

In the second part of the paper, we must decide which variables to retain. Thus, we test for the relevance of each regressors in explaining GDP growth over the short- and long-term. Two statistical methodologies are employed in order to establish some comparisons. The first one is the Weighted-Average Least Squares (WALS), which incorporates possible model uncertainty as well as uncertainty about estimations. The second method makes use of the Bayesian Model Averaging (BMA) method as a further check. We find a very robust set of indicators which can play a role for growth, namely: debt over GDP, the Sovereign and systemic stress indices, REER growth, the EURII and the shadow rates. Among the cycles, we add the ones for house prices and loan to NFCs and, lastly, one variable representative for synchronicity, i.e. between long term rates and households' loans.

As for the third part of the paper, we perform some statistical tests to choose the correct estimators for our panel. On the basis of these findings, we then apply as a preferred setup a panel error correction model, which deals with non-stationarity and cointegration. This also allows us to disentangle short and long run coefficients. Then to correct for possible endogeneity problems as well as the presence of unobserved global factors we look at a dynamic factor model in which we apply instrumental variables. In the last section, a simple panel VAR model for a sub-sample of our selected variables is provided to look at possible interactions across determinants as well.

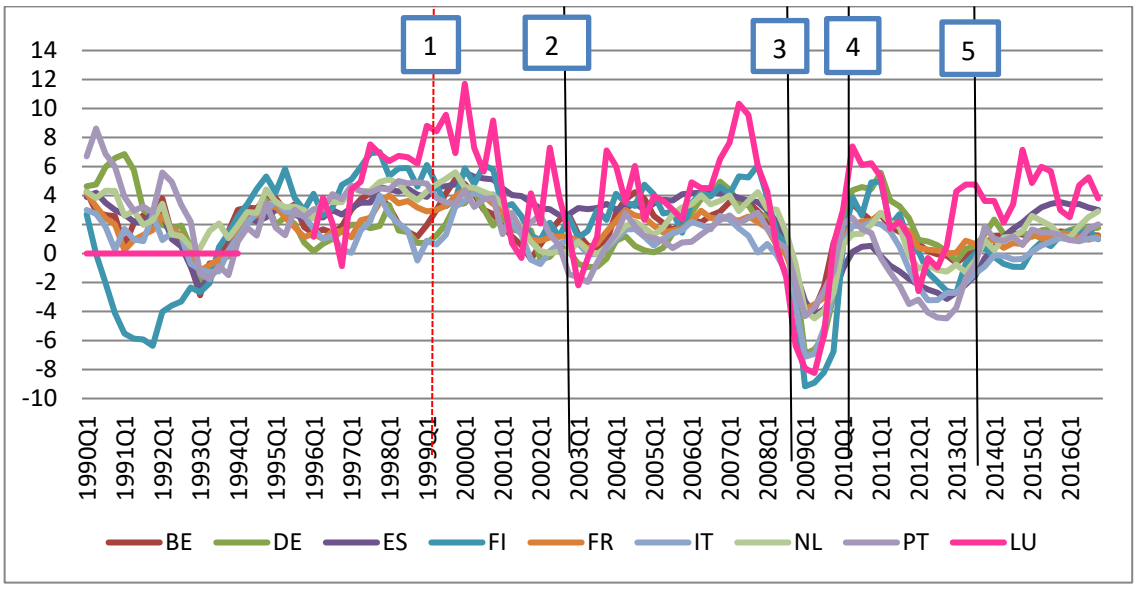
At the end it emerges that competitiveness and, above all, institutional integration at EU level has mattered for the member states in the long run. The latter factor played an important role. Credit to non-financial corporations could boost growth in some core euro are countries, where funds have been more efficiently allocated. Over and above these findings, the whole paper can be thought of as an atheoretical toolkit that is flexible and adaptable (and can be built upon as more data for all countries are collected).

1. Introduction and motivation

We provide an atheoretical framework to track fluctuations in euro area growth rates among nine original euro area countries since 1990.[1] We focus on original euro area countries for several reasons: they were bound by the process of European economic and monetary integration, they have experienced nominal convergence and have shared a single currency and monetary policy. At the same time, euro area countries have also experienced diverse shocks. Responses to the crisis that started in 2007 are also relevant to the discussion. Since the start of the Global Financial Crisis (GFC) and the subsequent euro area crisis, the European Central Bank (ECB) has implemented exceptional standard and non-standard monetary policies. Moreover, institutional, and structural reforms were introduced throughout the crises.

Indeed, euro area countries have experienced diverse growth rates across the sample period (see Figure 1). The core countries had high growth rates before the euro was launched. From the mid-2000s, Germany has experienced the most rapid increase in GDP, largely thanks to diverse structural reforms. Later, growth in the euro area core recovered faster and then stabilised at around 2%. Within the periphery group, Italy's GDP growth has stagnated since the beginning of the 1990s and posted the weakest recovery after the GFC and sovereign debt crisis (Papadia, 2017). Spain, instead, had a boom period lasting a decade, fuelled by reforms and an increase in the magnitude of the credit cycle (Comunale, 2020). Overall, the drop in growth for the periphery was less substantial during 2008-2009 but lasted a longer period.

Figure 1: Growth rates of euro area countries



Note: These are the real growth rates compared to the same quarter of previous year. The vertical lines represent 1) the introduction of the euro, 2) the dot-com bubble and the end of the tech-cycle, 3) the start of the global financial crisis, 4) the sovereign debt crisis, and 5) the start of the recovery/low inflation period. The areas are selected following Hartmann and Smets (2018).

[1] We look at two main sub-groups, defined as euro area "core" (Belgium, Germany, Finland, France, Luxembourg, and The Netherland) and "periphery" (Spain, Italy, and Portugal). Austria and Ireland, despite being original euro area countries are omitted from the analysis due to data limitations.

Hence, we ask: *Which factors played a role in stimulating growth or reducing it? Are these factors real, financial, monetary and/or institutional? Finally, how do these factors interact?* The main outcomes highlight the important positive role of institutional reforms for long-run growth overall. Furthermore, this is a robust result across specifications and setups. An improvement in competitiveness matters in sustaining long-run growth in the euro area, as does a decline in sovereign and systemic stress. A decrease in systemic stress matters even more for growth. The debt over GDP negatively influences growth for the periphery, but only in the short run. The loans to NFCs had a positive impact, especially for Germany, in a longer perspective.

The paper is organised as follows. Section 2 provides a brief literature review. Section 3 describes our data set. Section 4 describes the selection of variables. The econometric diagnostics are presented in Section 5. Section 6 shows the main results for the panel error correction model and provides various robustness checks. A panel VAR analysis and country-by-country VARs are presented in Section 7. Section 8 concludes.

2. Growth models and determinants of real convergence: a brief review

Our study is at the intersection of a rich literature. An initial group of studies follows the Solow exogenous growth model (Solow, 1956): if preferences and institutional features are the same across countries, a high expected return on investment in capital-scarce countries encourages capital to flow to the less endowed countries. The latter then 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). Yet, in the case of European countries, the empirical evidence for β-convergence is mixed (Barro and Sala-i-Martin, 1992). The Solow approach has limits as it requires identical preferences and institutions across countries, and it does not reflect different economic policies (Diaz del Hoyo et al., 2017).

Another group of studies endogenizes technological change through increased returns to production factors, or by generating innovations in its own right. Uzawa (1963) and Lucas (1988) include investment in human capital. Romer (1986) demonstrates that countries allocating more resources to innovation become more prosperous. Borsi and Metiu (2015) use a neoclassical growth model augmented by endogenous technological progress and find no evidence of overall real GDP per capita convergence for the EU27 during 1970-2010. However, they identify convergence clubs, or clusters. Endogenous growth models recognise the role of growth-enhancing strategies to target TFP, education, innovation and technological progress, in boosting economic growth and facilitating convergence (Diaz del Hoyo et al. (2017)).

In addition to the β- convergence, another common approach to growth convergence considers the notion of σ-convergence, i.e. when the dispersion of real per capita income across a group of economies falls over time. The idea of convergence clubs or clusters has been introduced by Phillips and Sul (2009). It considers cross-section heterogeneity among economies and evolution in rates of technological progress over time. This framework therefore allows for transitional behaviour among economies that includes convergence to a common steady-state path as well as various forms of transitional divergence and convergence, including club convergence. Recently convergence clubs in the EU has been investigated by Comunale et al. (2019) with data up to 2018Q4. The authors find for

GDP per capita two clubs. The first club members list mainly the so-called "core EU" countries. The periphery and all the new member states belong to the second club that has been detected. Alcidi et al. (2018) and Alcidi (2019) also show a "tale of two speeds": with overall income convergence over last 15 years, but with large diverging internal patterns.

A third group of studies explains cross-country variances in per capita growth with differences between institutions and governance (see North, 1991). Countries with strong institutions encouraging innovation tend to experience higher factor accumulation, more efficient resource allocation, and more stable long-term growth (Easterly and Levine, 1997). There is a positive correlation with a country's initial level of income and quality of governance (Han, Khan and Zhuang, 2014).

Summing up, the spectrum of variables affecting growth is broad and predictions are wide. We include several of the above variables in our exercise.

3. Data description

In order to explain GDP growth in the euro area, in both the short and the long run, we include several real, financial, monetary, and institutional variables, using various sub-samples of countries across time. This section describes the data in detail, and a summary table can be found in the Appendix (Table A.1), for convenience. The data covers a panel of nine initial euro area countries for the period 1990Q1-2016Q4, for a maximum of 972 observations.[2]

3.1. Real variables

The real GDP growth data for the countries – as well as the real and financial cycles – come from the database of ECB (2018). The real GDP growth series are extended by using IMF IFS data.[3][4]

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 CPI REER *vis-à-vis* 41 partners. All these series are from Eurostat. Next, we make use of 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. We consider 42 countries, including other advanced economies and emerging markets.[5]

3.2 Financial variables

We compute several measures of the financial cycle based on credit, house prices and equity prices. They overlap, of course, but are not identical. The 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 are computed 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

[2] The number of initial euro area members are limited to the data availability of the series.
[3] IMF data are interpolated by using cubic spline from annual to quarterly frequency.
[4] We include the real GDP (YER) -- i.e. business cycle -- in order to complete the set of the cyclical components, that is, to have a real counterpart for the financial cycles. This variable is never picked by the statistical methods when the dynamics is included, and we do not have business cycles in any of the results.
[5] Nine-euro area countries are included, making our variable rather suitable to account for possible spillover effects.

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 cycles from Comunale (2020). We look at all the country-pairs from the cycles described above.[6] The indices of synchronicity have been added to the possible set of regressors following recent evidence of their link to macro-financial characteristics of EU countries (ECB, 2018).[7]

In the context of sovereign and systemic stress, we also include indicators taking these aspects into consideration, which are especially important for the last 10 years of data. We have the country-specific Composite Indicator of Sovereign Stress (SOVCISS)[8] and the common Composite Indicator of Systemic Stress (CISS), as computed by Holló et al. (2012). Both are taken from ECB SDW. 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, for its part, is an indicator which uses information from equity, bonds, exchange rate volatilities, banks and payments systems, and weights more when stress has been found in several markets at the same time.

3.3 Monetary variables

For the monetary factor, with the ECB policy rate constrained by the zero lower bound (ZLB) over a significant portion of the sample period under investigation, we use shadow interest rates of Wu and Xia (2016) to capture both conventional and unconventional monetary policy actions.[9] 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 captures a further use of unconventional monetary policy measures.[10]

3.4 Institutional variables

We also include a European Index of Regional Institutional Integration (EURII), which maps developments in European integration for the 6 EU founding members in 1957 (Germany, France, Italy, Belgium, The Netherlands, and Luxembourg) on the basis of a monthly dataset from Dorrucci et

[6] These new measures provide us with proxies of macro-financial co-movements, capturing whether positive and negative cyclical phases coincide, i.e. they can be either both positive and both negative, regardless of their amplitudes (see Mink et al. (2012) for the cross-country analyses). Each index results in a value of either 1 or -1, where 1 means that cycles are perfectly synchronized at time t and, thus have the same sign (either positive or negative). A value of -1 indicates instead that the cycles have opposite signs.

[7] High synchronicity between real and financial cycles (or among financial cycles) can reflect structural characteristics of a country (e.g., homeownership, Loan-to-Value ratios, current account misalignments, and financial openness) and signal an upcoming recession (Comunale, 2020).

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

[9] 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 is 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, the shadow rates depend on the specification of the shadow/ZLB model and the data and method used for estimation.

[10] We decided to apply the specific Wu and Xia (2016) shadow rate because it has been widely used in the literature and 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 similar. Other shadow rates or methods to capture the unconventional monetary policy phase exists and have pros and cons (see Comunale and Striaukas, 2017).

al. (2015), extended to include 2016. The data are taken at quarterly frequency by averaging the monthly series. Common across all the countries and time-varying, this index represents a novelty in this type of study.[11] In the EURII index two overarching periods are defined. The first period is the "Common Market Era", from 1958 until 1993. The second period is the "Union Era", which starts after 1993. This era has four main components, namely: the economic, the fiscal, the financial, and the political unions.[12] A maximum score of 50 is assigned to each of these eras, with the index starting at 0 on 1 January 1958 and then making progress up to the current cumulated value of slightly above 76 as of 1 January 2015. The 100, i.e., the maximum total score that would be assigned in the index, is when all objectives of the Common Market and Union Eras were fully accomplished. In our sample, we start from the period just before stage two of EMU in 1994 until 2016 Q4.

Summing up, we have been able to round up about 35 variables in total, thus far, including the synchronicity indices. More variables might be added in the future.

4. Selection of variables

We now need to understand the relevance of each regressor in potentially affecting GDP growth. Significantly, we do not claim any causality: highly correlated variables do not guarantee causation, i.e. high correlation may be caused by a similar set of shocks. We also do not provide a forecasting exercise. Our main contribution is to have an atheoretical setup looking at the "usual suspects" in the policy debate, but rather "unusual" in the academic literature, as possible factors driving fluctuations and differences in growth rates among euro area countries since 1990. We do not rely on established theoretical models on growth, but, at the same time, we want to avoid spurious selections of variables. The selection is thus made in a statistical way, via model averaging algorithms. These methods combine information taken from parameters of each possible model using a weighted average of conditional estimates, i.e. they incorporate model uncertainty as well as uncertainty about estimations, selecting the best setup available in the set. As in all estimation procedures with model averaging algorithms, we look at a linear regression model, as in equation (1), also elaborated on in Magnus et al. (2010). This is reported below in a panel setup:

$$Y_{it} = \beta_1 X_{1,it} + \beta_2 X_{2,it} + \varepsilon_{it} \quad (1)$$

In this setup, $X_{1,it}$ includes our "focus" variables and $X_{2,it}$ is a (n x k) matrix of "auxiliary" variables. A different model arises whenever a different subset of $X_{2,it}$ is set equal to zero, and, in general, there are 2^k models to consider. In order to select the best one(s), the model averaging estimation proceeds in two steps: 1) we estimate the parameters, conditional upon a selected model; and then 2) we compute the estimator as a weighted average of these conditional estimators.

We apply as a preferred method the Weighted-Average Least Squares (WALS) proposed by Magnus et al. (2010) and reviewed by Magnus and De Luca (2016). WALS is a flexible approach proven quite efficient for the selection of GDP growth factors. The WALS approach also reduces the computational burden compared with other methods (see below), especially when we include

[11] An illustrative chart with the subcomponents of the EURII index is provided in the Appendix (A.3.).
[12] A check by using these four components separately is also provided.

synchronicity indices.[13] It combines frequentist, i.e. (constrained) least squares, estimations with only the weights taken as Bayesian. One key advantage is that the priors are here neutral, so the method relies on a transparent definition of prior ignorance.

Thereafter, as a check, we apply the Bayesian Model Averaging (BMA) method, which relies fully on Bayesian weights and estimates (used in Sala-i-Martin et al., 2004 and Masanjala and Papageorgiou, 2008).[14] In the BMA, informative priors need to be specified. An additional reason to apply BMA exclusively as a check is that, in so doing, we avoid combining frequentist approaches with pure Bayesian ones.

Summing up, we find a set of robust factors which need to be added as regressors (Table 1).[15]

Table 1: Comparison and selection of baseline

	BMA		WALS	
	pip	pip	(t-value)	(t-value)
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
Synchronicities				
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

[13] 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).

[14] Diverse caveats apply. Both WALS and BMA apply in a context of static linear regressions models and do not account for 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 analyses. In our view, this is, in any case, a worthwhile initial screening check.

[15] As in Magnus et al. (2010), we consider a rough guideline for "robustness" of a regressor to be whether it has a Posterior Inclusion Probability (PIP) value 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. We decided, however, to be more restrictive. In the case of WALS, only t-values greater than 1.5 in absolute terms are included in our study. For BMA, only regressors for which the PIP is close to one (minimum of 0.8) are selected and then added. If the PIP is exactly equal to one, the regressor needs to be included by probability one.

Note: The first column of each method includes the lag of the dependent variable (L.GDP growth). . L. GDP growth is the first lag of GDP growth, fiscal deficit is defined as the public balance between government revenue and expenditure, a budget deficit when negative. It is in percentage GDP and so is total government debt (Debt/GDP). REER growth refers to the growth rate in the Real Effective Exchange Rate. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress and ST rates are the EONIA/shadow rates. EURII is the European Index of Regional Institutional Integration. The cycles are based on data from equity price indices (EQP), nominal long-term rates (LTN), real GDP (YER), real credit to households (LHH), real credit to non-financial corporations (LNF), property prices (RPP), real total credit to private non-financial sector (TCN),. The synchronicities are based on cycle's pairs.

One finding is that the fiscal deficit should not be included and only some specific financial cycles. The selected variables are therefore: debt over GDP, CISS and SOVCISS, REER growth, the EURII and shadow rates. Among the cycles, we will add the ones for house prices and loan to NFCs and, lastly, one variable representative for synchronicity, i.e. the one between long- term rates and loans to households.[16] This is our baseline setup. Our alternative baseline excludes the synchronicity measure, which is not captured in BMA.

5. Econometric diagnostics and setup

Given the above selection of growth factors, choosing the right setup is a challenging task due to dimensionality problems and the properties of data. Therefore, we need to firstly test for cross-sectional dependence (CSD), non-stationarity, and possible cointegration. The sequence of the tests is crucial. For instance, without checking for the presence of CSD, we cannot choose the correct test for non-stationarity and for cointegration.[17]

Based on these findings, we apply as a preferred setup a panel error correction model (PECM), which deals with non-stationarity and cointegration and allows us to disentangle short- and long-run coefficients. Then, to correct for possible endogeneity problems and the presence of unobserved global factors, we look at a dynamic factor model with Instrumental Variables. In the last section, a simple panel VAR model for a sub-sample of our selected variables is provided to examine possible interactions across determinants as well.

Hence, first we reparametrize our setup from an Autoregressive Distributed Lag (ARDL) (Equation (2)) into a panel error correction model (PECM), as shown in equation (3).[18] The Mean Group (MG) estimator is the estimator chosen, because gives heterogeneous coefficients in both the short- and long-run analysis.[19]

$$GDPG_{i,t} = \beta_{1i} GDPG_{i,t-1} + \beta_{2i} X_{i,t} + \beta_{3i} X_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

[16] When the synchronicity between long term rates and loan to NFCs is included the results are highly robust with respect to the selected baseline. The same holds if both synchronicities are added together. These are all available upon request.
[17] More details on the tests and the outcomes can be found in the Appendix (A.5).
[18] The number of lags has been selected based on the Schwarz's Bayesian information criterion (SBIC). One lag has been selected (which makes the variations quarter-on-quarter). This method – implemented country by country -- provides more accurate outcomes for quarterly data series also in case of small samples for VARs and Vector ECMs (Ivanov and Kilian, 2005). Only for some countries would the SBIC criterion 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.
[19] The results with the Dynamic FE are also available upon request. The estimated coefficients are very robust with respect to the ones estimated by applying the MG.

$$\Delta GDPG_{i,t} = \phi_i\left(GDPG_{i,t-1} - \theta'_{0i} - \theta'_{1i}X_{i,t-1}\right) + \delta'^{*}_{11i}\Delta X_{i,t} + \mu_i + \varepsilon_{i,t} \quad (3)$$

The coefficients ϕ and (ϕ·θ) capture the long-run effects, while the coefficient δ corresponds to the impact of the variables in the short run. The X is the vector of the variables 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.

Second, to correct the cross-sectional dependence and a possible endogeneity problem in this dynamic panel setup, we apply the framework developed by Chudik and Pesaran (2015) and further implemented and extended in Ditzen (2018). This is a dynamic factor model (DFM IV) with cross-sectional averages for correcting the cross-sectional dependence and instrumental variables for the key regressors to deal with endogeneity.[20]

The estimator is a mean group-type which tries to keep as much heterogeneity in the coefficients as possible (CCEMG-IV). In equation (4), we can see an example of a representation of a dynamic factor model (Pesaran and Tosetti, 2011), to which we are applying our variables of interest:

$$y_{i,t} = \alpha_i + \delta'_i \boldsymbol{d}_t + \beta'_i \boldsymbol{x}_{it} + \gamma'_i \boldsymbol{f}_t + e_{it} \quad (4)$$

where $\boldsymbol{d}_t = (d_{1t}, \dots, d_{nt})$ is the vector of observed common variables, these are variables which are common across countries (see EURII) and are included explicitly., $\boldsymbol{x}_{it}$ is the vector of observed individual ones, i.e. the list of idiosyncratic variables selected by WALS method and $\boldsymbol{f}_t$ is a vector of *m* unobserved common factors which will represent the cross-sectional averages (i.e. spillovers) and other common factors.

6. Main results with the PECM

A comparison between the two PECM baselines based on the WALS technique – one with and the other without the synchronicity between real GDP and equity prices – can be found in Table 2.[21]

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 whether the difference in the coefficients is significantly non-zero (Table 3).

The EU institutional integration index EURII is the main variable associated with higher GDP growth in the long run for both core and periphery (Table 3). An interesting narrative emerges from the different EURII components, and the difference between core and periphery (see Comunale and Mongelli, 2020).[22] In the short -run, we can see a positive effect of fiscal integration on periphery

[20] The instruments are model-selected lags of our variables.
[21] As a check, we also run the regression from the WALS methodology directly. This comes with some important caveats on the estimator. It does not take into account the problems we encounter in our panel: the presence of unit roots, cointegration, cross-sectional dependence and heterogeneity. Moreover, it does not disentangle between short- and long-run effects. In any case, the main outcomes are once again confirmed, including the important positive role played by the EURII, even if the latter is smaller in magnitude when using WALS compared with other methods.
[22] The main findings from the other factors are confirmed in this specification.

countries, which, however, does not translate into any long-run effects. For the long run, instead, a deeper financial integration seems to have beneficial effects on the core, while such integration is not significant in the periphery. The opposite holds for political integration that boosts long-run growth only for the core countries.

Table 2: Baseline results with WALS and BMA selection

	WALS Baseline with synchronicity	BMA Baseline without synchronicity
	(1)	(2)
VARIABLES		
short-run		
ec	-0.501***	-0.493***
	(0.0521)	(0.0534)
D.EURII	0.0585	0.0751
	(0.141)	(0.140)
D.debt/GDP	-0.0691**	-0.0712**
	(0.0323)	(0.0280)
D.ciss	0.0285	0.0328
	(0.0206)	(0.0214)
D.sovciss	0.0414***	0.0373***
	(0.0116)	(0.00954)
D.reergr	0.0884	0.0838
	(0.0963)	(0.0968)
D.ST rates	0.0575	0.0419
	(0.163)	(0.193)
D.eqp_cycle	0.0612	0.0595
	(0.0463)	(0.0428)
D.rpp_cycle	0.413*	0.361
	(0.226)	(0.222)
D.lnf_cycle	-0.108	-0.111
	(0.307)	(0.317)
D.ltn_lhh	2.73e-05	
	(0.000837)	
Constant	-0.137**	-0.147**
	(0.0662)	(0.0733)
long-run		
EURII	0.523***	0.528***
	(0.121)	(0.135)
Debt/GDP	-0.0391	-0.0249
	(0.0810)	(0.0747)
ciss	-0.0703	-0.0761
	(0.0497)	(0.0507)
sovciss	-0.0378	-0.0280
	(0.0422)	(0.0467)
reergr	-0.509***	-0.473***
	(0.121)	(0.116)
ST rates	1.098**	1.092**

	(0.446)	(0.481)
eqp_cycle	-0.0114	-0.0129
	(0.0176)	(0.0190)
rpp_cycle	0.160	0.103
	(0.223)	(0.203)
lnf_cycle	0.239*	0.282*
	(0.133)	(0.145)
ltn_lhh	-0.00243	
	(0.00196)	
Observations	535	535

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

Note: Mean Group estimator has been applied here. 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. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress, REERGR refers to the growth rate in the Real Effective Exchange Rate and ST rates are the EONIA/shadow rates.

In the long run, an improvement in competitiveness matters for growth as well as a decline in sovereign and systemic stress.[23] By assembling our broad set of data and controlling for some econometric issues, we are in line with the previous literature. For example, Gala and Lucinda (2006) and Rodrik (2008) both indicate that a real depreciation, i.e., increase in competitiveness, is associated with higher GDP growth.

The debt over GDP negatively influences growth for the periphery only in the short run (and this drives the same results for the entire sample). This is in line with the general empirical literature on the relationship between public debt and economic growth, which is far from 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 showed that debt shocks do not make a significant impact on the growth dynamics across the euro zone.

The equity price cycle is positively associated with 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 loans 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 has been used in the different economies, i.e. for more-productive or less-productive sectors. As reported in Hassan et al. (2017), differences in the efficiency of fund allocations could have mattered. In Italy, for example, credit is allocated less efficiently than in France and Germany.

Table 3: Baseline results for core and periphery

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

	core	periphery	core	periphery
	(1)	(2)	(3)	(4)
VARIABLES	Baseline with synchronicity	Baseline with synchronicity	Baseline without synchronicity	Baseline without synchronicity
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	178	357	178

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

Note: Mean Group estimator has been applied here. 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. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress, REERGR refers to the growth rate in the Real Effective Exchange Rate and ST rates are the EONIA/shadow rates.

The only index that passes the WALS test is the one between long-term rates and loans to households. This is highly heterogeneous across EU members, being higher in Finland and Portugal (80% of the times these cycles are synchronized) and much lower in Germany, the Netherlands, Spain and Italy (less than 60%).[24] This index can be interpreted as a proxy for the link between long-term interest rates and financial conditions, in the spirit of Hördahl et al. (2016), without introducing an additional interest rate into the setup.

The monetary policy stance is proxied by the short-term rates until the ZLB, and then by the shadow rates.[25] There was a strong co-movement between EONIA and GDP growth interrupted at the crisis in 2008Q3.[26] Afterwards, when the ZLB has been reached, a lower shadow rate signals a further use of unconventional monetary policy measures. In our PECM for the time full sample, the coefficient for the rates is positive and significant in the long run, while positive but not significant in the short run. As expected, the sign is always positive, because monetary policy is set endogenously: when GDP rises, interest rates are set to go up, and, if GDP declines, the rates are set to decrease. In fact, in the early part of our sample period, GDP leads interest rates. Stagnation after the Global Financial Crisis and the Euro Area Crisis explain the need for easing the monetary policy stance. From the time of the sovereign debt crisis, the transmission mechanism broke down, and monetary policy has been increasingly accommodating. In 2013, there is a decoupling of the shadow rate from GDP growth, and the shadow rate captures the unconventional monetary policy.

6.1. Robustness checks for the baseline

We run the baseline adding the fiscal deficit. The fiscal deficit does not play a clear role regarding influencing growth in the short run, although we find a significant negative effect in some cases in the long run. Next, we perform the baseline estimations for the sample without Luxembourg, which experienced a higher volatility of growth rates than the other member states and has some series limited in its time dimension. The only significant difference is in the role of the property price cycle for growth in the short run: more substantial if we drop Luxembourg from the sample.[27]

[24] The financial cycles are generally also longer than business cycles. For more detail, see ECB (2018).
[25] We use pre-1992 country-specific short-term interest rates and then EONIA.
[26] In Table 3, we report the results up to 2010Q1, only in this case the coefficient for the short-term/shadow rates is negative in the short run.
[27] The outcomes for the sample without Luxembourg are available upon request.

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.[28] Economically, this variable is useful to check for a possible transmission of an increase in global GDP (or global business cycle) to European growth. As expected, global GDP growth positively affect euro area GDP growth in the short run.

Then we applied a different way to split the sample, based not on level of debt or sovereign stress (core vs. periphery) but rather on low vs. high volatilities of growth in the whole period.[29] 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 compared core vs. periphery (Table 2), they mattered more for the latter group of countries. This means that institutional reforms and further integration at the EU level and competitiveness may be more substantial factors in affecting growth for countries with higher debt or who are 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 negatively impacts growth in the long run for countries with lower volatilities in GDP growth.

We then examine the differences with the pre-crisis periods, comparing the whole sample with data up to 2010Q1 for the European sovereign debt crisis (see Appendix).[30] The main outcomes stress the important positive role for long-run growth of institutional integration reforms also before the sovereign debt crisis. Instead, in the short run, we see a negative impact only prior to the crisis.[31]

6.2 The dynamic factor model with instrumental variables

We aim to resolve some left econometric issues here, such as cross-sectional dependence and endogeneity in a dynamic panel setup, by using the framework developed by Chudik, and Pesaran (2015) and Ditzen (2018). At the same time, it is important to bear in mind that this setup does not disentangle the effects in the short and long run, which would require a larger T. Here we apply a dynamic common-correlated effect setup with mean group estimator and instrumental variables for the key regressors (CCEMG-IV). The main results are found in Table A.7 (in the Appendix). The institutional integration EURII is still positive and significant in this framework, too, if all the regressors are considered as endogenous. This result is broadly robust to checks with different sets of endogenous (and then instrumented) variables and lags.[32] The debt over GDP and the REER growth are negative and significant in our preferred setup (Table A.7.), and, in general, only if lags to regressors are applied. This confirms our findings regarding the importance of competitiveness for growth; thus, when REER decreases, competitiveness improves, GDP growth increases. In this setup, we also find a negative role played by the stock of debt, which was not completely clear in other specifications. We do not find any effect of the financial cycles on growth.

[28] The importance of global GDP growth is confirmed with WALS, and thus the variable could indeed be included.
[29] The results are in the Appendix (Table A.6).
[30] The results with data until 2008Q3 are available upon request. In a sum, the factors seem to matter mostly only in the short run, and equity prices and competitiveness are key. The sample from 2010Q2 to 2016Q4 lacks a degree of freedom to perform an ECM in a proper way, so we compare the pre-crisis rather with the entire sample.
[31] A second sub-sampling exercise has been performed looking only at the post-euro introduction (from 1999Q1). The results confirm the baseline, because we do not have enough observations in the periods before the introduction of the euro. Adding a dummy variable equal to 1 from 1999Q1 yields the same outcomes. Results are available upon request.
[32] The code does not run if we increase the number of regressors including, for example, the synchronicity indices.

7. Robustness check: VARs

As a further check, we provide VARs identified by a simple Cholesky scheme. This is done to take into account the possible endogeneity among our variables of interest.[33] We look at the EURII, SOVCISS,[34] REER growth, the shadow rates and one of the financial cycles (loans to NFCs), as the most significant contributor in the PECM.[35] We identify shocks as in equation (5), ranking the variables from the most exogenous variable to the most endogenous at time t.

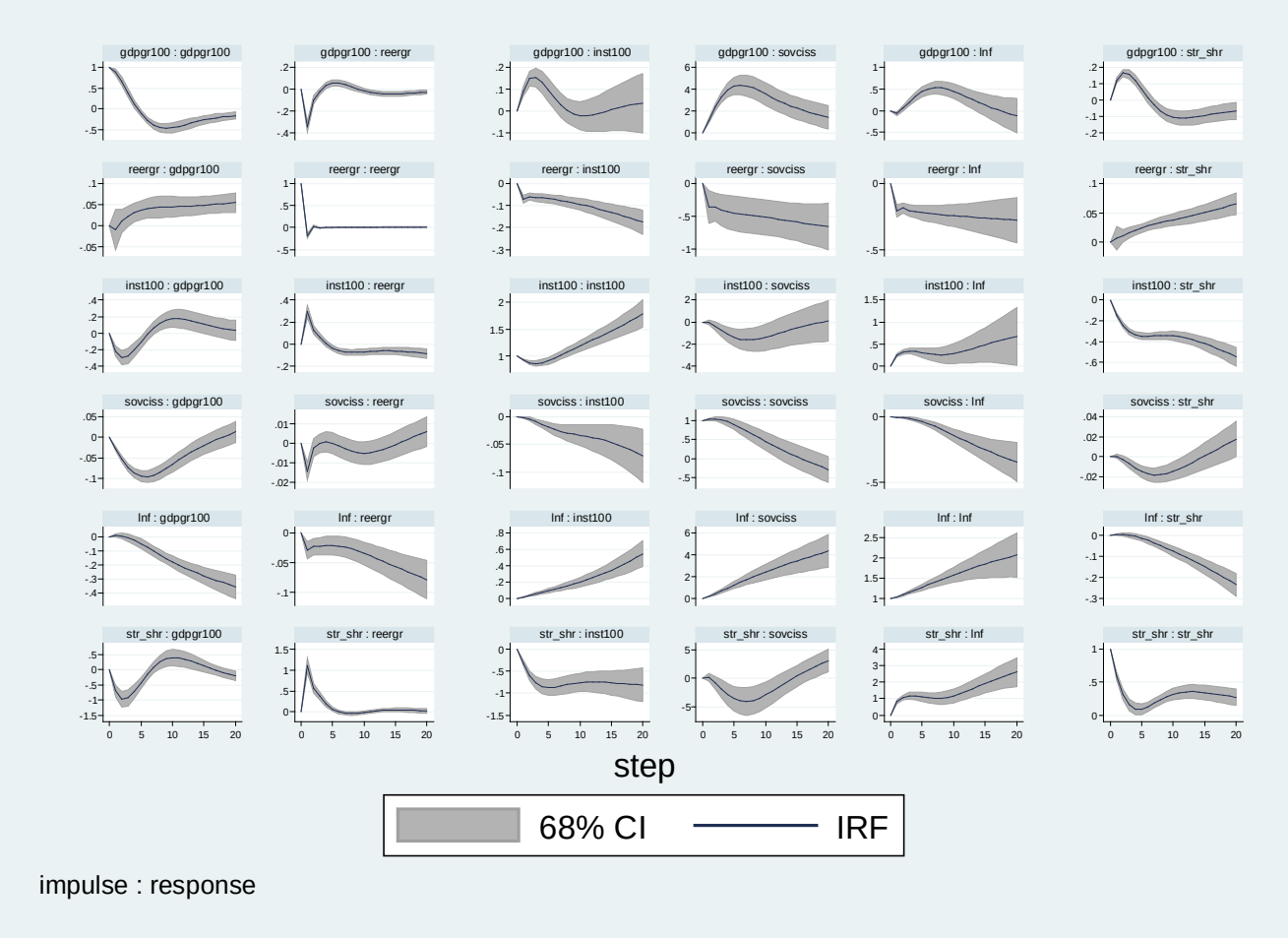
$$Y_t = (short\ term\ i_t, loans\ to\ NFC_t\ ,\ sovciss_t\ , eurii_t,\ reer\ growth_t\ ,\ GDP\ growth_t)' \qquad (5)$$

We have the short-term interest rates as we start with a monetary policy action, which can have a direct impact on contemporaneous variables. The rates affect loans to NFCs, as the boom/bust cycle in the credit market has also been influenced by interest rates and the further accommodation of unconventional measures to deal with the possibility of credit crunch. Ordering financial variables as last does not alter the main outcomes of our VAR exercise.[36] As a first simple check, we provide a simple panel VAR estimated by using a GMM-style estimator as in Albrigo and Love (2015).[37] The results for the baseline are shown in Figure 2.

As expected, the impact of REER on growth is negative, 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 (2017). An increase in sovereign stress can bring a decrement in growth. Monetary policy, including both standard and non-standard measures, affects growth contemporaneously in the baseline. The effect at impact is indeed negative, becoming insignificant or very small and positive after 1 year and a half.[38] The EU integration index EURII in the baseline setup at equation (5) has a negative impact on growth only in the very short run, whereas, in the long run, it is always positive and significant.[39] This is consistent with our results in the panel ECM section (see Table 1), where we see a significant positive coefficient for EURII in the long run. The short-term effect may be larger; however, it is not persistent and transitions quickly (after 1 year) to a positive sign in the medium-long run. The cumulative responses over 5 years (20 quarters) signal that these are negative for the first 2 years, and then turn slightly positive.[40]

[33] The high number of possible regressors together with new indicators, like the EURII, makes a more refined (panel) VAR exercise, i.e., with sign and zero restrictions in the short and long run, a task which may require a paper of its own.
[34] This is mainly because SOVCISS is country-specific and possibly more relevant for both core and periphery. Including both CISS and SOVCISS could also cause multicollinearity issues.
[35] This is because this cycle is the only one significant in our baseline setup with the PECM.
[36] There is no consensus on the identification of shocks using financial variables in VARs. The "traditional literature" orders financial variables as the most endogenous, since for instance asset prices are "fast-moving", while real variables are more "slow-moving" (see Paul (2017), among others). If a GDP shock can contemporaneously cause a financial change, this could be seen as assuming perfect foresight. Hence, ideally, one would try to identify two-way instantaneous causality, but this requires non-trivial identification schemes.
[37] We are aware that, in this case, the coefficients are homogeneous. The results, however, are robust to the ones with heterogeneous estimators in the previous sections. Confidence bands are set at 68%, and we consider one-unit shocks.
[38] The effect is negligible in the cases of other setups without the EURII institutional index and CISS.
[39] We also provide a sensitivity analysis for the specification with EURII. The EURII index is relatively slow moving, so one potential specification is to rank it last in the ordering (see Appendix, Figure A.3). The results for EU integration are once again confirmed.
[40] Complete charts for all the robustness checks are available on request. This outcome is very robust.

Figure 2: Impulse responses in a simple panel VAR



Note: GDPGR100 is real GDP growth rate. REERGR refers to the growth rate in the Real Effective Exchange Rate. INST100 is the European Index of Regional Institutional Integration (EURII). SOVCISS is the Composite Indicator of Sovereign Stress. The cycles are based on data from real credit to non-financial corporations (LNF), STR_SHR are the EONIA/shadow rates.

Ultimately, we want to account for the heterogeneity and the country-specific information we have from each of the 9 countries, and we apply our VAR identification (as in equation (5)) on a country-by-country basis.[41] The lags in this case are country-specific and automatically selected by SBIC criteria. We focus here first on the impact of a positive shock in institutional EU reforms on GDP growth. In the cases of Germany, Italy, the Netherlands, and France, the impact is negative but only in the short run. Interestingly, in Spain and Portugal, we see no negative impact in the short run of the institutional EU index, and the long-run positive impact is larger in magnitude and much more persistent over time. Overall, in the countries that we call "periphery", the impact of EU institutional changes is positive, especially in the medium-long run.

In a country-specific setup, the impact of competitiveness is less than clear-cut. SOVCISS has a large and persistent negative effect on growth in the periphery. An increase in loans to NFCs could help growth if the resources were better allocated to more productive sectors and industries; otherwise, it might even hamper growth (Hassan et al., 2017). As for a shock in loans to NFCs, this has a very

[41] The *caveat* is that for each country we have a maximum of around 60 observations, thus applied small-sample degrees-of-freedom adjustments without Bayesian techniques to avoid mixing frequentist approaches with Bayesians.

positive impact in the short and long runs only in the case of Germany, although for France, Italy, Spain, and, surprisingly, in the Netherlands and Finland, the impact is both highly negative and persistent.

8. Conclusions

Over the last 30 years, which factors have supported output growth in the short and long run in the euro area? Our paper has answered this question by addressing a severe dimensionality problem including: a large set of potential determinants, limited data, countries that are both heterogeneous and cross-sectionally correlated, the presence of possible unobserved common factors, and some nonstationary variables. Moreover, euro area countries have experienced profound economic, financial and institutional changes, during a period with several and diverse shocks, particularly during the recent tumultuous decade.

We started by assembling a rich array of thirty-five real, financial, monetary, and institutional variables, seeking to identify those that played a heightened role in stimulating growth, or reducing it in the short- versus long-term. Our main finding is that institutional integration at EU level supports long-run growth for all countries. This finding is robust across specifications and setups. Additionally, enhanced competitiveness matters for sustainable growth. A decline in systemic stress is also associated with growth. A higher level of indebtedness negatively influences growth for the periphery, but only in the short run. Surprisingly, the deficit plays no role. Instead, higher sovereign stress is associated with lower growth. Prior to the zero-lower bound, higher monetary policy rates are associated with growth. This relationship changes after the ZLB using the shadow rate, which captures exceptional standard and non-standard monetary policies. The equity price cycle positively affects GDP growth only pre-crisis and only in the very short run, while loans to NFCs had a positive impact for the core euro area, especially for Germany.

Our results must be considered as preliminary. Correlations and associations do not constitute causations. The evidence provided in the current paper requires corroboration by model-based analyses. We cover a period of intense flux in European economic, financial, monetary, and institutional history. Some of the countries in the sample experienced switches in policy regimes. Thus, much remains to be done in future research. From the standpoint of time series econometrics, a further contribution might include the use of a sign/zero restrictions (panel) VAR, or models that include changing parameters, stochastic volatility – or preferably, both. The array of explanatory variables may be extended. For example, the role of EU funds might be considered (but we currently lack enough data). Similarly, we do not have enough data availability for the new euro area governance and the SSM. Despite these limitations, our atheoretical framework has several important traits: it is flexible, adaptable, and can be built upon as more data for all countries are collected.

References

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.

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.

Alcidi, C., (2019) “Economic Integration and Income Convergence in the EU”, Forum CEPS, *Intereconomics*, Volume 54, January/February 2019, Number 1 pp. 5-11.

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

Borsi, M. & N. Metiu, (2015) "The evolution of economic convergence in the European Union," *Empirical Economics*, Springer, vol. 48(2), pages 657-681, March.

Checherita-Westphal, C. & P. Rother (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 T.J. Fitzgerald (2003) "The band-pass filter", *International Economic Review*, 44, 435-65.

Chudik, A., and M. H. Pesaran (2015) “Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors”. *Journal of Econometrics* 188: 393-420.

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. (2017) “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., (2020) “New synchronicity indices between real and financial cycles: is there any link to structural characteristics and recessions in EU countries?” *International Journal of Finance and Economics*, vol. 24, issue 4, October 2020, pages 617-641.

Comunale, M, & A. D. M. Nguyen and S. Soofi-Siavash (2019) “Convergence and growth decomposition: an analysis on Lithuania”, Bank of Lithuania, Discussion Paper Series no.17/2019.

Comunale, M. and F.P. Mongelli (2020) “Euro Area growth and European institutional reforms”, In: Campos, Nauro, De Grauwe, Paul and Ji, Yuemei (eds.) Structural reforms and economic growth in Europe. Cambridge University Press, 2020.

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

Cristina, F. and P. Garcia Perea (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.

Ditzen, J. (2018) “Estimating Dynamic Common Correlated Effects in Stata”, *The Stata Journal*, 18, Number 3, pp. 585-617.

Dorrucci, E., Ioannou, D., Mongelli, F. and A. Terzi (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.
Easterly, W. & R. Levine, (1997) "Africa's Growth Tragedy: Policies and Ethnic Divisions," *The Quarterly Journal of Economics*, Oxford University Press, vol. 112(4), pages 1203-1250.
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.
Gala, P. and C.R. Lucinda, (2006) “Exchange Rate Misalignment and Growth: Old and New Econometric Evidence”. *Revista Economia*, p.165-87.
Garcia-de-Andoain, C. and M. Kremer M. (2017) “Beyond spreads: Measuring sovereign market stress in the euro area”, *Economics Letters*, Volume 159, October 2017, Pages 153-156.
Hall, R.E. & C. I. Jones, (1999) "Why do Some Countries Produce So Much More Output Per Worker than Others?," *The Quarterly Journal of Economics*, Oxford University Press, vol. 114(1), pages 83-116.
Han, X., Khan, H. and J. Zhuang (2014) “Do governance indicators explain development performance? A cross-country analysis”, *Economics Working Paper Series*, No 417, Asian Development Bank.
Hartmann, P. & F. Smets (2018)"The first twenty years of the European Central Bank: monetary policy," Working Paper Series 2219, European Central Bank.
Hassan, F., F. Di Mauroand G. Ottaviano (2017)"Banks credit and productivity growth," Working Paper Series 2008, European Central Bank.
Holló, D. & Kremer, M. & M. Lo Duca (2012) "CISS - a composite indicator of systemic stress in the financial system," Working Paper Series 1426, European Central Bank.
Hördahl, P. & J. Sobrun & P. Turner (2016) "Low long-term interest rates as a global phenomenon," BIS Working Papers 574, Bank for International Settlements.
Ivanov V. and L. Kilian (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 G. De Luca (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. & T. Zumer (2017) "Indebtedness in the EU: a drag or a catalyst for growth?,"Working Paper Series 2118, European Central Bank.
Mink, M., Jacobs, J.P.A.M. and J. de Haan (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.
North, D.C. (1991) "Institutions," *Journal of Economic Perspectives*, American Economic Association, vol. 5(1), pages 97-112, Winter.
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 A.F. Presbitero (2013) “Public debt and economic growth in advanced economies: A survey”. *Swiss Journal of Economics and Statistics*, 149, 175–204.
Panizza, H., and A.F. Presbitero (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/
Paul, P., (2017). "The Time-Varying Effect of Monetary Policy on Asset Prices," Working Paper Series 2017-9, Federal Reserve Bank of San Francisco, revised 02 Jan 2018.
Pesaran, M. H. & E., Tosetti,, (2011). "Large panels with common factors and spatial correlation," *Journal of Econometrics*, Elsevier, vol. 161(2), pages 182-202, April.
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.
Phillips, P. C. B. and D. Sul, (2009) "Economic transition and growth," *Journal of Applied Econometrics* 24(7): 1153-1185.
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.
Romer, P.M, (1986) "Increasing Returns and Long-run Growth," *Journal of Political Economy*, University of Chicago Press, vol. 94(5), pages 1002-1037, October.
Sala-i-Martin, X., G. Doppelhofer, R.I. Miller (2004) “Determinants of long-term growth: A Bayesian averaging of classical estimates (BACE) approach”. *American Economic Review* 94, 813-835.
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.
Wu, J. C. and F.D. Xia (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).

Appendix:

A.1. Data description and sources

Variable	Description	Unit	Source
dependent variable:			
gdpgr	real GDP growth	y-o-y growth rate in %	ECB (2018), IMF IFS
regressors:			
cycles:			
eqp_cycle	cycle of equity price indices	Deviation from the trend (by using CF filter)	ECB (2018), OECD, BIS and national sources
ltn_cycle	cycle of nominal long-term rates		ECB (2018), OECD, BIS and national sources
yer_ cycle	business cycle, from real GDP		ECB (2018), BIS and national sources
lhh_cycle	cycle of real credit to households		ECB (2018), BIS and national sources
lnf_cycle	cycle of real credit to non-financial corporations		ECB (2018), BIS and national sources
rpp_cycle	cycle of property prices		ECB (2018), BIS and national sources
tcn_cycle	cycle of real total credit to private non-financial sector		ECB (2018), BIS and national sources
synchronicity measures:			
ltn_lhh	synchronisation of the cycle of nominal long-term rates and of real credit to households	Either 1 (synchronised) or -1 (not)	Comunale (2019)
all the cycles combinations	cycles pairs (dummy equal 1 when same sign)		Comunale (2019)
real variables:			

Fiscal deficit	seasonally adjusted fiscal deficit: it refers to the public balance between government revenue and expenditure, a deficit when negative.	To GDP ratio in %	Eurostat
Debt/GDP	total government debt over GDP (quarterly)	To GDP ratio in %	Eurostat
reergr	country-specific growth rate of the REER vis-à-vis 41 partners and deflated by CPI	y-o-y growth rate in %	Eurostat
monetary factors:			
eonia_shadow	monthly data --> averaged to quarterly From 2004Q4 shadow rates from Wu and Xia (2016) for EA only. When ZLB not binding=EONIA	In b.p.	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 (ECB)
institutional factors:			
EURII	European Index of Regional Institutional Integration	From 0 (no integration) to 100 (complete integration)	Dorrucci et al. (2015) updated
sovereign and systemic stress:			
ciss	composite Indicator of Systemic Stress - Daily data --> averaged to quarterly	From 0 (min) to 1 (max systemic stress)	ECB SDW
sovciss	composite Indicator of Sovereign Stress (SovCISS)	From 0 (min) to 1 (max systemic stress)	ECB SDW

A.2. Selection of variables: WALS

	(t-value)	(t-value)
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-value)>1.5 (dark green), and it is the one we use here. In the literature is normally as abs(t)>1 (light green). The first column of each method includes the lag of the dependent variable (L.GDP growth). L. GDP growth is the first lag of GDP growth, fiscal deficit is defined as the public balance between government revenue and expenditure, a budget deficit when negative. It is in percentage GDP and so is total government debt (Debt/GDP). REER growth refers to the growth rate in the Real Effective Exchange Rate. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress and ST rates are the EONIA/shadow rates. EURII is the European Index of Regional Institutional Integration. The cycles are based on data from equity price indices (EQP), nominal long-term rates (LTN), real GDP (YER), real credit to households (LHH), real credit to non-financial corporations (LNF), property prices (RPP), real total credit to private non-financial sector (TCN). The synchronicities are based on cycle's pairs.

A.3. Selection of variables: BMA

	pip	pip	pip	pip	pip	pip	pip
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
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 (as in the literature). The columns from (1) to (2) represent different variables inclusions for cycles and synchronicities. This is because the BMA method does not allow a large number of variables to work. The first column of each method includes the lag of the dependent variable (L.GDP growth). L. GDP growth is the first lag of GDP growth, fiscal deficit is defined as the public balance between government revenue and expenditure, a budget deficit when negative. It is in percentage GDP and so is total government debt (Debt/GDP). REER growth refers to the growth rate in the Real Effective Exchange Rate. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress and ST rates are the EONIA/shadow rates. EURII is the European Index of Regional Institutional Integration. The cycles are based on data from equity price indices (EQP), nominal long-term rates (LTN), real GDP (YER), real credit to households (LHH), real credit to non-financial corporations (LNF), property prices (RPP), real total credit to private non-financial sector (TCN),. The synchronicities are based on cycle's pairs.

A.4. Comparison and selection of baseline

	BMA		WALS	
	pip	pip	(t-value)	(t-value)
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
Synchronicities				
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 first column of each method includes the lag of the dependent variable (L.GDP growth). . L. GDP growth is the first lag of GDP growth, fiscal deficit is defined as the public balance between government revenue and expenditure, a budget deficit when negative. It is in percentage GDP and so is total government debt (Debt/GDP). REER growth refers to the growth rate in the Real Effective Exchange Rate. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress and ST rates are the EONIA/shadow rates. EURII is the European Index of Regional Institutional Integration. The cycles are based on data from equity price indices (EQP), nominal long-term rates (LTN), real GDP (YER), real credit to households (LHH), real credit to non-financial corporations (LNF), property prices (RPP), real total credit to private non-financial sector (TCN),. 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)[42]. *means non-stationarity for all series (cannot reject the null or we do accept the null). EURII is the European Index of Regional Institutional Integration. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress, REERGR refers to the growth rate in the Real Effective Exchange Rate and ST rates are the EONIA/shadow rates.

[42] 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 (2017).

A.6 Low vs. high volatility of growth

VARIABLES	(1) Low volatility	(2) High volatility
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	240

Note: Mean Group estimator has been applied. “ec” is the error correction term. 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. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress, REERGR refers to the growth rate in the Real Effective Exchange Rate and ST rates are the EONIA/shadow rates.

Table A.7. Heterogeneous dynamic factor model with IV and corrections for cross-sectional dependence

VARIABLES	(1) GDP growth
L.GDP growth	-0.238
	(0.207)
L.debt/GDP	-0.274*
	(0.147)
L.EURII	0.906*
	(0.492)
L.sovciss	-0.0178
	(0.165)
L.reergr	-0.574*
	(0.310)
L.eqp_cycle	-0.215
	(0.157)
L.rpp_cycle	-0.266
	(0.196)
L.lnf_cycle	-0.0950
	(0.365)
Constant	-0.386
	(0.251)
Observations	517
Number of groups	9

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

Note: CCEMG-IV estimator has been applied. CISS and short-term rates are zero and omitted in the outcomes. All the Cross Sectional Averaged Variables are included with 2 lags and used as implicit controls. To be consistent, 2 lags as instruments to the other regressors are applied. 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. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress, REERGR refers to the growth rate in the Real Effective Exchange Rate and ST rates are the EONIA/shadow rates.

Table A.8. Baseline results with sub-samples: data until 2010q1

VARIABLES	(1) Baseline without synchronicity	(2) Baseline with synchronicity
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	0.001	
	(0.0009)	
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

Note: Mean Group estimator has been applied here. 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. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress, REERGR refers to the growth rate in the Real Effective Exchange Rate and ST rates are the EONIA/shadow rates.

Contributions analysis

We thus calculated the contributions of each of the factors in determining changes in the growth rates during the years before 2010, and from 2010 to 2016. These two periods were chosen to expose possible differences between the contribution before and after the sovereign debt crisis, and in order to obtain a clearer idea of the respective magnitudes. We did so by using the long-run coefficients (group-specific coefficients as in Table 2) multiplied by the difference in the factors in the considered period. The results for the two periods -- before 2010, and then from 2010 to 2016 -- are provided in the Appendix (A.1 and A.2 respectively).

The institutional factor is again the main one associated with higher GDP growth. The contribution is greater in magnitude during the first period, given the major advancement in EMU design between the 1990s to the 2000s; however, the positive contribution for increase in GDP growth is clearly evident also after the sovereign debt crisis. For Spain, Italy and Portugal, both before and after 2010, the magnitude of the contribution of EURII to growth is larger compared to the core countries by 6pp before the GFC, and by around 3pp afterwards.

Ultimately, as for the other factors, in the period 2010-2016, we also see a decrease in the CISS, which captures systemic stress, and this has had a positive influence on growth. To a lesser extent, we see in 2016 a positive contribution to growth from a decrease in the sovereign stress indicator. We can see an increase in the important positive role of price competitiveness between 2010 and 2016. The role of cycles is mostly negative, but small in relative terms. Lastly, the impact of the short-term interest rates could be somehow counterintuitive. This is because the coefficients are positive for the whole period, and it is only after the ZLB that a more accommodative monetary policy means a decrease in the shadow rate.

Figure A.1. Contributions until 2010

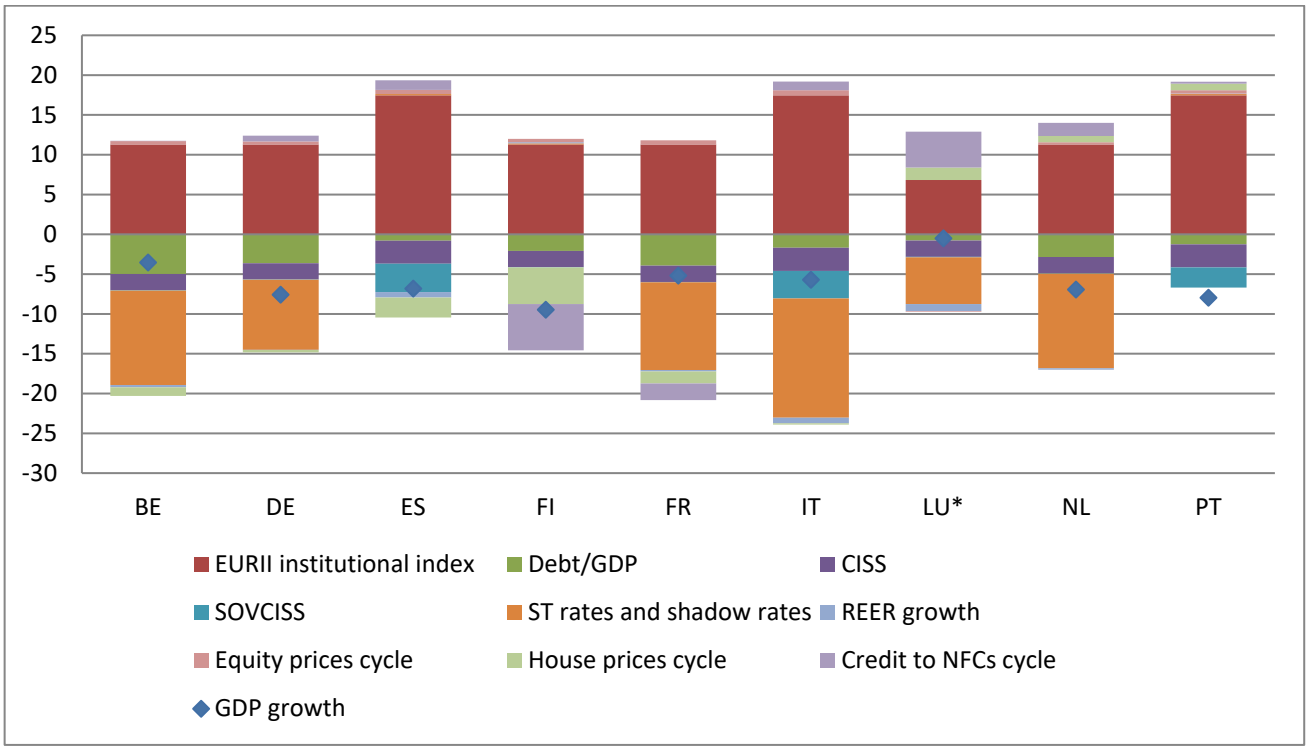
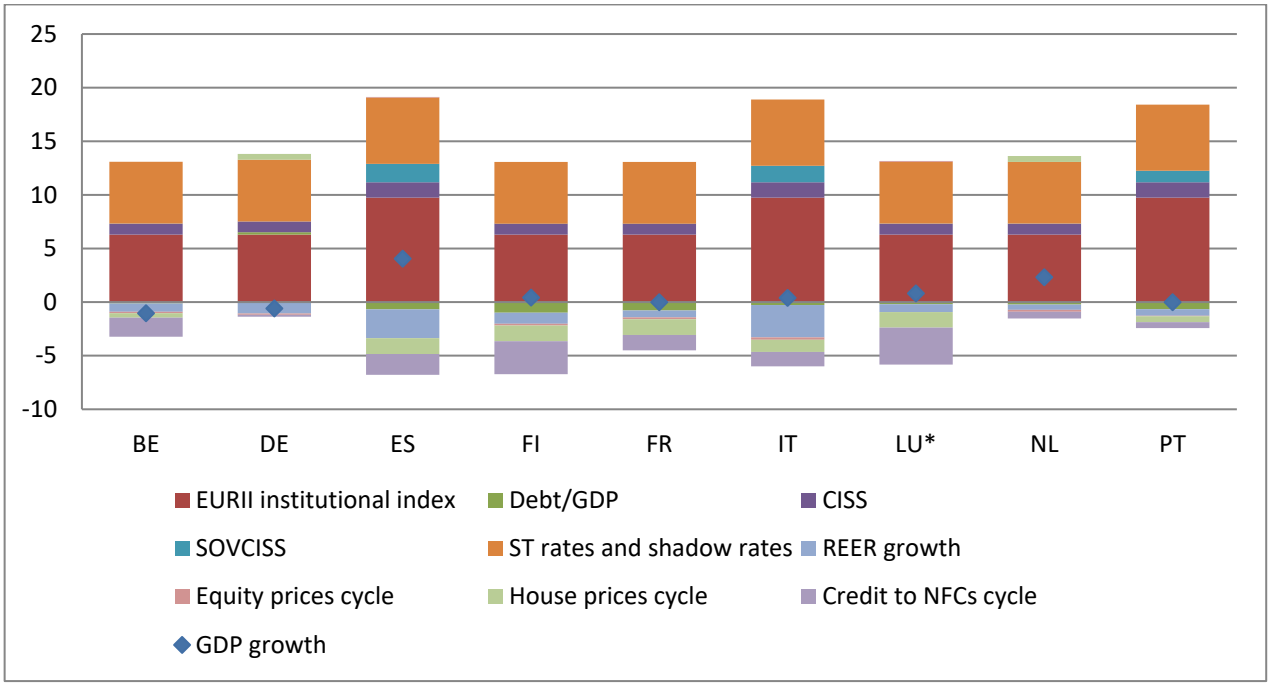
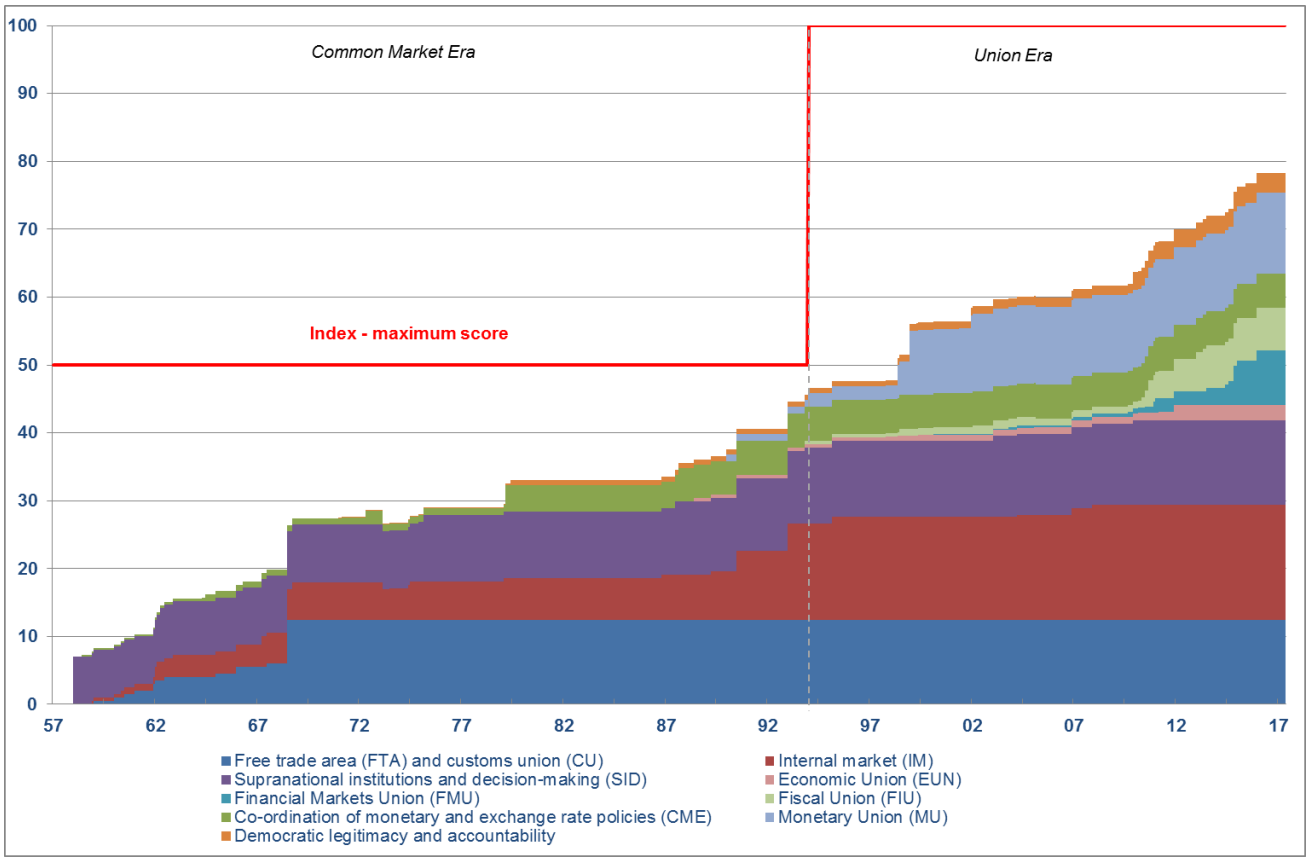


Figure A.2. Contributions from 2010 to 2016



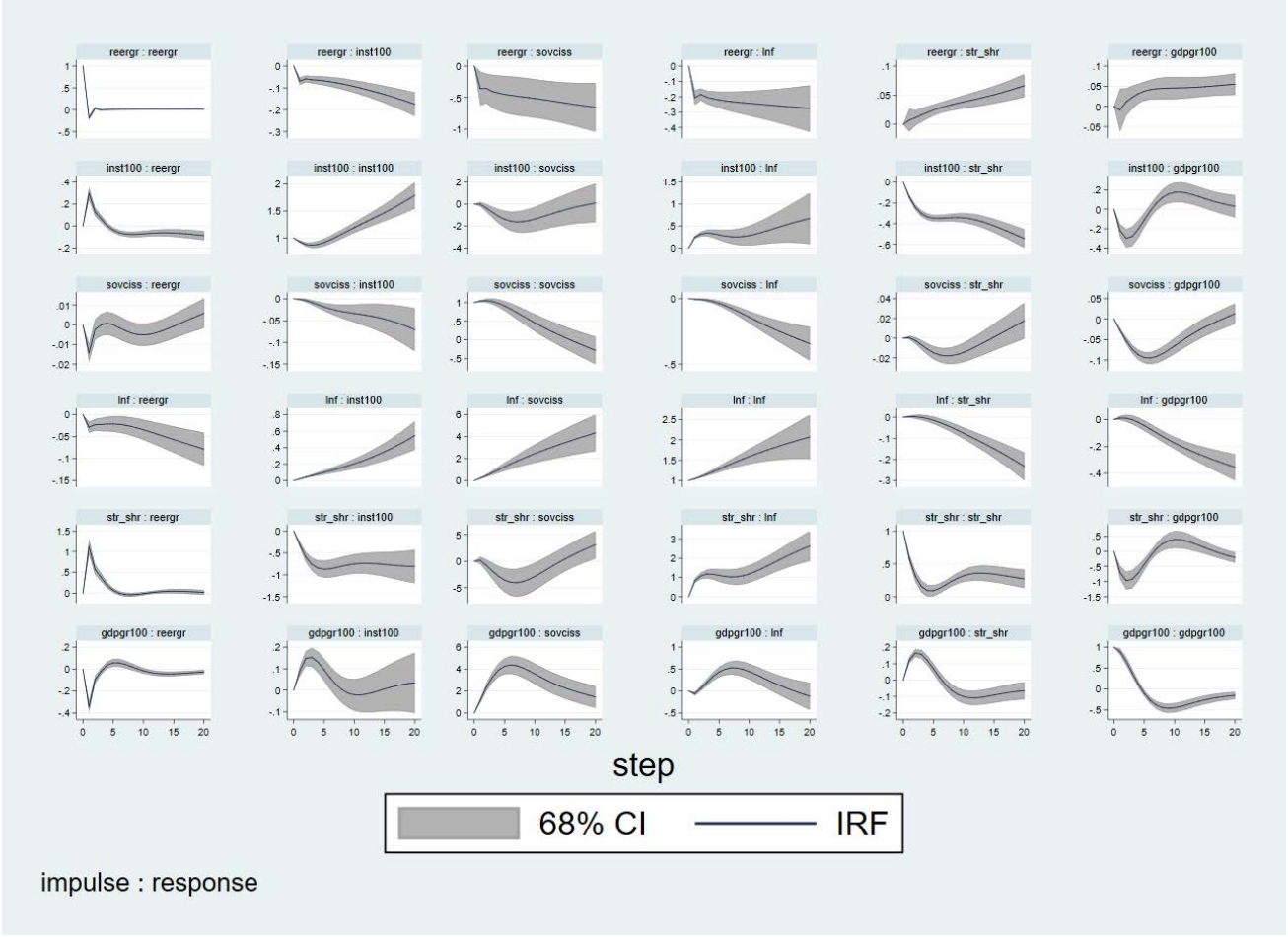
Note: The data for Luxembourg (LU*) are only from 1996Q1. The cycles are based on data from real GDP (YER), equity price indices (EQP), real total credit to private non-financial sector (TCN), real credit to non-financial corporations (LNF), real credit to households (LHH), property prices (RPP), nominal long-term rates (LTN). The synchronicities are based on cycle's pairs. EURII is the European Index of Regional Institutional Integration. CISS is the Composite Indicator of Systemic Stress, SOVCISS is the Composite Indicator of Sovereign Stress, REER growth refers to the growth rate in the Real Effective Exchange Rate and ST rates are the EONIA/shadow rates.

Figure A.3. The EURII index



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

Figure A.4. Panel VAR with EURII ordered last



Note: GDPGR100 is real GDP growth rate. REERGR refers to the growth rate in the Real Effective Exchange Rate. INST100 is the European Index of Regional Institutional Integration (EURII). SOVCISS is the Composite Indicator of Sovereign Stress. The cycles are based on data from real credit to non-financial corporations (LNF), STR_SHR are the EONIA/shadow rates.

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