Financial Cycles in Europe: Dynamics, Synchronicity and Implications for Business Cycles and Macroeconomic Imbalances

Amat Adarov[†]

This version: May 2019
Preliminary and incomplete. Do not cite or distribute without the author's permission.

Abstract

We estimate financial cycles for twenty European countries over the period 1960Q1–2015Q4 using dynamic factor models and state-space techniques and examine their cyclical properties, co-movement patterns and association with the business cycles. Using Bayesian panel VAR modeling we then assess dynamic interactions between financial imbalances as measured by the derived financial cycle index and external and internal macroeconomic imbalances based on the full European sample, its "core" and "periphery" sub-groups, as well as the euro area. We document the existence of slow-moving and persistent financial cycles for all countries in the sample, many of which also exhibit strong cross-country synchronization. Importantly, financial cycles are found to be an important driver of business cycles and public debt dynamics with much stronger shock transmission observed in the "core" and the euro area samples.

Keywords: financial cycles, macroeconomic imbalances, financial stability, business cycles, panel VAR, Bayesian VAR.
JEL Classification Numbers: E44, F32, G15, F4.

[†]Vienna Institute for International Economic Studies. Author's e-mail address: adarov@wiiw.ac.at. The study is supported by a research grant from the Austrian National Bank's Anniversary Fund (grant No.17044).

Contents

List of Figures

List of Tables

1 Introduction

The global financial crisis of 2007–2008 has put financial stability considerations at the center of policy discussions focusing on macroeconomic resilience and sustainable economic growth. The debate revisiting economic implications and impacts of financial markets has revealed major weaknesses in the existing macroeconomic policy frameworks driven largely by price stability considerations and neglecting financial market stability and risks, which proved to be costly. Financial markets appear to be prone to persistent long-run cyclical fluctuations—"financial cycles"—reflecting the build-up of imbalances as credit rapidly expands and asset prices rise to overinflated levels, followed by market corrections often taking the form of sharp adjustments (Adarov, 2018; Borio, 2013, 2014).

Therefore, while deep financial markets are indeed important for economic development, as the "finance-growth nexus" literature documents (Goldsmith, 1969; McKinnon, 1973; Shaw, 1973, Beck and Levine, 2004; Beck et al., 2000; Demetriades and Hussein 1996; King and Levine, 1993; Levine, 1997; Levine and Zervos, 1998; Rousseau and Wachtel, 2011), fluctuations in financial market activity may, by contrast, lead to vastly destabilizing macroeconomic effects.

In Europe the risk is aggravated by its overreliance on financial intermediation via banks, whereas capital markets remain less developed. This is believed to be among the factors that contributed to the depth of the recent crisis in Europe, prompting a renewed debate on the necessity to foster deeper capital markets and thereby diversify funding sources and facilitate risk sharing. In this paper we take a closer look at European financial markets from the perspective of their long-run cyclical dynamics, i.e. financial cycles, their co-movement patterns and implications for business cycles and macroeconomic imbalances.

Thematically thus the paper is most closely related to the growing empirical literature on financial cycles, including research on credit booms, financial stress and asset bubbles. While the idea of inherent instability and the cyclical nature of financial market dynamics conceptually is not new per se, going back to Minsky (1978, 1982), Kindleberger (1978) and related works, the crisis has revived interest in the topic. A growing body of research focuses on the estimation and analysis of financial cycles (Adarov, 2018; Aikman et al., 2015; Borio, 2013, 2014; Borio et al., 2013, 2014; Claessens et al., 2011, 2012; Claessens and Kose 2017; Drehmann et al., 2012; Hatzius et al. 2010; Miranda-Agrippino and Rey, 2015; Nowotny et al., 2014; Schüler et al., 2015; Schularick and Taylor, 2012; Stremmel, 2015). To date, only a few studies empirically document and analyze financial cycles focusing specifically on Europe, the EU or the euro area. Among the recent contributions, Schüler et al. (2016) estimate financial cycle indicators for euro area countries using credit, house, equity and bond prices. Rünstler et al. (2018) analyze cycles and study their properties for real GDP, house prices, credit, and nominal liquid financial assets in 17 EU countries. Similarly, in Stremmel (2015) financial cycles are extracted for 11 European countries using various credit aggregates and asset prices. All studies report the existence of slow-moving cycles in financial markets, which are closely associated with financial distress episodes. Examining the implications of financial cycles for current account balances and real effective exchange rates in EU countries, Comunale (2017) applies panel and Bayesian techniques and finds that financial gaps can have a greater influence on current account misalignments than output gaps. The literature however is still rather scarce, particularly, as regards the analysis of macroeconomic implications of financial cycles.

In this paper we contribute to the debate by deriving a novel financial cycle measure computed as a synthetic index based on aggregation of information from a large number of observable market characteristics conveying price, quantity and risk dynamics across four financial market segments—credit, housing, equity and bond markets. This allows for a more comprehensive approach to measuring financial cycles as opposed to proxy variables, for instance, credit-to-GDP ratios[1], and capture the joint dynamics of the banking sector, capital markets and the housing sectors. Second, the paper employs Bayesian panel vector autoregression (PVAR) approach to estimate the impact of financial cycles on macroeconomic imbalances. This framework allows to take take advantage of the richer information content contained in panel data as opposed to VAR models for individual countries, at the same time allowing for fully endogeneous covariates and dynamic interactions among them, in contrast to conventional panel data models, while Bayesian shrinkage mitigates overparametrization issues, especially relevant in the context of short data span available for many European countries. Finally, and related to the above, we study financial cycles for a broader set of European countries, comprising advanced and developing economies, while the literature mostly focuses on selected EU or euro area countries. Inter alia, this permits us to explore heterogeneous effects within Europe by estimating the extent of macro-financial spillovers for the European core and periphery countries, as well as the euro area, in addition to the full European sample.

More specifically, in this paper we estimate segment-specific and aggregate financial cycles for 20 European countries over the period 1960Q1–2015Q4 using dynamic factor modeling and state-space techniques, analyze their cyclical properties, cross-country synchronization and association with business cycles. We find that activity in financial markets is indeed characterized by highly persistent and recurring cyclical nature. These financial cycles fluctuate at much lower frequencies than business cycles and have a strong association with major financial distress episodes. In general, the length of European financial cycles falls into the range of 8–12 years, and for some countries is even longer reaching up to 20 years.

We find significant general co-movement among national financial cycles within Europe, and for many countries financial cycles are synchronized 70-80% of time, as measured by the phase concordance index. The analysis of contemporaneous synchronization between financial and business cycles reveals rather mixed patterns across countries, although for some countries co-movement between real and financial cycles is rather high, particularly for Hungary, Italy, Germany (financial cycles and business cycles tend to move in sync 70% of time or more).

To further disentangle the transmission of financial cycle shocks to economies we use Bayesian panel VAR framework, which allows for fully endogenous covariates in a panel data setting and addresses the "curse of dimensionality" issues. Using a parsimonious four-variable setup incorporating the derived financial cycle index, output gap as a percentage of potential GDP, current account balance as a share of GDP and general government debt as a share of GDP, we find that financial cycles do have non-trivial impacts on macroeconomic imbalances. The analysis strongly indicates in favor of the hypothesis that financial cycles indeed constitute an important

[1] See, for instance, Aikman et al., 2015; Claessens et al., 2012; Dell'Arriccia et al., 2012; Schularick and Taylor, 2012.

driver of business cycles, as well as influence the dynamics of debt-to-GDP ratio (the impact on current account balances appears to be largely insignificant). The magnitude of the impact is also non-negligible: a one-standard deviation shock in the financial cycle variable induces macroeconomic overheating equivalent to 0.5 percent of potential GDP (positive output gap) and a decline by 0.7 in the ratio of public debt to GDP. The strong impact on output gaps is attributed largely to the reaction in the core European economies, while the response in the periphery group is less statistically and economically significant. Notably, for the core European economies the relative importance of financial cycles for public debt-to-GDP ratios appears to be greater than that of the business cycle fluctuations. Fifteen percent of forecast error variance in output gap is explained by financial cycles in the case of the European core countries (five percent for the full European sample).

At the same time, in the euro area financial cycles invoke a particularly strong reaction of public debt ratios and a much stronger compared to other cases, albeit only marginally significant, reaction of the current account balance, revealing important implications of constraints imposed by the monetary union arrangements. The response is also highly persistent, especially in the case of the fiscal position variable: a one-standard-deviation positive shock in the financial cycle variable reduces the debt ratio by about one percent of GDP on impact (peak response) with the effect phasing out at the horizon of ten years.

The results have important policy implications highlighting the significance of tackling the buildup of financial imbalances as one of the roots of macroeconomic overheating leading to macroeconomic crises. Inter alia, besides an important role of prudential regulations to tackle systemic risks, this implies that macroeconomic policy frameworks focusing exclusively or predominantly on targeting inflation as the principal nominal anchor may be a suboptimal and need to be adjusted to allow for a more proactive monitoring and policy response to the buildup of financial misalignments. As a related matter, deepening of financial markets, and, particularly, the strive to facilitate capital markets in Europe, besides the known benefits, may carry additional macroeconomic stability risks associated with the interplay between self-reinforcing build-up of financial market imbalances and related boom-bust cycles, deepening macro-financial linkages across countries and increasing complexity of financial innovation, which need to be taken into account when designing the future European financial architecture.

The remainder of the paper is organized as follows. Section 2 describes the sample and data. Section 3 examines segment-specific and aggregate financial cycles and their properties. Section 4 reviews the extent to which financial cycles of European countries are synchronized, as well as reviews their co-movement with business cycles. Section 5 analyzes interactions between macro-financial imbalances for Europe. Section 6 reviews policy implications and concludes.

2 Data and sample

Segment-specific and aggregate financial cycles are estimated at a quarterly frequency for 20 European countries over the period 1960Q1–2015Q4 based on a large number of financial market variables. For the purposes of the panel VAR analysis of macro-financial spillovers we employ variables at an annual frequency and use a smaller strongly balanced panel data, which reduces the sample by three countries. Table 1 summarizes the country composition of the full sample and subgroups used in additional case studies (the European "core" and "periphery" countries, the euro area). The country composition and the length of the period under consideration is constrained by the availability of the data. In this regard, when estimating financial cycles, financial market data has been particularly limiting for the transition economies of Europe, for which the data is often available only in the post-2000 period and only for a limited number of series.

Table 1: Sample composition and characteristics

sample	countries included	period	N	T	Obs
A. Europe: quarterly full sample, unbalanced	Austria (AUT), Belgium (BEL), Switzerland (CHE), Czech Republic (CZE), Germany (DEU), Spain (ESP), Estonia (EST), Finland (FIN), France (FRA), United Kingdom (GBR), Hungary (HUN), Italy (ITA), Lithuania (LTU), latvia (LVA), Netherlands (NLD), Norway (NOR), Poland (POL), Russia (RUS), Slovakia (SVK), Sweden (SWE)	1960Q1–2015Q4	20	227	4540
B. Europe: annual full sample, strongly balanced	AUT, BEL, CHE, CZE, DEU, ESP, EST, FIN, FRA, GBR, HUN, ITA, NLD, NOR, POL, SVK, SWE	1998-2012	17	15	255
C. Europe: core	AUT, BEL, CHE, DEU, FRA, GBR, NLD	1998-2012	7	15	105
D. Europe: periphery	CZE, ESP, EST, FIN, HUN, ITA, NOR, POL, SVK, SWE	1998-2012	10	15	150
E. Euro area	AUT, BEL, DEU, ESP, EST, FIN, FRA, ITA, NLD, SVK	1998-2012	10	15	150

The data for financial markets, which was used for the estimation of financial cycles (discussed in the next section), is obtained from multiples sources, including Bank for International Settlements databases, IMF International Financial Statistics, OECD Main Economic Indicators, OECD Housing Statistics, Federal Reserve Economic Data, World Bank Global Financial Development Database, Investing.com, Yahoo Finance, Haver Analytics and national monetary authorities.

Table 2: Descriptive statistics and data sources, full sample

Variable name	Variable description	N	Mean	Std. dev.	Min	Max	Source
FC	Financial cycle index	255	0.07	0.83	-2.32	2.48	Own estimates
$YGAP$	Output gap, percent of potential GDP	255	0.13	2.63	-11.36	11.86	IMF World Economic Outlook, OECD Economic Outlook
CA	Current account balance, percent of GDP	255	0.68	6.15	-14.98	16.23	IMF World Economic Outlook
$DEBT$	General government debt, percent of GDP	255	54.75	25.52	3.66	123.34	IMF Historical Public Debt Database, IMF Global Debt Database

As regards the annual data use in the analysis of macroeconomic imbalances, the data sources along with descriptive statistics are listed in Table 2. Output gap estimates are obtained from the IMF World Economic Outlook and complemented by the OECD Economic Outlook for missing or shorter series. The public debt data are sourced from the IMF Historical Public Debt and the IMF Global Debt databases.

3 Estimation of segment-specific and aggregate financial cycles

3.1 State-space model for derivation of financial cycles

In this paper we focus on the properties and implications of European financial cycles, estimation details for the global sample of countries are documented in detail in Adarov (2018a,b). Financial cycles reflect the buildup and correction of imbalances in financial markets due to changing risk perceptions, liquidity conditions, and other demand and supply factors, and empirically manifest themselves in the form of repeated boom-bust cycles. In order to quantify these fluctuations we estimate financial cycle indexes for each financial market segment of each country in the sample using a separate dynamic factor model. Thus, for each country we first estimate segment-specific financial cycles for the four key financial market segments: the banking sector, housing, equity and debt security markets.

Figure 1: Estimation of aggregate financial cycles

*s*private credit by banks, lending, deposit and other interest rates, maturity and risk interest rate spreads → FC_c^{CR} (credit cycle)

real housing price index, price to rent and price to income ratios → FC_c^{H} (housing cycle)

maturity and risk bond yield spreads, government and corporate bond yields, bond market capitalization → FC_c^{B} (bond cycle)

benchmark stock market index returns, volatility of returns, stock market capitalization → FC_c^{EQ} (equity cycle)

FC_c^{CR}, FC_c^{H}, FC_c^{B}, FC_c^{EQ} → FC_c^{AG} (aggregate cycle)

Then, the estimated segment-specific financial cycles are used to extract a national aggregate financial cycle, characterizing the state of financial markets in a given country in general. The latent dynamic common factor is extracted from a range of observable variables conveying price, quantity and risk characteristics of activity in each of the four financial market segments, data permitting. Figure 1 summarizes the estimation sequencing listing some most commonly used variables (a detailed variable composition behind each financial cycle is available in Appendix B listing factor loadings and their statistical significance).

The dynamic factor models (Geweke, 1977; Sargent and Sims, 1977) are formulated in a state-space form, which allows their estimation via the Kalman filter and smoother. For country c's financial market segment S, the vector of observable financial market variables [2]

[2] The variables are standardized (demeaned and divided by their sample standard deviation) to ensure their variance contributes to the variance of the estimated latent factor symmetric regardless of their measurement scale and historical volatility.

$\mathbf{y}^S_{c,t} = [y_{c1t} \ ... \ y_{cNt}]'$ for $t = 1...T$ is modeled as the sum of the unobservable common factor $f^S_{c,t}$ and the vector of idiosyncratic shocks $\mathbf{v^S_{c,t}}$:

$$\begin{cases} f^S_{c,t} = \alpha^S_c \times f^S_{c,t-1} + u^S_{c,t} \\ \mathbf{y}^S_{c,t} = \mathbf{B^S_c} \times f^S_{c,t} + \mathbf{v^S_{c,t}} \end{cases} \tag{1}$$

where the state equation specifies a first-order autoregressive process with the persistence parameter α^S_c for the latent factor $f^S_{c,t}$. The $N \times 1$ vector of factor loadings $\mathbf{B^S_c}$ links N observable input financial variables to the latent common factor; $u^S_{c,t}$ and $\mathbf{v^S_{c,t}}$ are the state and the measurement equation *i.i.d.* error terms. The estimated common factor $\hat{f}^S_{c,t}$ in a standardized form (scaled to have a zero mean and a standard deviation of unity) constitutes a segment-specific financial cycle index for a given country and market segment.

Estimation of aggregate financial cycles for each country c is based on a state-space system with a similar structure, but using the four previously estimated segment-specific financial cycles as observed variables comprising the vector $\hat{\mathbf{f}}^S_{c,t}$ in the measurement equation:

$$\begin{cases} f^{AG}_{c,t} = \alpha^{AG}_c \times f^{AG}_{c,t-1} + u^{AG}_{c,t} \\ \hat{\mathbf{f}}^S_{c,t} = \mathbf{B^{AG}_c} \times f^{AG}_{c,t} + \mathbf{v^{AG}_{c,t}} \end{cases} \tag{2}$$

The aggregate financial cycle index is then the estimated factor, standardized to have a zero mean and a standard deviation of unity, which helps to interpret its magnitude in terms of standard deviations from the historical mean. For some countries estimation of certain segment-specific cycles is not possible given lack of data or the series are too short. In such cases we include instead a proxy variable with longer data availability (checking that the proxy variable co-moves with the estimated cycle) for a given segment-specific financial cycle (in particular, in a few cases real housing price index is used as a proxy for the synthetic housing financial cycle). An alternative model for estimating aggregate financial cycles uses observable financial market variables pooled across the four financial market segments instead of segment-specific financial cycles. Both estimation strategies however yield largely identical results.

Furthermore, in addition to the original financial cycle measure, we also use the Hodrick-Prescott filter to arrive at a "smoothed" version of financial cycles, which permits a more convenient interpretation of its long-run dynamics.[3]

3.2 Overview of European financial cycles and their key properties

The results for the smoothed segment-specific and aggregate financial cycles for each country in the sample are shown in Figure 2 (sorted alphabetically by ISO3 code). In addition, Figure 3 reports aggregate smoothed and unsmoothed financial cycles. As one can see, financial cycles reflect well major systemic financial market events, the synchronized downturn associated with the recent global financial crisis, as well as country-specific financial market distress episodes.

[3] In particular, the signal-to-noise ratio $\lambda = 1600$ is used to estimate the smoothed version, which is a typical choice for quarterly data. Alternative statistical filters, e.g. Christiano-Fitzerald, yield similar results.

It is also obvious that financial cycles tend to move at lower frequencies in comparison with business cycles, and it takes on average a decade for broad financial cycles to fully complete. In general, segment-specific cycles tend to move together during major boom-bust episodes, which are also picked up by the aggregate financial cycles. In many cases, however, stock market cycles exhibit leading properties relative to other segment-specific cycles as regards the timing of their turning points and phase sequencing.

Estimated financial cycles are highly persistent (Appendix B reports details on the variable composition, factor loadings and estimated persistence parameters for segment-specific and aggregate financial cycles for each country in the sample). The fitted autoregressive parameter yields generally very high values, in many cases reaching and exceeding 0.8–0.9, signifying that the accumulation of financial market imbalances and following corrections constitutes a rather persistent process as evidenced by financial cycles, which holds for both aggregate and segment specific cycles.

In order to pinpoint peaks and troughs, as well as quantify phases and cycles more precisely, we apply the BBQ turning point identification algorithm (Harding and Pagan, 2002) to dissect financial cycles them into alternating expansion and contraction phases. The BBQ algorithm is widely used in the literature on business cycles and is the quarterly implementation of the Bry and Boschan (1971) procedure developed originally for monthly frequency data. The algorithm identifies local peaks and troughs subject to constraints on the search window and minimum duration of cycles or phases. In our application, we set the moving search window $[\tilde{t}-k; \tilde{t}+k]$ to $k = 9$ quarters and the minimum phase duration to 3 quarters to avoid a possible bias towards long cycles. For a variable ψ (business cycle or financial cycle variables) the turning points tp are then defined as follows:

$$tp = 1 \text{ (peak) at } t = \tilde{t} \text{ if: } \begin{cases} \psi_{\tilde{t}} > 0; \psi_{\tilde{t}-1} > 0; \psi_{\tilde{t}-2} > 0 \\ \psi_{\tilde{t}+1} < 0; \psi_{\tilde{t}+2} < 0; \psi_{\tilde{t}+3} < 0 \\ \min |\tilde{t}_{peak} - t_{trough}| \geqslant 3 \text{ quarters} \end{cases} \tag{3}$$

$$tp = \text{-1 (trough) at } t = \tilde{t} \text{ if: } \begin{cases} \psi_{\tilde{t}} < 0; \psi_{\tilde{t}-1} < 0; \psi_{\tilde{t}-2} < 0 \\ \psi_{\tilde{t}+1} > 0; \psi_{\tilde{t}+2} > 0; \psi_{\tilde{t}+3} > 0 \\ \min |\tilde{t}_{peak} - t_{trough}| \geqslant 3 \text{ quarters} \end{cases} \tag{4}$$

Table 3 shows the average phase and cycle duration for each country and a summary for the sample (for both smoothed and unsmoothed aggregate financial cycles), also indicating the number of turning points identified by the BBQ algorithm.[4] In particular, it is noted that the duration of financial cycles across all segments and countries tends to be 6–8 years (9–15 years for the smoothed financial cycles). This also holds for European financial cycles. The average length of a financial cycle for the European sample is 8 years for unsmoothed FC and 12 years after smoothing is applied.

Notably, as can be seen by comparing the length of expansion and contraction phases in Table 3, financial cycles exhibit asymmetry and a "sawtooth" shape shape (as opposed to a

[4] For reference, summary statistics for the global sample are also provided. The discussion of the properties for a broader global sample of countries is available in Adarov (2018).

symmetric "sinewave" shape), with the buildup of financial imbalances being a relatively more protracted process than contractions, which often take the form of abrupt adjustments (financial crises). On average, financial cycle expansions are about six quarters longer than contractions, which holds for both smoothed and unsmoothed cycles.

Table 3: Cyclical properties of financial cycles

Notes: The table shows average duration in quarters of phases (**Avg. phase**) and cycles (**Avg. cycle**) for national aggregate financial cycles, smoothed and unsmoothed. The countries are listed by ISO3 code in alphabetic order. **Obs.** indicates the number of observations; **Exp. phase** and **Cont. phase** denote expansion and contraction phases; **TP count** denotes the number of turning points identified. * - the summary statistics provided for reference for the global sample are from Adarov (2018) and are based on 34 countries. Blanks indicate cases when turning points were not identified and thus a concordance index could not be computed.

Country	**Obs**	**Smoothed *FC***					**Unsmoothed *FC***				
		Exp. phase	**Cont. phase**	**Avg phase**	**Avg cycle**	**TP count**	**Exp. phase**	**Cont. phase**	**Avg phase**	**Avg cycle**	**TP count**
AUT	180	21.0	17.7	19.3	38.6	7	24.5	12.7	19.4	38.0	8
BEL	115	17.0	17.7	17.4	33.3	6	12.7	11.3	11.9	24.5	8
CHE	133	51.0	28.0	39.5	79.0	3	12.0	25.5	18.8	34.7	5
CZE	84	32.0		32.0		2	14.0	9.0	11.5	21.0	5
DEU	166	17.8	16.3	17.0	35.4	9	18.5	14.2	16.1	34.5	10
ESP	116	42.0	28.0	35.0	70.0	3	46.0	27.0	36.5	73.0	3
EST	71	25.0	18.0	21.5	43.0	3	17.5	6.0	11.8	23.7	5
FIN	89	42.0		42.0		2	19.0	10.0	16.0	29.0	4
FRA	148	17.0	15.8	16.3	32.8	8	16.0	17.3	16.7	32.5	8
GBR	133	34.0	30.0	31.3	64.0	4	21.0	15.3	17.6	36.0	6
HUN	92		43.0	43.0		2	14.0	17.0	16.0	31.0	4
ITA	133	40.0	26.0	33.0	66.0	3	15.5	11.5	13.5	28.0	9
LTU	55		19.0	19.0		2		15.0	15.0		2
LVA	56						15.0		15.0		2
NLD	90	14.0	18.0	16.0	32.0	3	18.0	8.3	12.2	27.0	6
NOR	124	22.0	15.0	19.7	37.0	4	19.0	11.5	14.7	30.2	8
POL	72						11.0	10.5	10.7	21.5	4
RUS	72		20.0	20.0		2	25.0	15.0	20.0	40.0	3
SVK	69	25.0		25.0		2	33.0	10.0	21.5	43.0	3
SWE	135	19.0	20.0	19.6	37.3	6	24.0	14.7	18.4	37.8	6
European sample											
avg	*106.7*	*27.9*	*22.2*	*25.9*	*47.4*	*3.9*	*19.8*	*13.8*	*16.7*	*33.6*	*5.5*
min	*55.0*	*14.0*	*15.0*	*16.0*	*32.0*	*2.0*	*11.0*	*6.0*	*10.7*	*21.0*	*2.0*
max	*180.0*	*51.0*	*43.0*	*43.0*	*79.0*	*9.0*	*46.0*	*27.0*	*36.5*	*73.0*	*10.0*
*Global sample**											
avg	*110.5*	*27.1*	*22.5*	*25.3*	*47.8*	*3.9*	*18.2*	*13.3*	*15.8*	*31.3*	*5.9*
min	*55.0*	*13.0*	*13.0*	*13.8*	*26.7*	*2.0*	*9.0*	*6.0*	*8.3*	*15.4*	*2.0*
max	*180.0*	*51.0*	*43.0*	*43.0*	*79.0*	*9.0*	*46.0*	*27.0*	*36.5*	*73.0*	*10.0*

Figure 2: Aggregate and segment-specific financial cycles in Europe

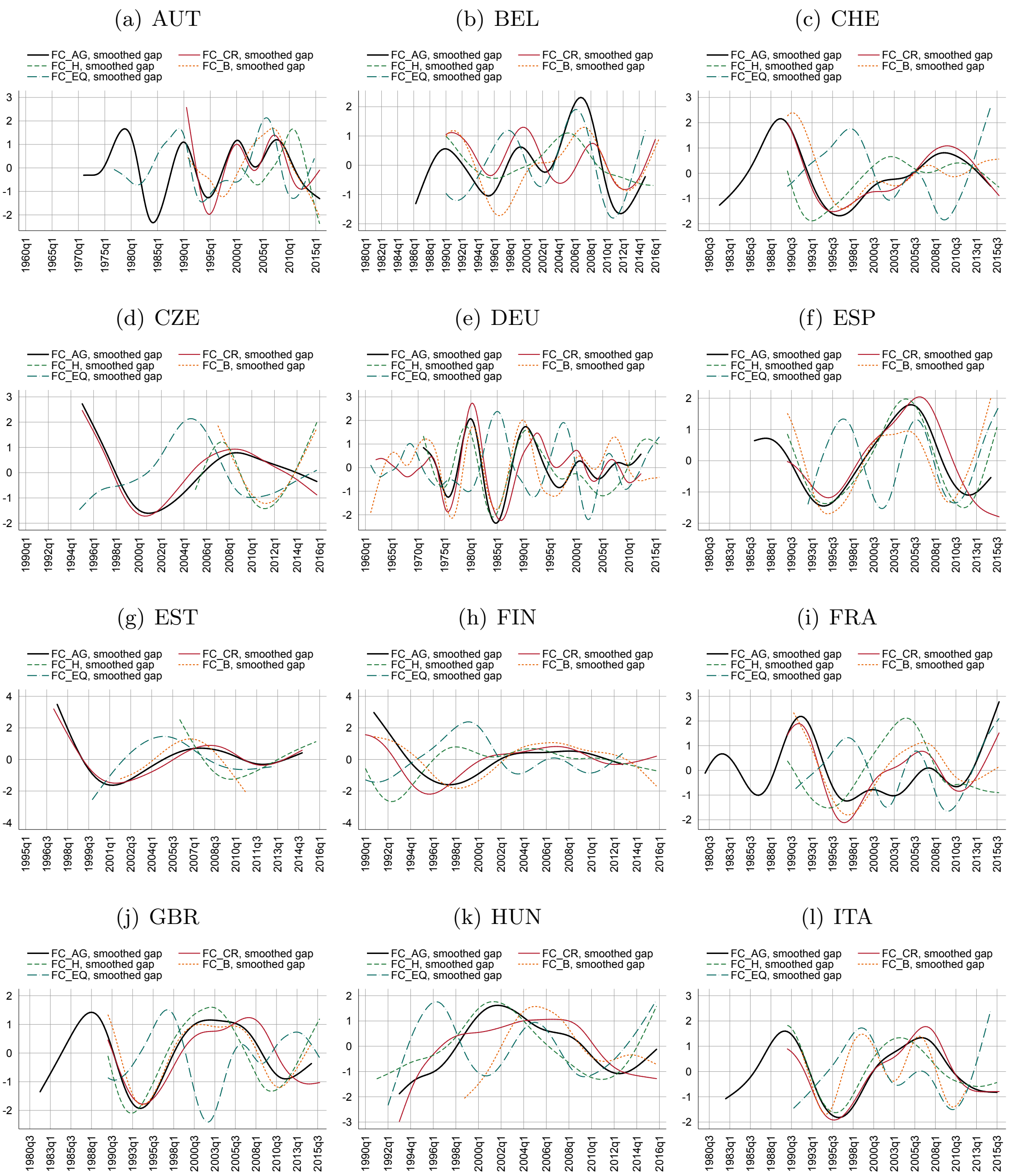


Figure 2 (cont.): Aggregate and segment-specific financial cycles in Europe

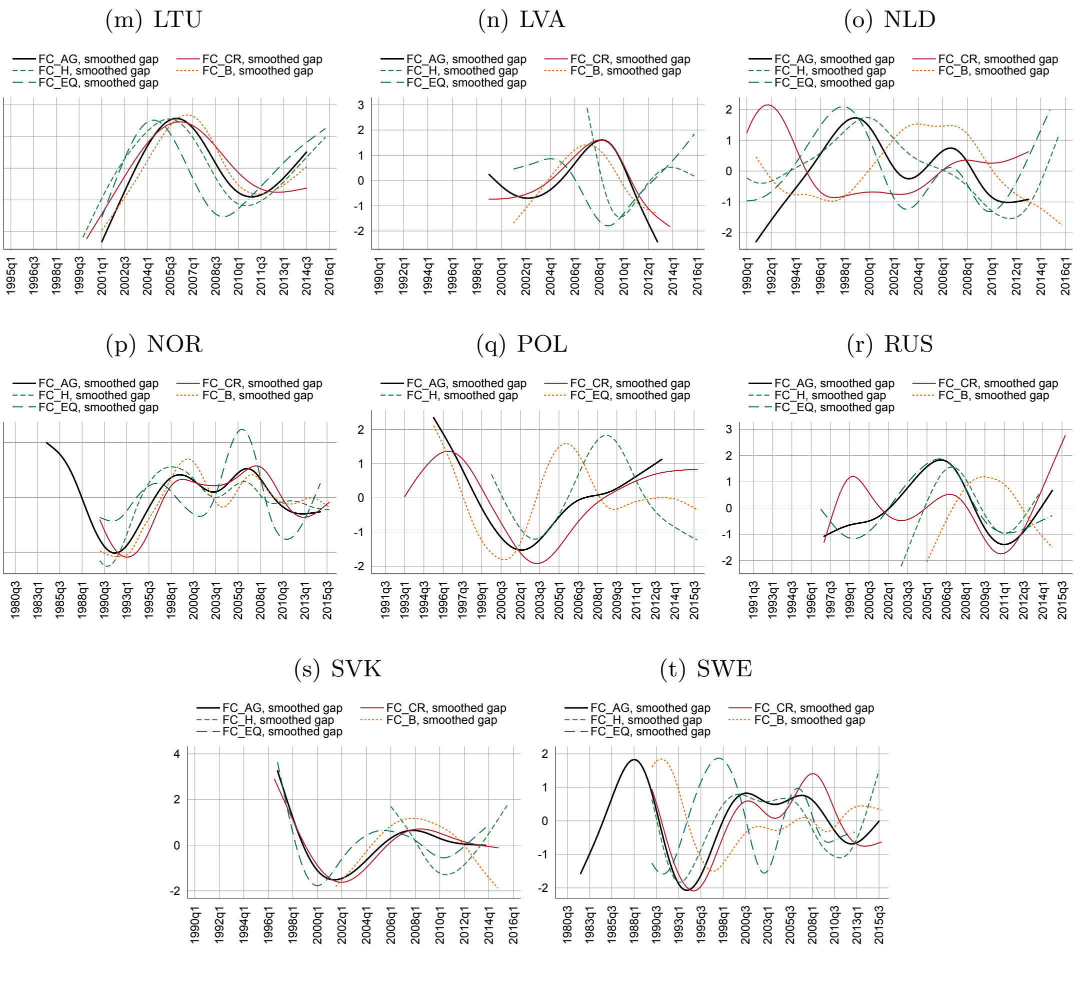


Figure 3: Aggregate financial cycles in Europe

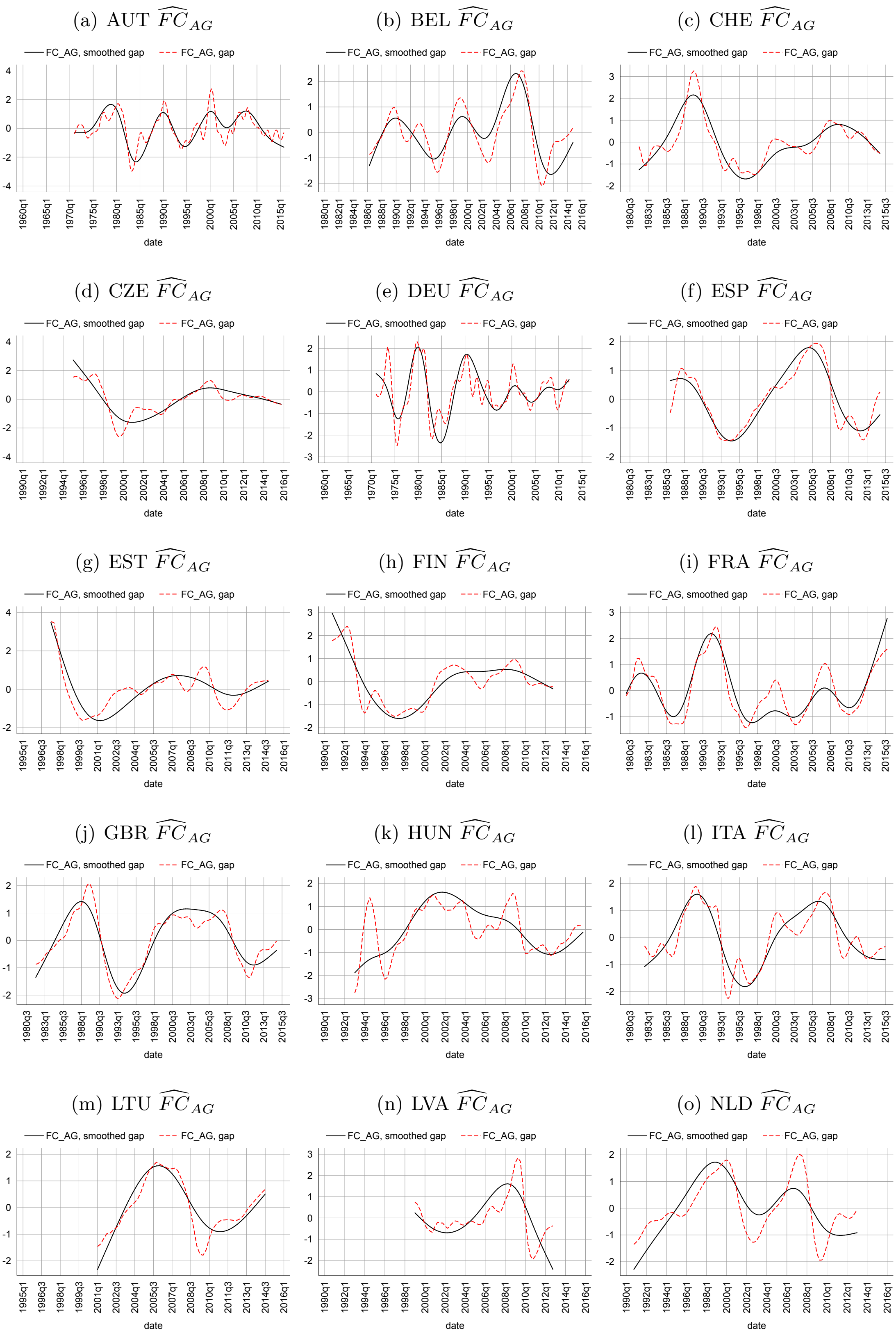
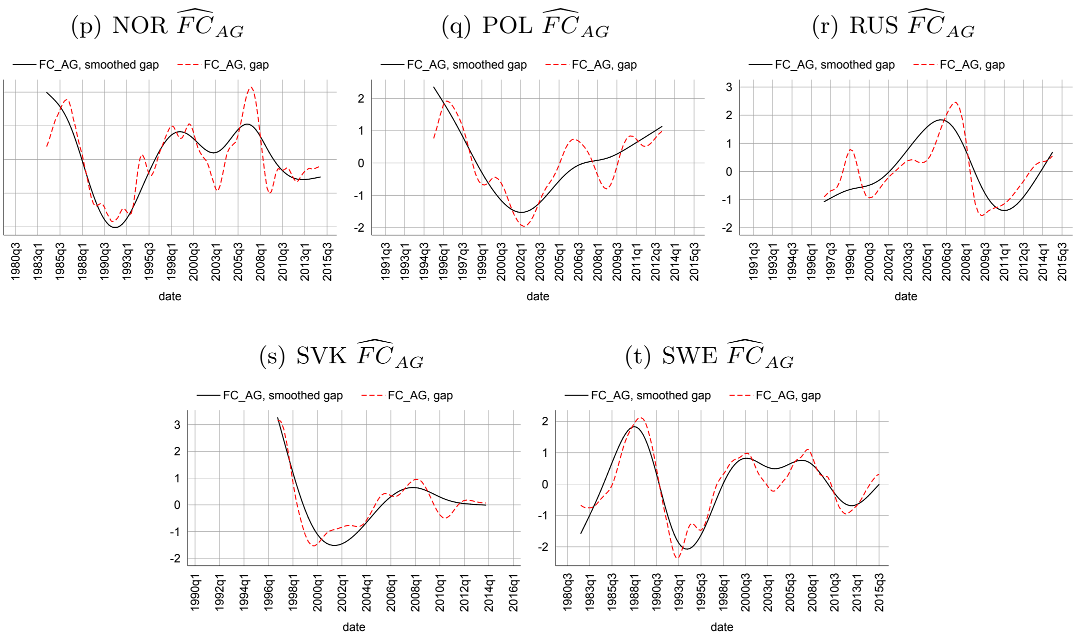


Figure 3 (cont.): Aggregate financial cycles in Europe



4 Cross-country synchronicity of financial cycles and co-movement with business cycles

4.1 Synchronicity between financial cycles and business cycles

In order to measure synchronicity of financial cycles across countries, as well as co-movement between financial cycles and business cycles we compute concordance indexes. A concordance index measures the share of time over which two given series are in the same phase (expansion or contraction) over the observed period of time.

The measure of business cycles BC is obtained by applying the Christiano-Fitzgerald band-pass filter to quarterly seasonally adjusted real GDP data series for each of the twenty countries in the sample. We filter out stochastic cycles at frequencies smaller than 6 and greater than 32 quarters. Alternative statistical filters (Baxter-King and the Hodrock-Prescott filters) produce very similar results. We then identify turning points for BC using the BBQ algorithm as described above for the financial cycles.

Using the identified turning points we compute $\Omega_c^{FC,BC}$ measuring co-movement between business cycles (BC_c) and financial cycles (FC_c) for each country c as follows:

$$\Omega_c^{FC,BC} = \frac{1}{T}\sum_{t=1}^{T}\left[\phi_{c,t}^{FC}\phi_{c,t}^{BC} + (1-\phi_{c,t}^{FC})(1-\phi_{c,t}^{BC})\right] \tag{5}$$

where $\phi_{c,t}^{FC}$ and $\phi_{c,t}^{BC}$ are the phase indicators for financial cycles and business cycles defined as:

$$\phi_{c,t}^{FC} \text{ (or } \phi_{c,t}^{BC}) = \begin{cases} 1 \text{ if } FC_c \text{ (or } BC_c) \text{ is in the expansion phase in } t \\ 0 \text{ if } FC_c \text{ (or } BC_c) \text{ is in the contraction phase in } t \end{cases} \tag{6}$$

By construction, $\Omega_c^{FC,BC}$ is 1 if both cycles are perfectly synchronized over the entire period T, and takes the value of 0 if the two series always move in opposite directions. $\Omega_{c1,c2}^{FC}$ is computed in the same fashion. The concordance index is better suited for measuring cyclical co-movement in comparison to correlations. The latter however is also examined as a complementary measure.

Table 4 reports the computed concordance index based on quarterly FC and BC series. We also indicate the length of the time (quarters) over which both cycles are available for a given country (T) as, obviously, $\Omega_c^{FC,BC}$ based on higher T implies a more robust relationship. For European transition economies the data is particularly scarce and high co-movement is largely associated with the Great Recession. At the same time, for some countries with longer historical span of both financial and business cycles contemporaneous association between financial and business cycles is particularly notable. Particularly, for Italy or Germany FC and BC move in-synch about 70% of time–a robust co-movement based on 30 and 39 years of data, respectively. On average for the entire sample, however, co-movement is not significant at 55%, which does not allow to conclude that the relationship holds strongly in general, and is also expected given that business cycles are not associated exclusively with financial market crises.

Table 4: Co-movement between financial and business cycles

Note: $\Omega_c^{FC,BC}$ indicates the value of the concordance index between financial cycles and business cycles; T denotes the number of observations available for FC and BC ($T_{FC} \cap T_{BC}$)

Rank	ISO3	$\Omega_c^{FC,BC}$	T	Rank	ISO3	$\Omega_c^{FC,BC}$	T
1	HUN	0.77	61	11	RUS	0.55	58
2	ITA	0.73	118	12	SVK	0.54	57
3	DEU	0.69	156	13	AUT	0.53	66
4	BEL	0.64	72	14	NLD	0.53	53
5	CHE	0.59	103	15	POL	0.52	44
6	CZE	0.59	71	16	FIN	0.48	64
7	LTU	0.58	36	17	LVA	0.47	49
8	SWE	0.58	108	18	ESP	0.41	71
9	FRA	0.56	137	19	NOR	0.37	115
10	GBR	0.56	104	20	EST	0.31	61

4.2 Cross-country synchronicity of financial cycles within Europe

Following the same approach as described above, we compute concordance indexes $\Omega_{c1,c2}^{FC}$ measuring co-movement between financial cycles of countries $c1$ and $c2$ for all pairs of countries in the sample. Figure 4 reports $\Omega_{c1,c2}^{FC}$ and simple correlations (based on first-differenced FC) for respective pairs of countries. In addition, the values are color-coded to aid inference and the number of observations per each country is reported to gauge the robustness of $\Omega_{c1,c2}^{FC}$ for the given pair (as discussed earlier, values based on short series are biased upwards, particularly in light of the recent global financial crisis during which multiple countries experienced a synchronized downturn).

The results point at a rather high degree of cross-country synchronicity of financial cycles within Europe. In many cases the concordance index reaches especially high levels above 0.8–0.9 even for the pairs of countries that have at least 100 quarterly observations. In particular, among the countries with long span of data, the results suggest that financial cycles in the pairs

SWE–BEL, ITA–CHE, ESP–GBR, FRA–DEU, GBR–SWE move in-synch 80-90% of time over the span of several decades.

Figure 4: Synchronicity of aggregate financial cycles

Note: The figure shows concordance and correlation coefficient between national aggregate financial cycle indexes. The colorscale reflects the degree of co-movement from red (highly positive) to green (highly negative). In the correlation tables, the bold font indicates the level of statistical significance of at least 10%. N denotes the number of observations for the country. Blank cells indicate cases when the BBQ algorithm could not identify turning points.

(a) Concordance index: smoothed FC

N		AUT	BEL	CHE	CZE	DEU	ESP	EST	FIN	FRA	GBR	HUN	ITA	LTU	LVA	NLD	NOR	POL	RUS	SVK	SWE
180	**AUT**																				
115	**BEL**	0.66																			
133	**CHE**	0.75	0.58																		
84	**CZE**	0.77	0.47	0.98																	
166	**DEU**	0.66	0.67	0.52	0.30																
116	**ESP**	0.52	0.74	0.53	0.47	0.51															
71	**EST**	0.53	0.87	0.60	0.61	0.63	0.84														
89	**FIN**	0.82	0.52	0.95	0.95	0.45	0.60	0.66													
148	**FRA**	0.59	0.72	0.49	0.38	0.81	0.60	0.77	0.51												
133	**GBR**	0.50	0.67	0.49	0.28	0.57	0.87	0.65	0.44	0.50											
92	**HUN**	0.43	0.65	0.23	0.25	0.57	0.75	0.58	0.30	0.58	0.88										
133	**ITA**	0.75	0.64	0.90	0.84	0.50	0.65	0.61	0.91	0.53	0.58	0.42									
55	**LTU**	0.28	0.84	0.16	0.19	0.72	0.88	0.74	0.26	0.86	0.93	0.84	0.42								
56	**LVA**	0.88	0.55	0.95	0.97	0.36	0.45	0.62	0.98	0.45	0.24	0.29	0.86	0.23							
90	**NLD**	0.85	0.64	0.63	0.72	0.38	0.39	0.52	0.68	0.51	0.31	0.48	0.72	0.37	0.83						
124	**NOR**	0.76	0.62	0.57	0.73	0.33	0.55	0.53	0.73	0.43	0.41	0.47	0.66	0.40	0.84	0.94					
72	**POL**																				
72	**RUS**	0.30	0.86	0.19	0.21	0.70	0.91	0.77	0.28	0.84	0.95	0.86	0.44	0.98	0.26	0.40	0.42				
69	**SVK**	0.87	0.56	0.92	0.93	0.34	0.51	0.67	0.98	0.46	0.31	0.32	0.90	0.28	0.97	0.82	0.84		0.30		
135	**SWE**	0.71	0.82	0.56	0.42	0.65	0.75	0.76	0.55	0.64	0.79	0.80	0.62	0.77	0.50	0.64	0.63		0.79	0.51	
N		*180*	*115*	*133*	*84*	*166*	*116*	*71*	*89*	*148*	*133*	*92*	*133*	*55*	*56*	*90*	*124*	*72*	*72*	*69*	*135*

(b) Pearson's correlation index: unsmoothed FC in first-differences

N		AUT	BEL	CHE	CZE	DEU	ESP	EST	FIN	FRA	GBR	HUN	ITA	LTU	LVA	NLD	NOR	POL	RUS	SVK	SWE
180	**AUT**																				
115	**BEL**	**0.20**																			
133	**CHE**	**0.33**	**0.30**																		
84	**CZE**	-0.14	0.02	-0.16																	
166	**DEU**	**0.44**	**0.28**	**0.45**	0.06																
116	**ESP**	**0.18**	**0.25**	0.13	**-0.27**	0.11															
71	**EST**	-0.10	**-0.32**	**-0.22**	**0.47**	**-0.41**	-0.11														
89	**FIN**	-0.09	-0.10	**0.38**	**0.36**	**0.27**	-0.17	0.11													
148	**FRA**	**0.21**	**0.49**	**0.26**	0.00	**0.31**	0.14	-0.11	**0.39**												
133	**GBR**	**0.18**	**0.51**	**0.56**	0.00	**0.18**	**0.49**	-0.18	-0.05	0.06											
92	**HUN**	0.06	0.23	**0.35**	0.04	**0.33**	-0.12	**-0.32**	-0.06	**-0.18**	**0.18**										
133	**ITA**	**0.39**	**0.26**	**0.45**	-0.05	**0.53**	**0.38**	**-0.47**	**0.62**	**0.52**	**0.30**	-0.16									
55	**LTU**	0.07	**0.46**	**-0.28**	-0.04	0.22	**0.80**	**-0.23**	**-0.48**	**0.43**	**0.47**	**-0.24**	**0.66**								
56	**LVA**	-0.16	0.14	**0.28**	**0.26**	-0.19	**-0.52**	**0.48**	**0.50**	-0.10	0.07	**0.31**	**-0.37**	**-0.61**							
90	**NLD**	**0.33**	**0.57**	0.06	**-0.23**	**0.27**	**0.55**	**-0.35**	**-0.27**	**0.50**	**0.28**	0.02	**0.36**	**0.69**	**-0.50**						
124	**NOR**	**0.24**	**0.20**	-0.09	-0.15	**0.17**	**0.37**	-0.04	-0.15	0.03	**0.22**	0.07	0.09	**0.54**	**-0.33**	**0.71**					
72	**POL**	**0.32**	**-0.21**	**-0.32**	0.03	-0.14	**0.27**	**0.41**	**-0.69**	0.10	**-0.26**	**-0.63**	-0.09	**0.41**	**-0.40**	**0.34**	**0.39**				
72	**RUS**	-0.15	**0.51**	0.06	**-0.29**	-0.12	**0.56**	-0.05	-0.12	**0.43**	**0.47**	-0.09	0.29	**0.70**	-0.15	**0.59**	**0.53**	0.06			
69	**SVK**	0.06	0.03	-0.07	**0.83**	0.07	**-0.21**	**0.60**	0.09	0.00	-0.14	-0.17	-0.02	**0.30**	**0.24**	-0.12	-0.11	**0.35**	-0.14		
135	**SWE**	**0.28**	**0.36**	**0.52**	-0.11	**0.16**	**0.55**	-0.06	**-0.26**	-0.05	**0.80**	**0.38**	0.11	0.23	0.10	**0.26**	**0.31**	-0.01	**0.39**	**-0.24**	
N		*180*	*115*	*133*	*84*	*166*	*116*	*71*	*89*	*148*	*133*	*92*	*133*	*55*	*56*	*90*	*124*	*72*	*72*	*69*	*135*

5 Implications of financial cycles for macroeconomic imbalances

5.1 Panel VAR model setup

As a final exercise we analyze the extent of mutual interactions between financial cycles, business cycles and macroeconomic imbalances using a panel VAR model. A panel VAR setup allows to control for individual country heterogeneity and model dynamic mutual impacts among multiple endogenous covariates. As our sample of countries is rather small, to address the "the curse of dimensionality" we resort to Bayesian shrinkage techniques and estimate Bayesian PVAR models. Formalizing, given N countries indexed $i = 1, ..., N$ and time $t = 1, ..., T$, the model is defined as follows:

$$\mathbf{X}_{it} = \mu_i + \mathbf{\Theta}(\mathbf{L})\mathbf{X}_{it} + \epsilon_{it} \tag{7}$$

where the vector $\mathbf{X}_{it} = \begin{bmatrix} FC_{it} & YGAP_{it} & CA_{it} & DEBT_{it} \end{bmatrix}'$ consists of the financial cycle index (FC), output gap as a percent of potential GDP ($YGAP$), current account as a percent of GDP (CA) and public debt as a percent of GDP ($DEBT$). $\mathbf{\Theta}(\mathbf{L})$ is a matrix polynomial in the lag operator L, μ_i is the vector of time-invariant country effects, ϵ_{it} is the error term. In alternative specifications estimated for robustness the model is sequentially augmented by exogenous variables for VIX, US financial cycle and US output gap.

The variables enter the model in first differences, which ensures their stationarity.[5] The annualized financial cycles expressed in year-on-year changes as used in the PVAR analysis along with other variables are reported in Appendix A (Figure 9). The conventional lag order selection criteria (Schwarz Bayesian information criterion (SBIC), Akaike information criterion (AIC) and Hannan and Quinn information criterion (HQ)) suggest a specification with one lag for the variables, which is also helpful for arriving at a most parsimonious model.

Nevertheless, the number of observations is still relatively small and therefore to avoid overparametrization issues we estimate the model via Bayesian panel VAR estimation techniques.[6] Under the Bayesian VAR approach (see Litterman, 1979 and Doan et al., 1984), model parameters are treated as random variables, characterized by an underlying probability distribution defined by hyperparameters. The prior information about the model parameters can then be used to update these probability distributions conditional on actually observed data. We use the standard normal-Wishart prior with hyperparameter values optimized via a grid-search procedure. The normal-Wishart prior has the benefit over another popular choice for similar applications, the Minnesota (Litterman) prior, as it assumes that the panel VAR coefficients and the residual covariance matrix are both unknown.

The model is estimated first for the full European sample to get the general inference on macro-financial spillovers in Europe. Then, to explore the heterogeneous effects within Europe, we estimate the model by splitting the European sample into the core and the periphery subgroups in the first case study, and, as a second case study, focusing on the euro area.

[5] This is confirmed by Im-Pesaran-Shin (2003) and Fisher-type panel unit root tests.

[6] To this end we use the MATLAB version of the Bayesian Estimation, Analysis and Regression (BEAR) toolbox introduced in Dieppe et al. (2016).

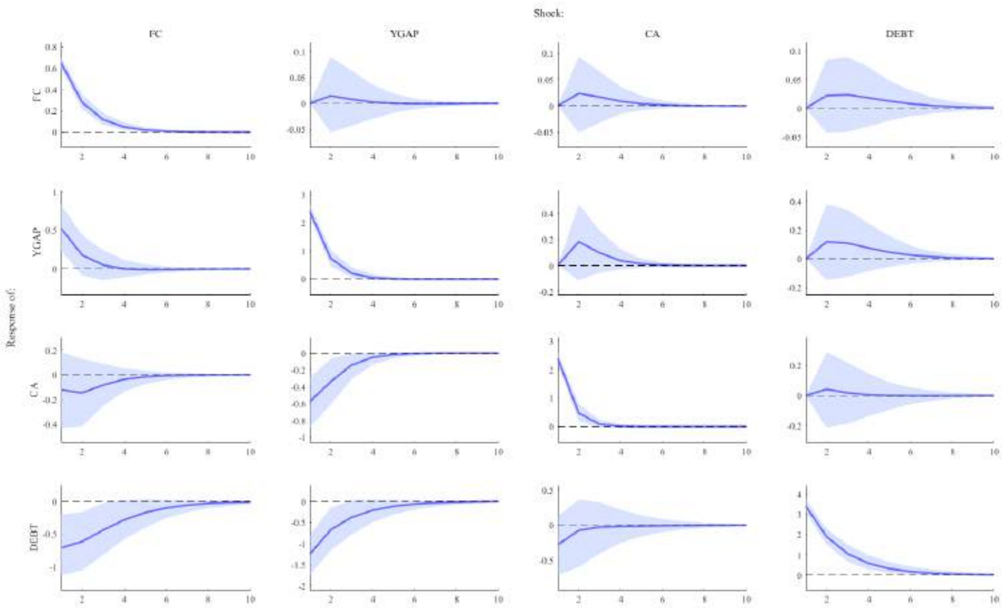
5.2 Evidence for the full European sample

We first use the pooled Bayesian PVAR estimator to gauge the extent of dynamic interactions between financial and macroeconomic imbalanced for the full European sample comprising 17 countries. The results confirm the conjecture of the significant role played by financial cycles in shaping macroeconomic imbalances. Most importantly, we find that financial cycles constitute an important driver of business cycles and quantify the magnitude of this effect over time.

Figure 5 shows the orthogonalized impulse response functions (IRFs) associated with the estimated model. The IRFs are obtained via Cholesky factorization scheme with the variables ordered as in the PVAR specification: $\mathbf{X}_{it} = \begin{bmatrix} FC_{it} & YGAP_{it} & CA_{it} & DEBT_{it} \end{bmatrix}'$. This scheme implies that variables lower in the ordering may affect the variables of higher order only with a lag, while being affected by innovations in the variables higher in the ordering contemporaneously (i.e. $DEBT$ is the "most endogenous", while FC is the "most exogenous" variable in $\mathbf{X}_{it}$). The results however remain robust to alternative ordering schemes.

Figure 5: Impulse response functions, Europe–full sample

Note: The figure shows orthogonalized impulse response functions along with the 95% confidence intervals. The impulse variables are listed in the first row, the response variables are listed in the first column.



A positive shock in the financial cycle measure FC invokes a statistically significant positive response of the output gap $YGAP$, as well as a negative response of the fiscal stance variable $DEBT$ (vice versa for negative shocks). The results are also notable as regards the magnitudes of responses: a one-standard deviation innovation in FC (corresponds to a magnitude of 0.7)[7]

[7] As noted above, financial cycle indexes are difficult to interpret given the absence of economic scale. Standardization allows to interpret the magnitudes in terms of the number of standard deviations from the historical mean of FC. The magnitudes can then be related to the past financial distress episodes as a benchmark—see Figure 4. Generally, systemic financial market events are typically reflected in financial cycle fluctuations of at least one standard deviation in magnitude.

induces a widening of the output gap by about 0.5 percent of GDP (overheating) and a decline in the public debt-to-GDP ratio by 0.7. The responses in both cases are also fast and persistent: peaking in the first year, it phases out only four years after the shock in the case of the output gap and over eight years for the public debt ratio. By contrast, the impact on the current account balance is not significant, and it is largely influenced in the model by output gap innovations as positive demand shocks lead to growing imports.

Complementing the empirical evidence from the IRFs, in Table 5 we report forecast error variance decomposition (FEVD) showing the proportion of forecast error variance explained by innovations in model variables at selected time horizons—1, 5 and 10 years following the initial shock—sorted first by the impulse variable and then by the response variable. The table reports the results for the full sample of European countries used in the analysis, as well as for additional case studies discussed in the next section. Most of the forecast error variance is attributed to own innovations. Nevertheless, fluctuations in both financial cycles and business cycles do have notable explanatory power, consistent with the evidence from the IRF analysis and the Granger causality tests. In particular, FC fluctuations contribute notably to the variance of $YGAP$ and $DEBT$, but not CA. The impact of FC on $YGAP$ already in the first year after the initial shock reaches 4.5% of its total forecast error variance, and increases only marginally over the next years reaching the sustained level of 4.8%. The effect of FC on $DEBT$ is also significant: financial cycle shocks explains 3.7% of its total forecast error variance in the first year, gradually increasing afterwards to 6% ten years after the shock. In this regard the impact of business cycle shocks is more important for both the public debt-to GDP ratio and the current account balance variables (output gap shocks explain 7.8% of forecast error variance in the current account and 11.1% in the public debt variable over a ten-year horizon). The feedback from $YGAP$, CA, $DEBT$ on FC is not significant, supporting evidence from the IRF analysis.

For additional insights on potential causal impacts we also perform a sequence of Granger causality tests for all model variables following the Dumistrescu and Hurlin (2012) methodology. The test is based on the average of individual Wald statistics for Granger non-causality tests computed for each cross-section unit. It is simple to implement and does not require panel estimations for each model, while retaining its power for small N and T and being particularly well-suited for heterogeneous panels.

The results of the test, reported in Table 6, also suggest a potentially causal link from FC to $YGAP$ as evidenced by the statistically significant test statistic, also supporting results from other empirical exercises. The test also points at Granger causality from FC to CA (at the 5%-level). This is however not supported by neither the impulse-response analysis nor the forecast error variance decomposition results. The analysis also suggests a positive feedback from business cycles to financial cycles, which is however also not supported by other results at statistically significant levels.

5.3 Results for the European core-periphery and the euro area samples

We further examine whether the interactions among macro-financial imbalances exhibit different patterns within Europe by splitting the sample into the “core” and the “periphery”, where the “core” comprises relatively more mature and influential economies of Europe with

Table 5: Forecast error variance decomposition

Note: The table reports forecast error variance decomposition for panel VAR variables at the horizons of 1, 5 and 10 years. The results are listed for the four PVAR models associated with the full sample, European core and periphery samples, as well as the euro area.

Horizon	Impulse variable	Response variable	Share of variance explained, percent			
			I. Europe: full sample	II. Europe: core	III. Europe: periphery	IV. Euro area
1	FC	FC	100.0%	100.0%	100.0%	100.0%
5	FC	FC	98.4%	94.7%	97.0%	96.5%
10	FC	FC	98.3%	94.2%	96.8%	96.2%
1	FC	YGAP	4.5%	14.6%	1.3%	3.2%
5	FC	YGAP	4.8%	15.0%	2.0%	3.8%
10	FC	YGAP	4.8%	15.1%	2.0%	3.9%
1	FC	CA	0.3%	0.5%	0.8%	0.3%
5	FC	CA	1.1%	2.5%	1.4%	2.9%
10	FC	CA	1.1%	2.6%	1.4%	3.0%
1	FC	DEBT	3.7%	11.9%	0.5%	9.1%
5	FC	DEBT	5.9%	11.6%	2.6%	9.8%
10	FC	DEBT	6.0%	11.6%	2.7%	9.8%
1	YGAP	FC	0.0%	0.0%	0.0%	0.0%
5	YGAP	FC	0.3%	2.3%	0.8%	0.5%
10	YGAP	FC	0.3%	2.6%	0.8%	0.5%
1	YGAP	YGAP	95.5%	85.4%	98.7%	96.8%
5	YGAP	YGAP	93.1%	80.5%	94.9%	91.9%
10	YGAP	YGAP	93.0%	80.3%	94.7%	91.4%
1	YGAP	CA	5.6%	0.5%	9.3%	11.6%
5	YGAP	CA	7.8%	4.4%	9.7%	12.9%
10	YGAP	CA	7.8%	4.5%	9.7%	12.9%
1	YGAP	DEBT	11.1%	8.4%	11.7%	15.1%
5	YGAP	DEBT	11.1%	8.2%	11.6%	13.3%
10	YGAP	DEBT	11.1%	8.2%	11.7%	13.1%
1	CA	FC	0.0%	0.0%	0.0%	0.0%
5	CA	FC	0.3%	0.8%	0.4%	0.9%
10	CA	FC	0.3%	0.8%	0.4%	1.0%
1	CA	YGAP	0.0%	0.0%	0.0%	0.0%
5	CA	YGAP	0.7%	2.5%	0.5%	1.3%
10	CA	YGAP	0.7%	2.6%	0.5%	1.3%
1	CA	CA	93.7%	98.5%	89.0%	87.7%
5	CA	CA	90.2%	90.6%	87.1%	82.3%
10	CA	CA	90.1%	90.3%	87.0%	82.1%
1	CA	DEBT	0.6%	3.2%	0.3%	1.0%
5	CA	DEBT	0.8%	3.6%	0.9%	1.5%
10	CA	DEBT	0.8%	3.6%	0.9%	1.6%
1	DEBT	FC	0.0%	0.0%	0.0%	0.0%
5	DEBT	FC	0.4%	0.8%	0.7%	0.9%
10	DEBT	FC	0.5%	1.0%	0.8%	1.0%
1	DEBT	YGAP	0.0%	0.0%	0.0%	0.0%
5	DEBT	YGAP	0.6%	0.6%	1.3%	1.6%
10	DEBT	YGAP	0.6%	0.7%	1.5%	1.9%
1	DEBT	CA	0.0%	0.0%	0.0%	0.0%
5	DEBT	CA	0.3%	0.8%	0.5%	0.5%
10	DEBT	CA	0.3%	0.8%	0.5%	0.5%
1	DEBT	DEBT	84.1%	74.9%	86.7%	73.9%
5	DEBT	DEBT	81.4%	73.9%	83.6%	74.0%
10	DEBT	DEBT	81.3%	73.7%	83.3%	74.0%

Table 6: Granger causality test results

Note: The table shows the results of the Dumistrescu and Hurlin (2012) Granger causality test for heterogeneous panel data models. Null-hypothesis: variable X (first row) does not Granger-cause variable Y (first column). ***, **, * indicate statistical significance at the 1%, 5% and 10% levels.

I. Europe: full sample

Y ↓	X →	*FC*	*YGAP*	*CA*	*DEBT*
FC	$\tilde{Z}$		4.59***	1.60	0.39
	p-value		0.00	0.11	0.69
YGAP	$\tilde{Z}$	5.92***		-0.32	0.30
	p-value	0.00		0.75	0.77
CA	$\tilde{Z}$	2.37**	3.88***		-0.29
	p-value	0.02	0.00		0.77
DEBT	$\tilde{Z}$	0.95	1.30	-1.39	
	p-value	0.34	0.19	0.16	

II. Europe: periphery

Y ↓	X →	*FC*	*YGAP*	*CA*	*DEBT*
FC	$\tilde{Z}$		3.44***	1.73*	0.90
	p-value		0.00	0.08	0.37
YGAP	$\tilde{Z}$	5.40***		-1.41	0.02
	p-value	0.00		0.16	0.98
CA	$\tilde{Z}$	1.81*	-1.22		-1.14
	p-value	0.07	0.22		0.25
DEBT	$\tilde{Z}$	0.73	-0.69	-0.82	
	p-value	0.47	0.49	0.41	

III. Europe: core

Y ↓	X →	*FC*	*YGAP*	*CA*	*DEBT*
FC	$\tilde{Z}$		3.04***	0.43	-0.46
	p-value		0.00	0.67	0.64
YGAP	$\tilde{Z}$	2.78***		1.18	0.44
	p-value	0.00		0.24	0.66
CA	$\tilde{Z}$	1.53	7.51***		0.91
	p-value	0.13	0.00		0.36
DEBT	$\tilde{Z}$	0.60	2.85***	-1.19	
	p-value	0.55	0.00	0.23	

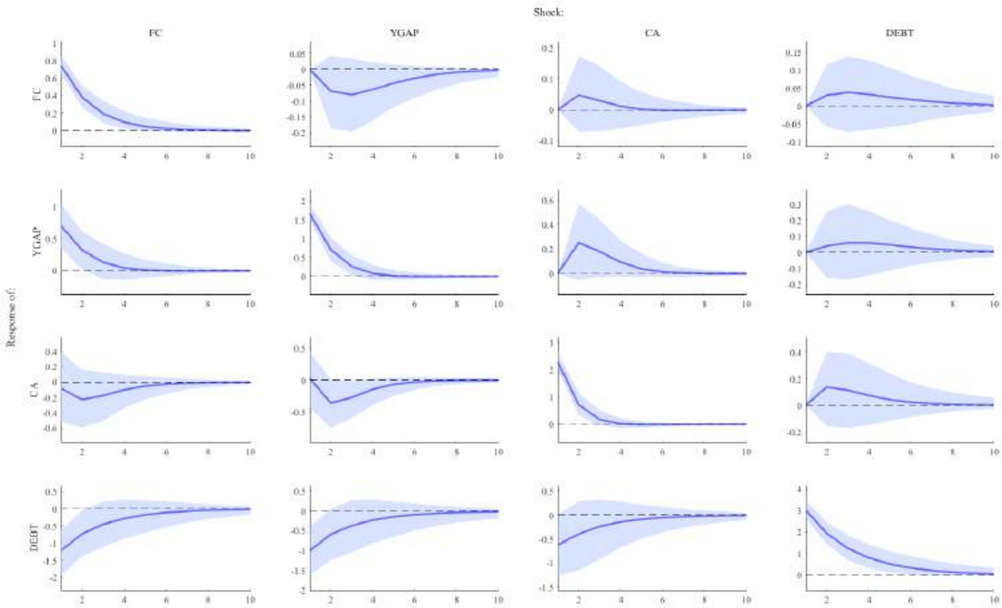
IV. Euro area

Y ↓	X →	*FC*	*YGAP*	*CA*	*DEBT*
FC	$\tilde{Z}$		3.82***	1.06	0.13
	p-value		0.00	0.31	0.89
YGAP	$\tilde{Z}$	4.81***		-0.30	0.03
	p-value	0.00		0.76	0.98
CA	$\tilde{Z}$	1.55	2.03**		-0.10
	p-value	0.12	0.04		0.92
DEBT	$\tilde{Z}$	0.71	2.11**	-1.11	
	p-value	0.48	0.04	0.27	

deeper financial markets and thus likely stronger linkages of the financial sector with the real economy (see the sample composition in the section on data and sample). Separate Bayesian PVAR models are estimated for each sample retaining the same period of time (1998–2012) for comparability. The orthogonal IRF plots are reported in Figures 6 and 7 for the European core and the periphery groups, respectively. FEVD and Granger causality test results are listed in Tables 5 and 6, along with the baseline full-sample results.

Figure 6: Impulse response functions, European core

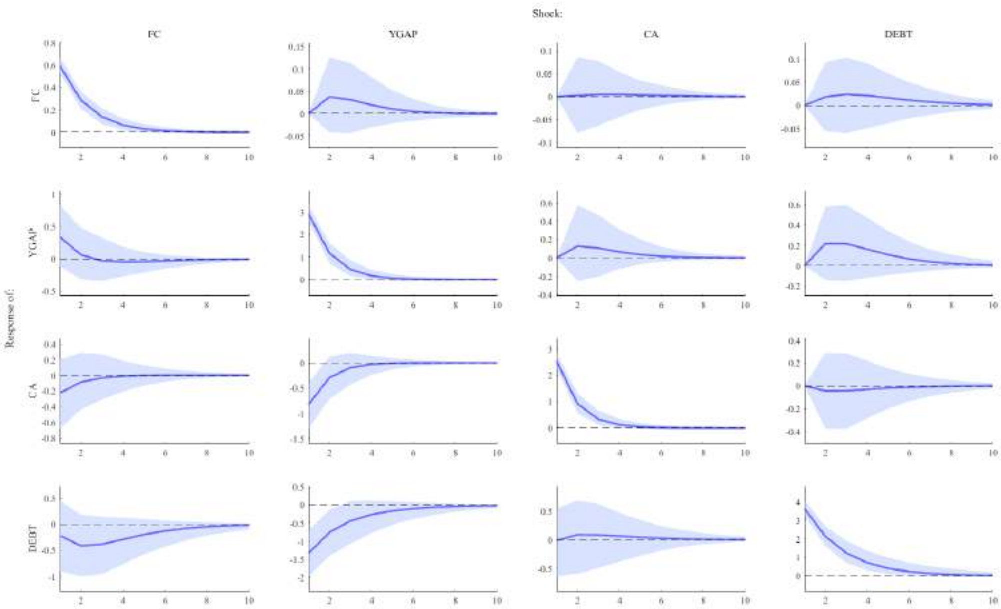
Note: The figure shows orthogonalized impulse response functions along with the 95% confidence intervals. The impulse variables are listed in the first row, the response variables are listed in the first column.



The analysis reveals significant differences between the core and the periphery groups. In particular, the European core group exhibits a much stronger impact of financial cycles on other variables in comparison with the periphery group characterized by much more subdued spillovers. In fact, for the European periphery sample the impact of FC is not significant for CA and $DEBT$, and is only marginally significant for $YGAP$, as evidenced by the corresponding IRF profile and a low share of forecast error variance explained (only 2% at the horizon of 10 years). By contrast, in the case of the European core the impact of FC on $YGAP$ and $DEBT$ is very strong: an one-standard-deviation positive shock in FC invokes macroeconomic overheating equivalent to 0.7% of potential GDP on impact and a reduction in public debt-to-GDP ratio by 1.1 percentage points. The response to financial shocks is also long-lasting: the impact on $YGAP$ dissipates over the course of about 5 years (longer than for other samples examined) and the impact on $DEBT$ takes as long as 8-9 years to fade away. Notably, confirming the results from the IRF profiles, for the European core the share of variation explained by FC is very high for both $YGAP$ (15%) and $DEBT$ (11.6%)—the highest across all other samples, including the full European sample.

Figure 7: Impulse response functions, European periphery

Note: The figure shows orthogonalized impulse response functions along with the 95% confidence intervals. The impulse variables are listed in the first row, the response variables are listed in the first column.



As a final exercise, we also estimate a Bayesian Panel VAR model for the euro area subgroup, comprising ten countries (see Table 1) over the period 1998–2012. Most of the countries in the sample are the founding members of the bloc, except for Estonia (joined in 2011) and Slovakia (joined in 2009). The latter countries participated in the European Exchange Rate Mechanism II before the accession, and therefore are included in the sample for the entire period. The constraints imposed by the euro area arrangements on macroeconomic policy and the dynamics of imbalances, along with a lack of optimal currency area characteristics (see Mundell, 1961 and McKinnon, 1963) may have important implications on the transmission of shocks in comparison with the broader European sample, which we try to test in additional exercise. Macroeconomic imbalances and rapid credit expansion prior to the recent global financial crisis have contributed to the depth of the recession and the "twin crisis" of banks and sovereigns (see also Lane, 2012 for discussion).

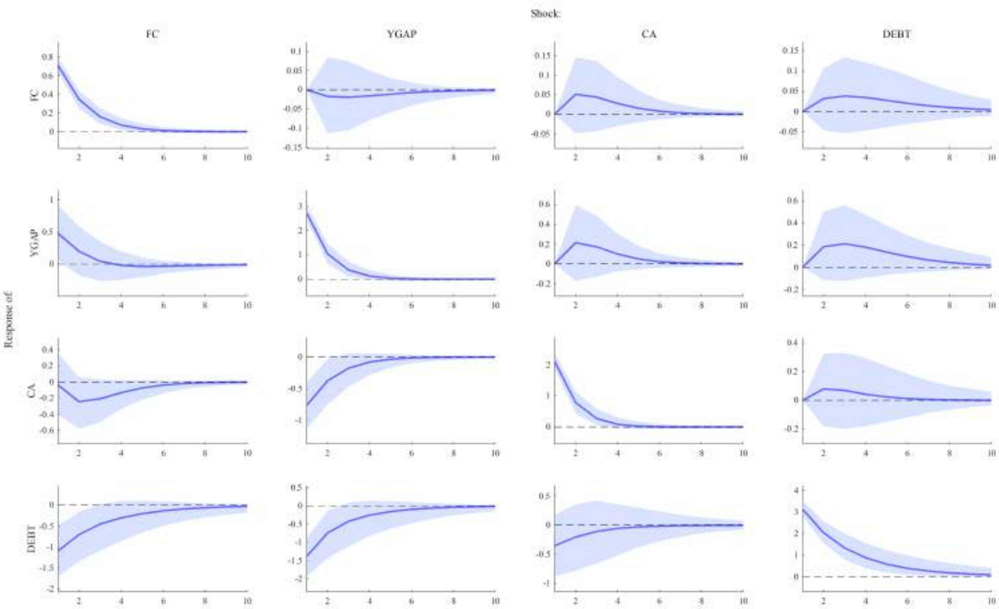
The orthogonal IRF plots for the euro area analysis are reported in Figure 8, FEVD and Granger causality test results are listed in Tables 5 and 6 (along with the baseline results). The results are largely consistent with the evidence from other samples discussed above as far as the implications of financial cycles are concerned. In particular, a one-standard deviation shock in FC leads to a positive change in $YGAP$ of about 0.5 in the first period with the impact phasing out at the horizon of 3 years.

The influence of financial cycles on current account and public debt dynamics are however much stronger in the euro area in terms of both economic and statistical significance in comparison with the full European sample. The share of forecast error variance explained by FC reaches 3% for CA and 10% for $DEBT$ over the horizon of ten years.

Overall, the impact of FC on other model variables in the case of the euro area appears to be rather similar to that for the European core. The main difference is in the more significant (economically and statistically) effect of $YGAP$ shocks on other model variables. The impact of FC is also rather persistent, especially for the public debt ratio: the peak response (a reduction of the debt-to-GDP ratio by about one percentage point) is reached in the first period and dissipates fully only after 10 years. The effect of FC on CA is also more significant in the case of the euro area in comparison with all other cases examined. Similarly to the European core sample, the peak response to a shock in FC of CA (-0.2 percent of GDP) is observed not on impact, but in the second year and gradually phases out over six years. In terms of economic significance and the proportion of variance explained this effect however is not sizable, similarly to other cases examined.

Figure 8: Impulse response functions, euro area

Note: The figure shows orthogonalized impulse response functions along with the 95% confidence intervals. The impulse variables are listed in the first row, the response variables are listed in the first column.



6 Conclusion

The recent global financial crisis has revealed major gaps in the understanding of the macroeconomic impacts of financial markets. The paper has shown important implications of the inherent cyclicality exhibited by financial markets in the context of European economies. Empirical evidence supports the conjecture that financial markets are prone to persistent cyclical dynamics associated with accumulation of imbalances and followed by contractions often leading to economic downturns. The analysis is based on a synthetic measure of financial cycles estimated using information on relevant price, quantity and risk characteristics across several key financial market segments. We document the existence of financial cycles in Europe and demonstrate empirically their significance as a driver of business cycles and an important factor shaping public debt dynamics, as well as show tendencies for their cross-country synchronization.

The results thus have importatant policy implications. Financial markets in Europe are currently undergoing a transition towards a presumably more resilient structure. Overreliance on traditional forms of financial intermediation via the banking sector, while capital markets remain relatively less developed, has been recognized as one of the vulnerabilities of European economies. The importance of fostering deeper capital markets and thereby diversify funding sources and facilitate risk sharing has therfore received much emphasis giving rise to the Capital Markets Union initiative to facilitate development of deep and mutually integrated capital markets in the EU.

At the same time, capital markets are also prone to inherent instability risks perhaps even to a greater extent than credit markets, and may themselves contribute to systemic risks associated with the procyclicality and formation of asset bubbles, especially if one takes into account the rapid development of innovative structured financial instruments for which risks are more difficult to understand. Therefore, deepening of capital markets needs to be accompanied by a carefully designed regulatory framework to deal with the buildup of financial imbalances as one of the roots of macroeconomic overheating, as well as limiting the risks of spillovers to other financial market segments and countries.

While much progress has been made in regulating the banking sector in Europe, particularly along the lines of the Basel III reforms focusing on macroprudential measures to strengthen its resilience to shocks and improve its risk management capacity, vulnerabilities still stem from the unregulated shadow banking sector, which is growing in importance and is interconnected with the banking sector. This again highlights the importance of further work on strengthening the Banking Union and the Capital Markets Union initiatives launched by European Commission and complementary regulatory reforms.

At a more general level, aside from prudential regulations, the macroeconomic policy itself should be revisited in light of the risks stemming from financial markets. This however brings up yet more challenges, as, for instance, the ongoing debates on the needed single European safe financial asset and the importance of fiscal union elements for a truly effective Capital Markets Union demonstrate. Monetary policy focusing predominantly or exclusively on inflation targeting as the principal nominal anchor need to be reassessed given financial instability risks and strong interactions between financial and macroeconomic imbalances as shown in the paper: a more proactive monitoring and policy response to the buildup of financial imbalances needs to be implemented in macroeconomic policy frameworks in general as guidance provided by conventional inflation and output gaps measures proved to be insufficient.

Appendix A

Figure 9: Dynamics of macro-financial imbalances

Note: The figure shows the dynamics of the variables used in the empirical analysis, including the financial cycle index (FC), the output gap as a percentage of potential GDP ($YGAP$), the current account as a percentage of GDP (CA), the general government debt as a percentage of GDP ($DEBT$), all expressed in first-differences. The countries are arranged alphabetically by their ISO3 codes.

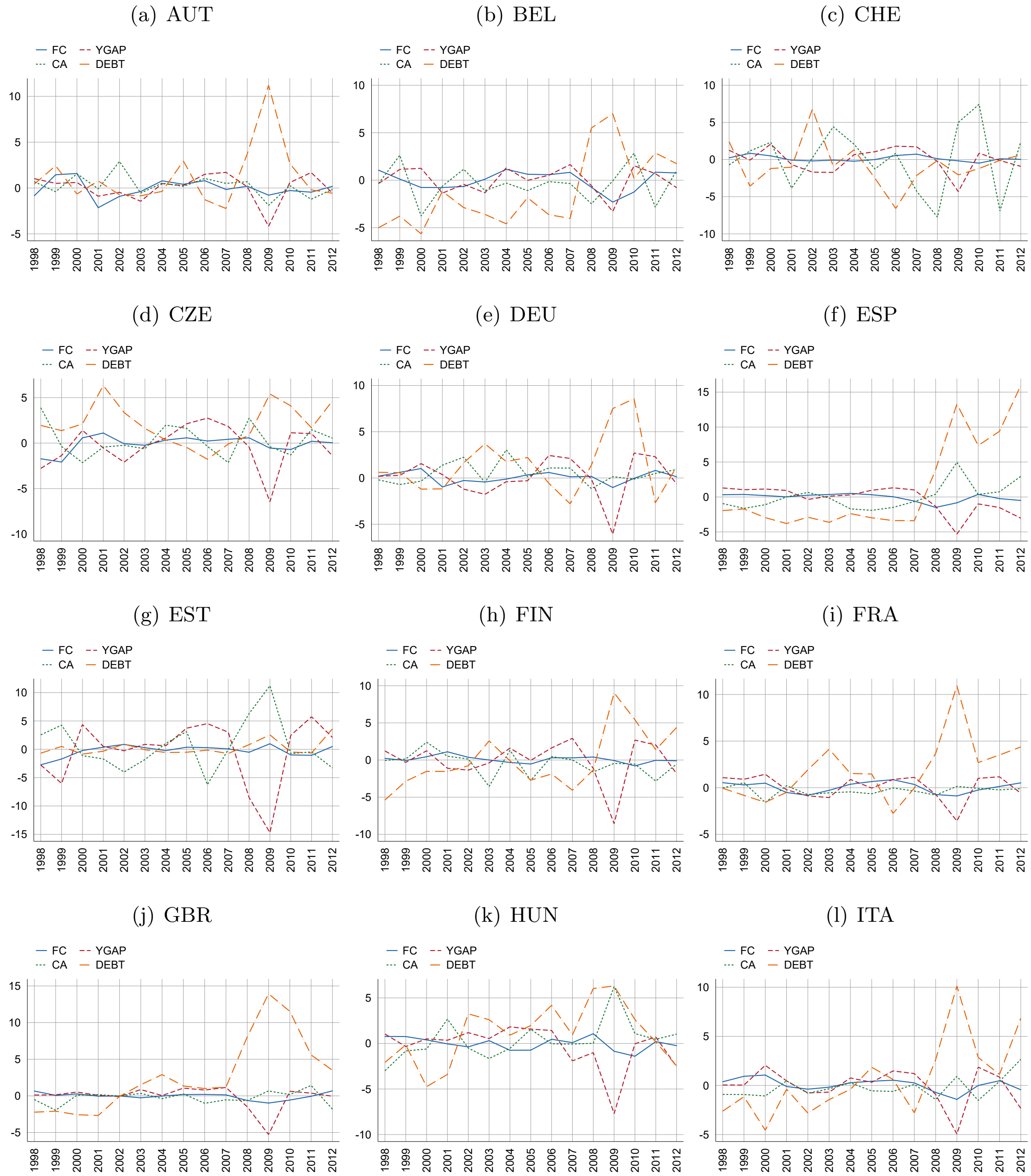
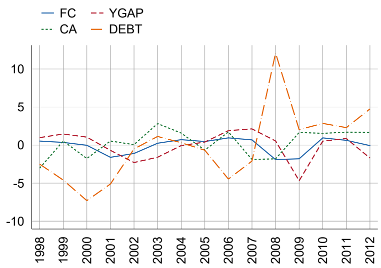
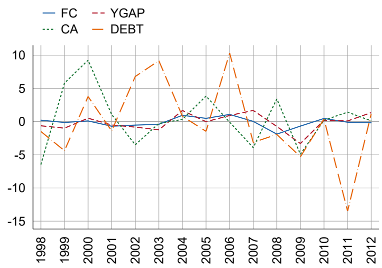


Figure 9 (cont.): Dynamics of macro-financial imbalances

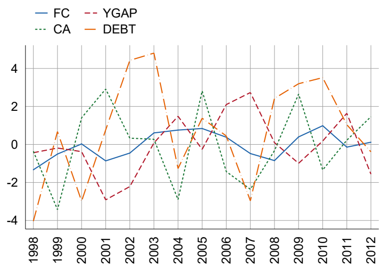
(m) NLD



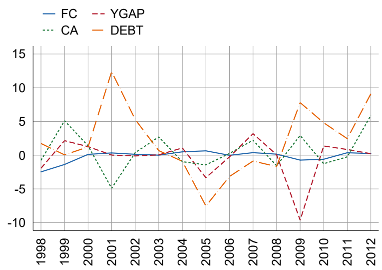
(n) NOR



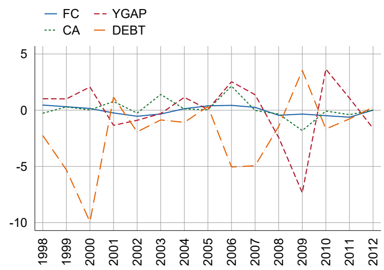
(o) POL



(p) SVK



(q) SWE



Appendix B

The appendix includes tables reporting autoregressive coefficient estimates (denoted by f_{t-1}) and factor loadings on the latent common factor of input signal variables from the dynamic factor models associated with segment-specific and aggregate financial cycles, indicated by FC^{CR} (credit market cycle), FC^{H} (housing market cycle), FC^{B} (bond market cycle), FC^{EQ} (equity market cycle), FC^{AG} (aggregate financial cycle).

Column **Coef** reports parameter estimates; *, **, *** denote statistical significance at the 10, 5 and 1% levels, respectively; *n/a* indicates the listed variable was used as a proxy for the respective financial cycle (instead of a dynamic factor model, owing to data availability issues); Column **SE** reports standard errors. Column **Attr** indicates the market attribute the variable captures: Price (P), Quantity (Q), Risk (R), or (C) in the cases when estimated segment-specific cycles are used as input variables in the estimation of aggregate financial cycles. Column **Trans** reports transformations applied to input signal variables prior to their inclusion in the respective dynamic factor model: *std*—standardization (the variable is demeaned and divided by its standard deviation); Δyoy—year-on-year difference; $std\%\Delta yoy$—year-on-year percent change. The tables are organized by country ISO3 code in alphabetic order.

Table 1: AUT

AUT FC^{CR}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.03)		
Total credit to private non-financial sector, % of GDP	0.27***	(0.10)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.29***	(0.04)	$std\%\Delta yoy$	Q
3-Month or 90-day Rates and Yields: Interbank Rates	0.11	(0.10)	$std\Delta yoy$	P
Money market interest rate, % pa	0.10	(0.06)	$std\Delta yoy$	P
Spread between 3-month interbank interest rate and government bond rate	0.18***	(0.05)	std	R
Spread between money market and 3-month interbank interest rate	-0.03	(0.07)	std	R
AUT FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.63***	(0.11)		
Price to rent ratio	0.71***	(0.09)	$std\Delta yoy$	P
Price to income ratio	0.72***	(0.09)	$std\Delta yoy$	P
Real house price index, sa	0.74***	(0.10)	$std\%\Delta yoy$	P
AUT FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.83***	(0.05)		
International debt securities by all issuers, amt outstanding, mln USD	0.12***	(0.02)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	0.48***	(0.05)	$std\%\Delta yoy$	Q
Government Bonds Interest Rate, % pa	0.35***	(0.06)	$std\Delta yoy$	P
AUT FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.89***	(0.04)		
Stock market capitalization to GDP (%)	0.28***	(0.06)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.35***	(0.04)	$std\Delta yoy$	Q
Stock market turnover ratio (%)	0.31***	(0.08)	$std\Delta yoy$	Q
AUT Share prices: VSE WBI index	0.38***	(0.07)	$std\%\Delta yoy$	P
AUT FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.93***	(0.02)		
Total credit to private non-financial sector, % of GDP	0.29***	(0.05)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.31***	(0.02)	$std\%\Delta yoy$	Q
Government Bonds Interest Rate, % pa	0.19***	(0.05)	$std\Delta yoy$	P
AUT Share prices: VSE WBI index	0.02	(0.06)	$std\%\Delta yoy$	P

Table 2: BEL

BEL FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.87***	(0.03)		
Total credit to private non-financial sector, % of GDP	0.35***	(0.06)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.40***	(0.03)	$std\%\Delta yoy$	Q
3-Month or 90-day Rates and Yields: Interbank Rates	0.09	(0.11)	$std\Delta yoy$	P
Spread between 3-month interbank rates and treasury bill rate	-0.10	(0.10)	std	R
BEL FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.95***	(0.02)		
Price to rent ratio	0.28***	(0.02)	$std\Delta yoy$	P
Price to income ratio	0.27***	(0.02)	$std\Delta yoy$	P
Real house price index, sa	0.27***	(0.02)	$std\%\Delta yoy$	P
BEL FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.88***	(0.03)		
10Y-3M government bond spread	-0.36***	(0.04)	std	R
Long-Term Government Bond Yields: 10-year	0.33***	(0.04)	$std\Delta yoy$	P
BEL FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.02)		
Stock market capitalization to GDP (%)	0.27*	(0.14)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.38***	(0.05)	$std\Delta yoy$	Q
Stock market turnover ratio (%)	0.27***	(0.10)	$std\Delta yoy$	Q
BEL Share prices: All Shares index	0.20*	(0.12)	$std\%\Delta yoy$	P
BEL FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.02)		
FC^{CR}	0.22***	(0.08)	std	C
FC^{B}	0.19***	(0.06)	std	C
FC^{EQ}	0.26***	(0.09)	std	C
FC^{H}	0.09**	(0.05)	std	C

Table 3: CHE

CHE FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.91***	(0.05)		
Total credit to private non-financial sector, % of GDP	0.25**	(0.11)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.36***	(0.07)	$std\%\Delta yoy$	Q
Call Money/Interbank Rate	0.15*	(0.09)	$std\Delta yoy$	P
Money market interest rate, % pa	0.14	(0.12)	$std\Delta yoy$	P
Spread between lending and deposit interest rate	-0.26***	(0.05)	std	R
Spread between 3-month and overnight interbank rates	0.08**	(0.03)	std	R
CHE FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.03)		
Price to rent ratio	0.38***	(0.02)	$std\Delta yoy$	P
Price to income ratio	0.37***	(0.02)	$std\Delta yoy$	P
Real house price index, sa	0.38***	(0.02)	$std\%\Delta yoy$	P
CHE FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.04)		
10Y-3M government bond spread	-0.35***	(0.03)	std	R
Long-Term Government Bond Yields: 10-year	0.28***	(0.07)	$std\Delta yoy$	P
CHE FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.86***	(0.04)		
Stock market capitalization to GDP (%)	0.39***	(0.12)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	-0.14	(0.38)	$std\Delta yoy$	Q
Stock market turnover ratio (%)	-0.16	(0.32)	$std\Delta yoy$	Q
CHE Share prices: UBS 100 index	0.38***	(0.07)	$std\%\Delta yoy$	P
CHE FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.95***	(0.02)		
FC^{CR}	0.26***	(0.03)	std	C
FC^{B}	0.18***	(0.06)	std	C
FC^{EQ}	-0.10	(0.08)	std	C
FC^{H}	0.11	(0.09)	std	C

Table 4: CZE

CZE FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.77***	(0.11)		
Total credit to private non-financial sector, % of GDP	0.44***	(0.07)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.45***	(0.07)	$std\%\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	0.35	(0.39)	$std\Delta yoy$	P
Money market interest rate, % pa	0.40	(0.33)	$std\Delta yoy$	P
Spread between lending interest rate and deposit interest rate	0.19***	(0.06)	std	R
Spread between lending interest rate and treasury bill rate	0.26	(0.20)	std	R
CZE FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
Real housing price	n/a		$std\%\Delta yoy$	P
CZE FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.89***	(0.05)		
10Y-3M government bond spread	-0.44***	(0.11)	std	R
International debt securities by all issuers, amt outstanding, mln USD	-0.12	(0.07)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	-0.13	(0.16)	$std\%\Delta yoy$	Q
Treasury Bill Rate, % pa	0.09	(0.06)	$std\Delta yoy$	P
CZE FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.82***	(0.07)		
Average daily stock market index value	0.49***	(0.07)	$std\%\Delta yoy$	P
Average daily stock market return	0.21***	(0.05)	std	P
Standard deviation of daily stock market returns	-0.17***	(0.05)	std	R
CZE FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.91***	(0.03)		
Treasury Bill Rate, % pa	0.26***	(0.10)	$std\Delta yoy$	P
FC^{CR}	0.26***	(0.07)	std	C
FC^{EQ}	-0.13	(0.20)	std	C

Table 5: DEU

DEU FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.76***	(0.05)		
Spread between money market rate and treasury bond rate	0.24**	(0.12)	std	R
Spread between 3-month and overnight interbank rates	0.09	(0.13)	std	R
Total credit to private non-financial sector, % of GDP	0.16	(0.14)	$std\Delta yoy$	Q
3-month interbank interest rate	0.53***	(0.09)	$std\Delta yoy$	P
Money market interest rate, pp	0.52***	(0.09)	$std\Delta yoy$	P
Private credit by banks, LCU	0.19	(0.14)	$std\%\Delta yoy$	Q
DEU FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.95***	(0.02)		
Price to rent ratio	0.30***	(0.02)	$std\Delta yoy$	P
Real house price index, sa	0.31***	(0.02)	$std\%\Delta yoy$	P
DEU FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.84***	(0.03)		
Yields on debt securities outstanding issued by residents / Corporate bonds	0.47***	(0.04)	$std\Delta yoy$	P
Government Bonds Interest Rate, % pa	0.48***	(0.03)	$std\Delta yoy$	P
Spread between corporate bond rate and government bond rate	-0.04	(0.07)	std	R
DEU FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
DEU Share prices: CDAX index / Growth rate same period previous year	n/a		std	P
DEU FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.88***	(0.03)		
FC^{CR}	0.32***	(0.07)	std	C
FC^{B}	0.39***	(0.04)	std	C
FC^{EQ}	-0.14**	(0.06)	std	C
FC^{H}	0.28***	(0.04)	std	C

Table 6: ESP

ESP FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.98***	(0.01)		
Total credit to private non-financial sector, % of GDP	0.23***	(0.02)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.20***	(0.02)	$std\%\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	0.02**	(0.01)	$std\Delta yoy$	P
Money market interest rate, % pa	0.02*	(0.01)	$std\Delta yoy$	P
Spread between money market rate and overnight rate	-0.01	(0.01)	std	R
Spread between money market interest rate and treasury bill rate	0.03	(0.02)	std	R
ESP FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.95***	(0.02)		
Price to rent ratio	0.30***	(0.02)	$std\Delta yoy$	P
Price to income ratio	0.30***	(0.02)	$std\Delta yoy$	P
Real house price index, sa	0.30***	(0.02)	$std\%\Delta yoy$	P
ESP FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.82***	(0.05)		
Outstanding international private debt securities to GDP (%)	-0.18	(0.15)	$std\Delta yoy$	Q
Outstanding international public debt securities to GDP (%)	-0.38***	(0.12)	$std\Delta yoy$	Q
10Y-3M government bond spread	-0.21	(0.21)	std	R
Treasury Bill Rate, % pa	0.38**	(0.16)	$std\Delta yoy$	P
ESP FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.82***	(0.07)		
Average daily stock market index value	0.44***	(0.07)	$std\%\Delta yoy$	P
Average daily stock market return	0.27***	(0.07)	std	P
Standard deviation of daily stock market returns	-0.37***	(0.08)	std	R
ESP FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.96***	(0.01)		
Total Share Prices for All Shares	0.07*	(0.04)	$std\%\Delta yoy$	P
FC^{CR}	0.21***	(0.02)	std	C
FC^{B}	0.11***	(0.04)	std	C
FC^{H}	0.26***	(0.04)	std	C

Table 7: EST

EST FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.91***	(0.08)		
Private credit by deposit money banks to GDP (%)	0.30***	(0.09)	$std\Delta yoy$	Q
3-Month or 90-day Rates and Yields: Interbank Rates	0.40***	(0.10)	$std\Delta yoy$	P
Lending interest rate, % pa	0.39***	(0.09)	$std\Delta yoy$	P
Private credit by banks, LCU	0.24***	(0.09)	$std\%\Delta yoy$	Q
Spread between lending and deposit interest rate	0.03	(0.07)	std	R
EST FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.07)		
Price to rent ratio	0.32***	(0.06)	$std\Delta yoy$	P
Price to income ratio	0.42***	(0.07)	$std\Delta yoy$	P
Real house price index, sa	0.41***	(0.07)	$std\%\Delta yoy$	P
EST FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.90***	(0.03)		
Outstanding international private debt securities to GDP (%)	-0.17*	(0.10)	$std\Delta yoy$	Q
Outstanding international public debt securities to GDP (%)	-0.42**	(0.19)	$std\Delta yoy$	Q
International debt securities by all issuers, amt outstanding, mln USD	-0.16***	(0.05)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	-0.24***	(0.09)	$std\%\Delta yoy$	Q
Government Bonds Interest Rate, % pa	0.29***	(0.06)	$std\Delta yoy$	P
EST FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.93***	(0.11)		
Stock market capitalization to GDP (%)	-0.10	(0.19)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.37***	(0.06)	$std\Delta yoy$	Q
Stock market turnover ratio (%)	0.34***	(0.12)	$std\Delta yoy$	Q
Average daily stock market index value	0.08	(0.08)	$std\%\Delta yoy$	P
Average daily stock market return	-0.00	(0.10)	std	P
Standard deviation of daily stock market returns	-0.14***	(0.04)	std	R
EST FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.94***	(0.18)		
Average daily stock market index value	0.24	(0.40)	$std\%\Delta yoy$	P
FC^{CR}	0.34**	(0.15)	std	C

Table 8: FIN

FIN FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.92***	(0.03)		
Total credit to private non-financial sector, % of GDP	0.38***	(0.07)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.28***	(0.07)	$std\%\Delta yoy$	Q
3-Month or 90-day Rates and Yields: Interbank Rates	0.21**	(0.11)	$std\Delta yoy$	P
Money market interest rate, % pa	0.17**	(0.08)	$std\Delta yoy$	P
Spread between money market interest rate and treasury bond rate	0.29***	(0.05)	std	R
Spread between money market and 3-month interbank rate	0.08*	(0.04)	std	R
FIN FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.04)		
Price to rent ratio	0.38***	(0.04)	$std\Delta yoy$	P
Price to income ratio	0.37***	(0.04)	$std\Delta yoy$	P
Real house price index, sa	0.38***	(0.04)	$std\%\Delta yoy$	P
FIN FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.76***	(0.09)		
International debt securities by all issuers, amt outstanding, mln USD	0.04***	(0.01)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	0.51***	(0.08)	$std\%\Delta yoy$	Q
Government Bonds Interest Rate, % pa	0.34	(0.25)	$std\Delta yoy$	P
FIN FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.91***	(0.04)		
Stock market capitalization to GDP (%)	0.34***	(0.04)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.26***	(0.05)	$std\Delta yoy$	Q
FIN Share prices: OMXH All Share index	0.37***	(0.07)	$std\%\Delta yoy$	P
FIN FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.93***	(0.04)		
FC^{CR}	0.27***	(0.07)	std	C
FC^{B}	0.20***	(0.06)	std	C
FC^{EQ}	-0.25***	(0.09)	std	C
FC^{H}	-0.22***	(0.06)	std	C

Table 9: FRA

FRA FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.91***	(0.04)		
Total credit to private non-financial sector, % of GDP	-0.07	(0.06)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.26***	(0.05)	$std\%\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	0.15	(0.11)	$std\Delta yoy$	P
Deposit interest rate, %	0.01	(0.04)	$std\Delta yoy$	P
Spread between deposit interest rate and overnight interbank interest rate	-0.36***	(0.13)	std	R
Spread between 3-month interbank and overnight interbank interest rate	-0.15	(0.13)	std	R
Spread between overnight interbank interest rate and treasury bond rate	0.28**	(0.13)	std	R
FRA FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.96***	(0.02)		
Price to rent ratio	0.29***	(0.02)	$std\Delta yoy$	P
Price to income ratio	0.27***	(0.02)	$std\Delta yoy$	P
Real house price index, sa	0.28***	(0.02)	$std\%\Delta yoy$	P
FRA FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.93***	(0.03)		
10Y-3M government bond spread	-0.32***	(0.05)	std	R
International debt securities by all issuers, amt outstanding, mln USD	0.09***	(0.03)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	0.21***	(0.08)	$std\%\Delta yoy$	Q
Treasury Bill Rate, % pa	0.06*	(0.03)	$std\Delta yoy$	P
FRA FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.82***	(0.05)		
Average daily stock market index value	0.43***	(0.04)	$std\%\Delta yoy$	P
Average daily stock market return	0.18*	(0.10)	std	P
Standard deviation of daily stock market returns	-0.37***	(0.11)	std	R
FRA FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.98***	(0.01)		
Total Share Prices Index	0.04	(0.03)	$std\%\Delta yoy$	P
Treasury Bill Rate, % pa	0.04	(0.05)	$std\Delta yoy$	P
FC^{CR}	0.19***	(0.05)	std	C
FC^{H}	-0.05	(0.07)	std	C

Table 10: GBR

GBR FC^{CR}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.95***	(0.02)		
Total credit to private non-financial sector, % of GDP	0.28***	(0.03)	$std\Delta yoy$	Q
Lending interest rate, % pa	-0.00	(0.02)	$std\Delta yoy$	P
Money market interest rate, % pa	-0.01	(0.03)	$std\Delta yoy$	P
Private credit by banks, LCU	0.23***	(0.08)	$std\%\Delta yoy$	Q
Spread between lending interest rate and treasury bill rate	0.03***	(0.01)	std	R
Spread between 3-month and overnight interbank rates	0.03	(0.03)	std	R
GBR FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.90***	(0.03)		
Household Variable Mortgage Rate in the United Kingdom	0.19***	(0.06)	$std\Delta yoy$	P
Price to rent ratio	0.38***	(0.03)	$std\Delta yoy$	P
Real house price index, sa	0.39***	(0.03)	$std\%\Delta yoy$	P
GBR FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.92***	(0.02)		
Outstanding international private debt securities to GDP (%)	0.02	(0.15)	$std\Delta yoy$	Q
Outstanding international public debt securities to GDP (%)	-0.20**	(0.08)	$std\Delta yoy$	Q
10Y-3M government bond spread	-0.32***	(0.05)	std	R
Treasury Bill Rate, % pa	0.14*	(0.08)	$std\Delta yoy$	P
GBR FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
GBR FTSE 100 share price index	n/a		$std\%\Delta yoy$	P
GBR FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.96***	(0.01)		
FC^{CR}	0.22***	(0.02)	std	C
FC^{B}	0.22***	(0.02)	std	C
FC^{EQ}	0.00	(0.02)	std	C
FC^{H}	0.16***	(0.03)	std	C

Table 11: HUN

HUN FC^{CR}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.85***	(0.13)		
Total credit to private non-financial sector, % of GDP	0.38***	(0.10)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.40***	(0.12)	$std\%\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	0.33	(0.24)	$std\Delta yoy$	P
Deposit interest rate	0.36*	(0.21)	$std\Delta yoy$	P
Spread between lending interest rate and deposit interest rate	-0.15	(0.15)	std	R
Spread between lending interest rate and treasury bill rate	-0.26	(0.16)	std	R
HUN FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
Real housing price	n/a		$std\%\Delta yoy$	P
HUN FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.90***	(0.05)		
5Y-3M government bond spread	-0.29***	(0.05)	std	R
International debt securities by all issuers, amt outstanding, mln USD	0.15***	(0.05)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	0.34***	(0.10)	$std\%\Delta yoy$	Q
Treasury Bill Rate, % pa	0.02	(0.03)	$std\Delta yoy$	P
HUN FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.78***	(0.08)		
Average daily stock market return	0.28***	(0.08)	std	P
Standard deviation of daily stock market returns	-0.18*	(0.09)	std	R
Average daily stock market index value	0.46***	(0.08)	$std\%\Delta yoy$	P
HUN FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.88***	(0.07)		
Treasury Bill Rate, % pa	0.15	(0.17)	$std\Delta yoy$	P
FC^{CR}	0.35	(0.22)	std	C
FC^{EQ}	-0.18	(0.23)	std	C
FC^{H}	0.30***	(0.09)	std	C

Table 12: ITA

ITA FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.94***	(0.03)		
Total credit to private non-financial sector, % of GDP	0.11*	(0.06)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.32***	(0.05)	$std\%\Delta yoy$	Q
Money market interest rate, % pa	0.09	(0.06)	$std\Delta yoy$	P
ITA 3-month interbank rate on deposits	0.12*	(0.07)	$std\Delta yoy$	P
Spread between lending interest rate and money market interest rate	-0.12	(0.08)	std	R
Spread between money market interest rate and treasury bond rate	0.19***	(0.04)	std	R
ITA FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.84***	(0.07)		
Price to rent ratio	0.51***	(0.05)	$std\Delta yoy$	P
Price to income ratio	0.51***	(0.06)	$std\Delta yoy$	P
Real house price index, sa	0.52***	(0.06)	$std\%\Delta yoy$	P
ITA FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.87***	(0.03)		
Outstanding domestic private debt securities to GDP (%)	-0.39***	(0.06)	$std\Delta yoy$	Q
Outstanding domestic public debt securities to GDP (%)	-0.38***	(0.05)	$std\Delta yoy$	Q
Outstanding international private debt securities to GDP (%)	-0.19	(0.16)	$std\Delta yoy$	Q
Outstanding international public debt securities to GDP (%)	-0.28***	(0.09)	$std\Delta yoy$	Q
10Y-3M government bond spread	-0.20***	(0.06)	std	R
International debt securities by all issuers, amt outstanding, mln USD	-0.03	(0.04)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	-0.18**	(0.08)	$std\%\Delta yoy$	Q
Treasury Bill Rate, % pa	0.08	(0.08)	$std\Delta yoy$	P
ITA FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.93***	(0.02)		
Stock market capitalization to GDP (%)	0.30***	(0.04)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.39***	(0.04)	$std\Delta yoy$	Q
Equities, Index	0.15***	(0.04)	$std\%\Delta yoy$	P
ITA FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.93***	(0.03)		
Treasury Bill Rate, % pa	0.15	(0.11)	$std\Delta yoy$	P
Equities, Index	-0.07	(0.11)	$std\%\Delta yoy$	P
FC^{CR}	0.29***	(0.04)	std	C
FC^{H}	0.17***	(0.06)	std	C

Table 13: NLD

NLD FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.98***	(0.01)		
Total credit to private non-financial sector, % of GDP	0.02	(0.03)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.08***	(0.03)	$std\%\Delta yoy$	Q
3-Month or 90-day Rates and Yields: Interbank Rates	0.03	(0.04)	$std\Delta yoy$	P
Lending interest rate, % pa	0.03	(0.03)	$std\Delta yoy$	P
Spread between lending and deposit interest rate	0.21***	(0.03)	std	R
Spread between lending and treasury bond rate	0.19***	(0.04)	std	R
NLD FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.97***	(0.02)		
Price to rent ratio	0.21***	(0.02)	$std\Delta yoy$	P
Price to income ratio	0.27***	(0.02)	$std\Delta yoy$	P
Real house price index, sa	0.22***	(0.02)	$std\%\Delta yoy$	P
NLD FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.85***	(0.05)		
International debt securities by all issuers, amt outstanding, mln USD	0.14***	(0.02)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	0.45***	(0.04)	$std\%\Delta yoy$	Q
Government Bonds Interest Rate, % pa	0.28***	(0.07)	$std\Delta yoy$	P
NLD FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.90***	(0.03)		
Stock market capitalization to GDP (%)	0.40***	(0.07)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.34***	(0.06)	$std\Delta yoy$	Q
Stock market turnover ratio (%)	0.25***	(0.08)	$std\Delta yoy$	Q
Average daily stock market index value	0.29***	(0.09)	$std\%\Delta yoy$	P
Average daily stock market return	0.09	(0.08)	std	P
Standard deviation of daily stock market returns	-0.18*	(0.10)	std	R
NLD FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.96***	(0.02)		
FC^{CR}	0.16***	(0.04)	std	C
FC^{B}	0.07*	(0.04)	std	C
FC^{EQ}	0.27***	(0.07)	std	C
FC^{H}	0.22***	(0.03)	std	C

Table 14: NOR

NOR FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.94***	(0.02)		
Total credit to private non-financial sector, % of GDP	0.31***	(0.04)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.30***	(0.03)	$std\%\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	0.04	(0.06)	$std\Delta yoy$	P
Spread between 3-month and overnight interbank rates	0.06	(0.06)	std	R

NOR FC^{H}	Coef	SE	Trans	Attr
f_{t-1}	0.91***	(0.03)		
Price to rent ratio	0.39***	(0.03)	$std\Delta yoy$	P
Price to income ratio	0.39***	(0.03)	$std\Delta yoy$	P
Real house price index, sa	0.42***	(0.03)	$std\%\Delta yoy$	P

NOR FC^{B}	Coef	SE	Trans	Attr
Government Bonds Interest Rate, %pa	n/a		$std\Delta yoy$	P

NOR FC^{EQ}	Coef	SE	Trans	Attr
f_{t-1}	0.87***	(0.04)		
Stock market capitalization to GDP (%)	0.31***	(0.08)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.37***	(0.05)	$std\Delta yoy$	Q
Stock market turnover ratio (%)	0.23***	(0.07)	$std\Delta yoy$	Q
Average daily stock market index value	0.33***	(0.10)	$std\%\Delta yoy$	P
Average daily stock market return	0.12	(0.08)	std	P
Standard deviation of daily stock market returns	-0.19	(0.15)	std	R

NOR FC^{AG}	Coef	SE	Trans	Attr
f_{t-1}	0.93***	(0.02)		
FC^{CR}	0.24***	(0.03)	std	C
FC^{B}	0.22***	(0.07)	std	C
FC^{EQ}	0.16**	(0.08)	std	C
FC^{H}	0.29***	(0.06)	std	C

Table 15: POL

POL FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.91***	(0.05)		
Total credit to private non-financial sector, % of GDP	-0.09	(0.14)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.26***	(0.06)	$std\%\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	0.33*	(0.20)	$std\Delta yoy$	P
Money market interest rate, % pa	0.29	(0.21)	$std\Delta yoy$	P
Spread between money market interest rate and overnight interbank rate	-0.12**	(0.05)	std	R

POL FC^{H}	Coef	SE	Trans	Attr
Average House Price: Residential Bldgs	n/a		$std\%\Delta yoy$	P

POL FC^{B}	Coef	SE	Trans	Attr
f_{t-1}	0.72***	(0.13)		
10Y-3M government bond spread	0.05	(0.13)	std	R
International debt securities by all issuers, amt outstanding, mln USD	-0.05*	(0.03)	$std\%\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	0.62***	(0.14)	$std\%\Delta yoy$	Q
Treasury Bill Rate, % pa	0.18**	(0.08)	$std\Delta yoy$	P

POL FC^{EQ}	Coef	SE	Trans	Attr
f_{t-1}	0.78***	(0.05)		
Average daily stock market index value	0.49***	(0.05)	$std\%\Delta yoy$	P
Average daily stock market return	0.23**	(0.10)	std	P
Standard deviation of daily stock market returns	-0.07	(0.11)	std	R

POL FC^{AG}	Coef	SE	Trans	Attr
f_{t-1}	0.96***	(0.04)		
Treasury Bill Rate, % pa	-0.03	(0.05)	$std\Delta yoy$	P
FC^{CR}	0.26***	(0.05)	std	C
FC^{EQ}	0.16	(0.15)	std	C

Table 16: SVK

SVK FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.93***	(0.07)		
Private credit by deposit money banks to GDP (%)	0.24***	(0.05)	$std\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money	0.11	(0.24)	$std\Delta yoy$	P
Private credit by banks, LCU	0.31	(0.20)	$std\%\Delta yoy$	Q
Spread between 3-month and overnight interbank rates	-0.08	(0.20)	std	R
SVK FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.89***	(0.06)		
Residential property prices total	0.32***	(0.04)	$std\%\Delta yoy$	P
Price to rent ratio	0.41***	(0.05)	$std\Delta yoy$	P
Price to income ratio	0.41***	(0.05)	$std\Delta yoy$	P
SVK FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.89***	(0.05)		
Outstanding international private debt securities to GDP (%)	-0.42***	(0.07)	$std\Delta yoy$	Q
Outstanding international public debt securities to GDP (%)	-0.19	(0.18)	$std\Delta yoy$	Q
Debt securities by all issuers, amt outstanding, mln USD	-0.01	(0.03)	$std\%\Delta yoy$	Q
Government Bonds Interest Rate, % pa	0.19	(0.15)	$std\Delta yoy$	P
SVK FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.90***	(0.11)		
Stock market capitalization to GDP (%)	-0.14	(0.14)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.36***	(0.07)	$std\Delta yoy$	Q
Stock price volatility	-0.40***	(0.07)	$std\Delta yoy$	R
SVK Share prices: SAX index	0.20	(0.15)	$std\%\Delta yoy$	P
SVK FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.96***	(0.07)		
FC^{CR}	0.32***	(0.04)	std	C
FC^{EQ}	0.26***	(0.09)	std	C

Table 17: SWE

SWE FC^{CR}	Coef	SE	Trans	Attr
f_{t-1}	0.92***	(0.03)		
Total credit to private non-financial sector, % of GDP	0.34***	(0.04)	$std\Delta yoy$	Q
Total credit to private non-financial sector, LCU	0.39***	(0.06)	$std\%\Delta yoy$	Q
Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	-0.08	(0.10)	$std\Delta yoy$	P
Money market interest rate, % pa	-0.06	(0.14)	$std\Delta yoy$	P
Spread between money market and 3-month interbank rate	-0.07	(0.14)	std	R
Spread between money market interest rate and treasury bill rate	-0.08	(0.16)	std	R
SWE FC^{H}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.96***	(0.02)		
Price to rent ratio	0.30***	(0.02)	$std\Delta yoy$	P
Price to income ratio	0.30***	(0.02)	$std\Delta yoy$	P
Real house price index, sa	0.33***	(0.02)	$std\%\Delta yoy$	P
SWE FC^{B}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.76***	(0.05)		
5Y-3M government bond spread	-0.50***	(0.05)	std	R
Treasury Bill Rate, % pa	0.46***	(0.07)	$std\Delta yoy$	P
SWE FC^{EQ}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.88***	(0.03)		
Stock market capitalization to GDP (%)	0.40***	(0.04)	$std\Delta yoy$	Q
Stock market total value traded to GDP (%)	0.25***	(0.06)	$std\Delta yoy$	Q
SWE Share prices: OMXS30 index	0.40***	(0.08)	$std\%\Delta yoy$	P
SWE FC^{AG}	**Coef**	**SE**	**Trans**	**Attr**
f_{t-1}	0.95***	(0.01)		
Total Share Prices for All Shares	-0.00	(0.09)	$std\%\Delta yoy$	P
Real house price index, sa	0.27***	(0.05)	$std\%\Delta yoy$	P
FC^{CR}	0.23***	(0.04)	std	C
FC^{B}	-0.03	(0.05)	std	C

References

Abrigo, Michael R. M. and Inessa Love (2016). "Estimation of panel vector autoregression in Stata," Stata Journal, StataCorp LP, vol. 16(3), pages 778–804, September.

Adarov, Amat (2017). "Financial Cycles in Credit, Housing and Capital Markets: Evidence from Systemic Economies", Vienna Institute for International Economic Studies (wiiw) Working Paper, No. 140, Vienna, December 2017.

Adarov, Amat (2018). "Financial Cycles Around the World", Vienna Institute for International Economic Studies (wiiw) Working Paper No. 145, March 2018.

Aikman, D., Haldane, A. G. and Nelson (2015). "Curbing the Credit Cycle." The Economic Journal, 125: 1072–1109.

Beck, Thorsten, Asl Demirgüç-Kunt and Ross Levine (2000). "A New Database on Financial Development and Structure", World Bank Economic Review 14, 597–605.

Beck, Thorsten, and Ross Levine (2004). "Stock Markets, Banks, and Growth: Panel Evidence," Journal of Banking and Finance, Vol. 28, pp. 423–42.

Borio, Claudio (2013). "The Great Financial Crisis: Setting priorities for new statistics," Journal of Banking Regulation, Palgrave Macmillan, vol. 14(3-4), pages 306–317, July.

Borio, Claudio (2014). "The financial cycle and macroeconomics: What have we learnt?" Journal of Banking and Finance, Elsevier, vol. 45(C), pages 182–198.

Borio, Claudio, Frank Piti Disyatat, and Mikael Juselius (2013). "Rethinking potential output: Embedding information about the financial cycle," BIS Working Papers 404, BIS.

Borio, Claudio, Piti Disyatat and Mikael Juselius (2014). "A parsimonious approach to incorporating economic information in measures of potential output," BIS Working Papers 442, BIS.

Bry, Gerhard and Charlotte Boschan (1971). *Cyclical Analysis of Time Series: Procedures and Computer Programs*, New York, NBER.

Comunale, Mariarosaria (2017). "A panel VAR analysis of macro-financial imbalances in the EU." Working Paper Series 2026, European Central Bank.

Claessens, S., M. Kose and M. Terrones (2011). "Financial cycles: What? How? When?" IMF Working Paper no WP/11/76.

Claessens, Stijn, Kose, M., Ayhan, and Terrones, Marco E. (2012). "How do business and financial cycles interact?" Journal of International Economics, Elsevier, vol. 87(1), pages 178–190.

Claessens, Stijn and Kose, Ayhan (2013). "Financial Crises Explanations, Types, and Implications." IMF Working Papers 13/28, International Monetary Fund.

Claessens, Stijn and Kose, Ayhan (2017). "Asset prices and macroeconomic outcomes: a survey," Policy Research Working Paper Series 8259, The World Bank.

Demetriades, P. O., and K. A. Hussein (1996). "Does Financial Development Cause Economic Growth? Time-series Evidence from 16 Countries", Journal of Development Economics 51(2), 387–411.

Dieppe, A., R. Legrand, and B. van Roye (2016). "The BEAR Toolbox" Working Paper Series 1934, European Central Bank.

Doan, T., Litterman, R., and Sims, C. (1984). "Forecasting and conditional projection using realistic prior distributions." Econometric Reviews, 3(1): 1–100.

Drehmann, Mathias, Claudio Borio, and Kostas Tsatsaronis (2012). "Characterising the financial cycle: don't lose sight of the medium term!," BIS Working Papers 380, Bank for International Settlements.

Dumitrescu, Elena-Ivona and Christophe Hurlin (2012). "Testing for Granger non-causality in heterogeneous panels," Economic Modelling, Volume 29, Issue 4, 2012, pp. 1450–1460.

Geweke, J. (1977). "The dynamic factor analysis of economic time series", in D.J. Aigner, and A.S. Goldberger (eds.), Latent Variables in SocioEconomic Models, Amsterdam: North-Holland.

Goldsmith, R.W. (1969). "Financial Structure and Development". Yale University Press, New Haven.

Harding, D and A Pagan (2002). "Dissecting the cycle: a methodological investigation", Journal of Monetary Economics, vol 49, pp 365-81.

Hatzius, J., P. Hooper, F. Mishkin, K. Schoenholtz and M. Watson (2010). "Financial conditions indexes: a fresh look after the financial crisis", NBER Working Papers, no 16150.

Im, K. S., M. H. Pesaran, and Y. Shin (2003). "Testing for unit roots in heterogeneous panels" Journal of Econometrics 115: 53–74.

Jordá, O., Schularick, M.and Taylor, A. (2011). "Financial Crises, Credit Booms, and External Imbalances: 140 Years of Lessons." IMF Economic Review, 59, issue 2, pp. 340–378.

King, Robert and Ross Levine (1993). "Finance and Growth: Schumpeter Might Be Right." Quarterly Journal of Economics, August, 153 (3): 717–738.

Kiyotaki, N. and J. Moore (1997). "Credit Cycles." Journal of Political Economy 105(2): 211–248.

Levine, Ross (1997). "Financial Development and Economic Growth: Views and Agenda," Journal of Economic Literature, Vol. 35(2), pp. 688–726.

Levine, Ross (2003). "Bank-Based or Market-Based Financial Systems: Which Is Better?" Journal of Financial Intermediation, Vol. 11, pp. 398–428.

Levine, R. and S. Zervos (1998). "Stock markets, banks and economic growth," American Economic Review, vol 88, pp 537–558.

Litterman, Robert B. (1979). "Techniques of forecasting using vector autoregressions." Working Papers 115, Federal Reserve Bank of Minneapolis.

McKinnon, R. (1963). "Optimum currency areas", American Economic Review, vol. 53, pp. 717–725.

Minsky, Hyman P. (1978). "The Financial Instability Hypothesis: A Restatement". Hyman P. Minsky Archive. Paper 180

Minsky, Hyman P. (1982). "Can it happen again?", Essays on Instability and Finance, Armonk: M E Sharpe.

Miranda-Agrippino, Silvia and Hélène Rey (2015). "World Asset Markets and the Global Financial Cycle," NBER Working Papers 21722, National Bureau of Economic Research, Inc.

Mundell, R. (1961). "A theory of optimum currency areas" American Economic Review, vol. 51, pp. 657–665.

Nowotny, Ewald, Doris Ritzberger-Grünwald and Peter Backe (ed.), 2014. "Financial Cycles and the Real Economy", Books, Edward Elgar, number 15914.

Rousseau, Peter L. and Paul Wachtel (2011). "What is Happening to the Impact of Financial Deepening on Economic Growth?" Economic Inquiry, Vol. 49, No.1, pp. 276–288.

Rünstler, Gerhard, Balfoussia, H., et al. (2018). "Real and financial cycles in EU countries - Stylised facts and modelling implication". Occasional Paper Series 205, European Central Bank.

Sargent, T.J., and Sims, C.A. (1977). "Business cycle modeling without pretending to have too much a priory economic theory", in C.A. Sims (ed.), New Methods in Business Cycle Research, Minneapolis: Federal Reserve Bank of Minneapolis.

Schüler, Yves S., Hiebert, Paul and Peltonen, Tuomas A. (2015). "Characterising the financial cycle: a multivariate and time-varying approach." Working Paper Series 1846, European Central Bank.

Schularick, Moritz and Alan M. Taylor (2012). "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008." American Economic Review 102(2), 1029–1061.

Shaw, E.S. (1973). "Financial Deepening in Economic Development" Oxford University Press, London.

Stremmel, Hanno (2015). "Capturing the financial cycle in Europe", Working Paper Series 1811, European Central Bank.