ECONOMICS – WORKING PAPERS 2022/15

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This is a publication of the EIB Economics Department.
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Published by the European Investment Bank.
Printed on FSC® Paper.

pdf: QH-BK-22-015-EN-N ISBN 978-92-861-5408-9 ISSN 2599-736X doi: 10.2867/255979

Estimating financial integration in Europe: How to separate structural trends from cyclical fluctuations*

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November 17, 2022

Abstract

We construct a new indicator of de facto financial integration in the EU. The resulting indicator is pro-cyclical as it evolves along the cyclical pattern of economic activity in the European Union. It is then appended to a set of relevant financial and macroeconomic variables, within a FAVAR framework, to allow us to separate the impact of cyclical boom-bust shocks from structural integration shocks. Increasing structural financial integration tends to improve risk absorption and reduce income disparities among European countries. However, our analysis suggests that most of the movements in the indicator reflect business cycle dynamics, not proper integration. Given the estimated beneficial effects of stronger structural financial integration, these results highlight the need to develop further policies to foster it in the EU.

Keywords: Business Cycle, FAVAR Models, Financial Markets, Macroeconomic Shocks.

JEL Classifications: E44, F36, F44, G15.

*The authors would like to thank Andrea Brasili for the comments and suggestions on this paper. Views presented in the paper are those of the authors only and do not necessarily represent the views of the European Investment Bank (EIB). Declarations of interest: none

1 Introduction

Financial integration has the potential to channel capital to where it is most productive and so improve investment levels, consumption smoothing, and the pass-through of monetary policy. However, reaping these benefits may depend on the type of financial integration. For instance, cyclical financial integration is likely to support investment during upswings, but to recede during downturns, thereby amplifying the propagation of adverse shocks across countries. Nevertheless, there has been little study of the cyclicality of financial integration and how financial integration responds to macroeconomic shocks. We aim to fill this gap in the literature by producing an indicator of de facto financial integration in the EU within a Bayesian FAVAR setup. We then identify boom-bust and true integration shocks in this setup to disentangle the drivers of financial integration in the EU.

International financial integration is broadly defined as a process of increased cross-border linkages between financial markets. Since the two main observable economic features of a typical financial market relate to price and holding position, increased cross-border financial holdings and cross-border price convergence, signal stronger international financial integration, as explained in Eyraud et al. (2017). Nevertheless, these measures are influenced by factors of another nature than those driving financial integration in the long run. As such, they provide an estimation of de facto financial integration, different from the de jure financial integration defined by Schindler (2009) as reflecting a region's integration strategy. In the literature, the predictable returns of assets primarily reflect aversion to the non-diversifiable risks they carry, as asset holdings are usually selected to maximise expected returns adjusted for aversion to expected risks. Several risks and factors can be conceived of as aversion to risk that the literature suggests may apply specifically or particularly to the holding of international assets. Coeurdacier & Rey (2013) provide a summary of these risks, including exchange rate risk, counterparty risk and jurisdictional risk, and of factors, including imperfect knowledge and behavioral home bias. Therefore, de facto

financial integration decreases along the increasing risk aversion of holding cross-border intra-European assets.

In general, the development of integration of a financial system can be driven by both cyclical and structural changes. Cyclical changes are likely to be driven by the correlations of the business cycle with general risk aversion (Campbell (1999)), macroeconomic uncertainty (Bloom (2014)), or exchange rate volatility (Grossmann et al. (2014)). Structural changes can include reductions in exchange rate risk related to the establishment of a currency union, such as the Economic and Monetary Union (EMU) (Jappelli & Pagano (2008)), strengthened regulatory or supervisory convergence, or, on the negative side, stigmas from the previous financial crises (Reinhart & Rogoff (2009)). In the European Union, macroeconomic shocks which increase output seem likely to be accompanied by reductions in uncertainty (Bloom (2014)), exchange rate risk (Evans & Lyons (2008)) and redenomination risk (De Santis (2015)). However, this is not necessarily the case. For instance, markets may believe that the rise in output is unsustainable or might expose uncertainties about regional divides, which may raise uncertainty and exchange rate risk. Additionally, recent evidence suggests that risk aversion is more directly related to financial market confidence, as suggested in Guiso et al. (2018), rather than simply wealth, as in Brunnermeier & Nagel (2008), which may increase if a shock that reduces output triggers also a reduction of risk.

Our paper is related to four main strands of literature. The first one consists of reports published by European institutions and bodies, as the biannual Financial Integration and Structure in the Euro Area report by the ECB, European Central Bank (2020), the European Financial Stability and Integration Review, published yearly by the European Commission, European Commission (2021), as well as the Investment Report, published yearly by the European Investment Bank, occasionally covering the topic (European Investment Bank (2022)). These reports regularly provide indicators and analyses of developments in

financial integration within the European Union. The second strand consists of articles analysing the determinants of financial flows and macroeconomic variables. Examples include Rey (2015) and Fornari & Stracca (2012) studying the response of financial flows to specific shocks using time series data, and Forbes & Warnock (2012), on the characteristics associated with changes in financial flows. Differently from ours, these papers mainly focus on intra-country financial flows rather than on cross-border financial flows. The third strand of literature studies the determinants of asset price convergence and divergence in Europe mainly focusing on a particular asset type. For instance, Bekaert et al. (2013) focus on equity, Christiansen (2014) on bonds and Sander & Kleimeier (2004) on the banking sector, to analyse the empirical features of asset price convergence as well as structural changes associated with major policy or institutional changes, such as the introduction of the EMU. Lastly, we consider the literature that focuses on the effect of financial integration on consumption smoothing. Some of these papers correlate international consumption smoothing with different financial integration periods (Kalemli-Ozcan et al. (2014) or Rangvid et al. (2016)), while others study the effect of more specific integration changes on it (Friedrich (2015) for example).

Our contribution to the discussed literature is twofold. Firstly, we generate a comprehensive indicator able to gauge the level of integration of EU financial markets. Secondly, we identify two shocks to analyse the different impacts of cyclical macroeconomic developments and structural integration on a set of relevant covariates in order to draw policy conclusions. In addition, this last exercise allows us to shed light on the dynamic forces contributing to reducing financial fragmentation since the establishment of the EMU. We tackle our research question with a full macroeconometric approach using a factor-augmented vector autoregression, estimating its state equation using Bayesian techniques. The remainder of the paper develops as follows: Section 2 sets out the econometric framework and describes the data, Section 3 presents our financial integration indicator and illustrates the

identification strategy, Section 4 reports the results of the estimation and studies the main historical drivers of financial integration in the EU, and finally, Section 5 concludes.

2 Econometric setup and data

This section outlines the econometric framework adopted, its estimation and identification. We then describe the dataset, consisting of time series data with quarterly frequency spanning the period 2000:Q1 - 2019:Q4. It is composed of an auxiliary dataset, used to estimate the financial integration indicator, and a main dataset, comprising the variables employed for the structural analysis. We do not include the COVID-19 period and leave the effect of its policy response on financial integration for future research, as it is still proceeding at the time of writing.

2.1 Econometric framework

The econometric model that we use for our analysis is a factor-augmented vector autoregression (FAVAR) á la Bernanke et al. (2005). Define $\mathbf{Y}_t$ as the whole dataset at period t, which can be split into two parts, such that $\mathbf{Y}_t = (\mathbf{Y}_t^{a\prime}, \mathbf{Y}_t^{m\prime})'$. $\mathbf{Y}_t^a$ is the auxiliary dataset, and it is an $n \times 1$ vector of variables containing relevant information about financial integration at period t, and $\mathbf{Y}_t^m$ is the main dataset and it is an $(m-1) \times 1$ vector containing key macroeconomic and financial variables at period t. Define $\mathbf{F}_t$ as the unobserved level of financial integration at period t, $\mathbf{z}_t = (\mathbf{F}_t', \mathbf{Y}_t^{m'})'$ and $\mathbf{Z}_t = (\mathbf{z}_t' \dots \mathbf{z}_{t+1-L}')'$, where L is the lag period. The measurement equation is given by:

$$\mathbf{Y}_t = \mathbf{\Gamma} + \mathbf{\Lambda}\mathbf{z}_t + \mathbf{U}_t \tag{1}$$

with,

$$\mathbf{\Gamma} = \begin{pmatrix} \boldsymbol{\gamma} \\ 0 \end{pmatrix}, \quad \mathbf{\Lambda} = \begin{pmatrix} \boldsymbol{\lambda} & 0 \\ 0 & \mathbf{I} \end{pmatrix}, \quad \mathbf{U}_t = \begin{pmatrix} \boldsymbol{u}_t \\ 0 \end{pmatrix}$$

where $\boldsymbol{\gamma}$ is a vector of constants, $\boldsymbol{\lambda}$ is a vector of factor loadings, $\boldsymbol{u}_t \sim N(0, \mathbf{\Omega})$ is a set of idiosyncratic error terms, where $\mathbf{\Omega}$ is a diagonal variance-covariance matrix with ω variances. Note that one factor loading will have to be set to one to ensure the uniqueness of the factor. However, with one factor, this becomes a scaling constant. The state equation is given by:

$$\boldsymbol{Z}_t = \mathbf{\Theta} + \mathbf{\Phi}\boldsymbol{Z}_{t-1} + \boldsymbol{V}_t \tag{2}$$

with,

$$\mathbf{\Theta} = \begin{pmatrix} \boldsymbol{\theta} \\ 0 \end{pmatrix}, \quad \mathbf{\Phi} = \begin{pmatrix} \boldsymbol{\phi} \\ \boldsymbol{I} & 0 \end{pmatrix}, \quad \boldsymbol{V}_t = \begin{pmatrix} \boldsymbol{v}_t \\ 0 \end{pmatrix}$$

where $\boldsymbol{\theta}$ is a vector of constants, $\boldsymbol{\phi}$ is a matrix of VAR coefficients, $\boldsymbol{v_t} \sim N(0, \mathbf{\Sigma})$ is a set of reduced form error terms, where $\mathbf{\Sigma}$ is the variance-covariance matrix with σ variances. The structural errors are given by:

$$\boldsymbol{\eta}_t = \boldsymbol{D}\,\boldsymbol{v}_t = chol(\sigma)\,\boldsymbol{Q}\,\boldsymbol{v}_t \tag{3}$$

where $\boldsymbol{\eta}_t \sim N(0, \boldsymbol{I})$, with $\boldsymbol{Q} \sim orthonormal$.

Regarding the estimation technique, we follow a procedure consisting of two steps. In the first step, we estimate a financial integration factor by applying principal component analysis on a comprehensive set of quantity and price integration measures, while in the

second step, we estimate the vector autoregression in the factor and other endogenous variables using Bayesian techniques. In the estimation of equation 2, we follow Canova (2007) to set proper prior distributions. We set Minnesota type priors for $\mathbf{\Theta}$ and $\mathbf{\Phi}$ with a mean that implies a univariate random walk for each variable and a diagonal variance-covariance matrix. The hyperparameters are set to 0.2 on their own variable lags, to 1 on other variable lags, 2 on lags greater than one and 100 on constant terms. An inverse-Wishart ($\mathcal{IW}$) prior is chosen for the variance-covariance matrix of the state equation such that $\mathbf{\Sigma} \sim \mathcal{IW}(\mathbf{\Psi}, \nu)$, with $\mathbf{\Psi}$ set by taking the covariance of the residuals from random walks for each variable and degrees of freedom ν equal to 9. Our choice of the independent conjugate prior distributions follows the usual two-step estimation of Bayesian FAVAR models and ensures that the conditional distribution of each group of parameters is known and hence, tractable. Therefore, we can estimate the parameters via a Gibbs sampling algorithm as in Carter & Kohn (1994), where at each step, we draw one group of parameters from their posterior distribution, conditional on all parameters not in their group. We set the lag length to two according to the Bayes-Schwartz information criterion and simulated 30,000 initial draws, of which the first 10,000 are discarded.

Regarding the identification of the structural form, the usual methods employed for VAR models can also be applied to FAVAR models, as long as the restrictions are economically meaningful. Hence, recursive identification schemes, short-run and long-run sign and zero restrictions can be employed. In our case, we use the approach of Arias et al. (2018), setting a mixture of sign and zero restrictions both in the short and the long-run.

2.2 Main dataset

The main dataset consists of six series, including the financial integration indicator. The series are plotted in figure 1 and, together with the estimated factor, they are the endogenous variables of the state equation of the Bayesian FAVAR. As the financial integration

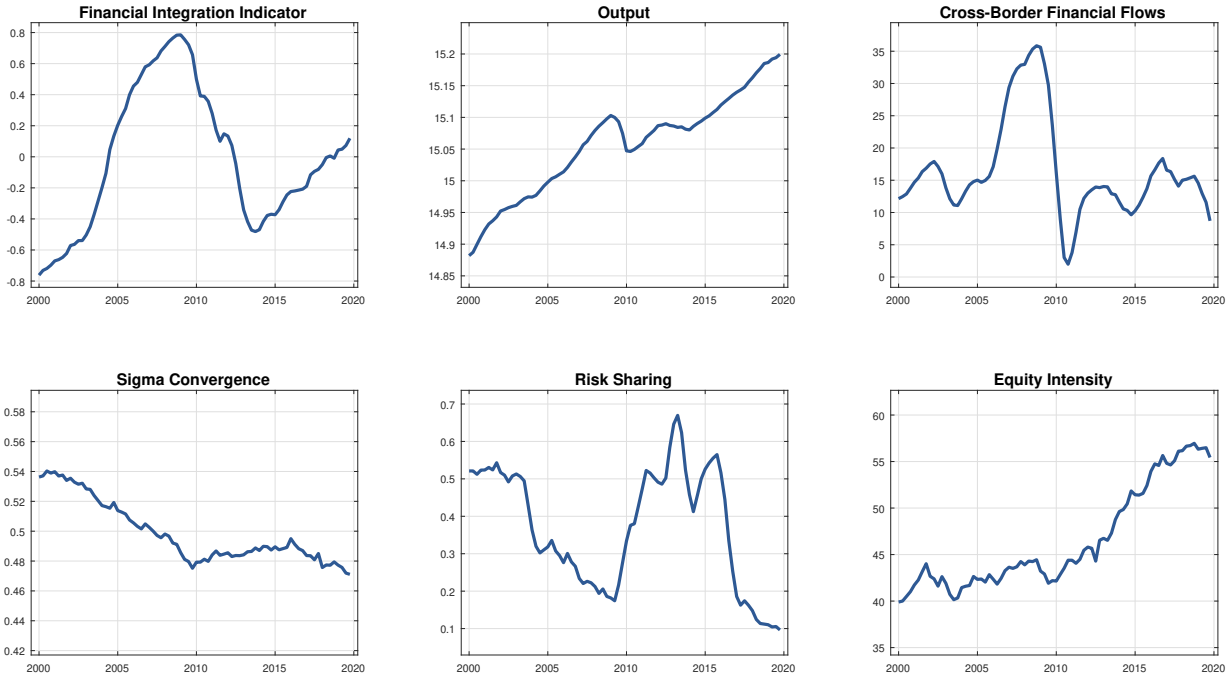

Figure 1: *Main dataset.*
The top left panel shows the financial integration indicator estimated with the auxiliary dataset, whereas the other panels show the endogenous variables of the state equation.

indicator is not an observable variable but an estimated time series, we leave its detailed description to the next section. The variable "Output" is the seasonal and calendar-adjusted chain-linked GDP volumes for the EU27 from Eurostat, deflated and in logarithmic form. The series "Cross-border financial flows" is constructed as the average cross-border financial flows, inflows and outflows for EU27 member states, as a percentage of GDP. It is based on EIB internal calculations on multiple series of the International Financial Statistics database of the International Monetary Fund (IMF).[1]

We also include in our state equation a "Sigma Convergence" series able to grasp the time-varying reduction of disparities among EU27 countries. Following the methodology of

[1]Ideally, we would need the geographical breakdown of the balance of payments to compile proper estimates of intra and extra cross-border financial flows. However, the data that would enable the breakdown is not publicly available. An EU-wide breakdown can be compiled using debits and credits reported by Eurostat, for the EU countries and the EU aggregate (which is consolidated and therefore excludes the intra-component). Such computation shows that the breakdown is relatively stable: intra-flows and extra-flows co-move substantially. Therefore, we can rely on total cross-border flows as a proxy to infer about intra-cross border financial flows.

Monfort (2008, 2020), our convergence indicator is computed as the coefficient of variation of GDP per capita, i.e. the ratio between its weighted standard deviation and its weighted average. A decreasing value indicates a reduction of disparities, as shown for the pre- and post-crisis periods.

When considering integration in financial markets, risk absorption also plays a crucial role. In our specific case, the less integrated are European markets, the less asymmetric shocks are absorbed by the whole system. Therefore, we decide to include in our state equation a "Risk Sharing" indicator following the methodology of European Central Bank (2020) by estimating the correlation between GDP growth and aggregate consumption growth for a panel of EA12 countries excluding Ireland. The time series is constructed by concatenating panel fixed-effects regression coefficients in a twelve-quarter rolling window. The estimated regression reads as:

$$\Delta \, log \, C_{i,t} = \beta_y \, \Delta log Y_{i,t} + \alpha_i + \delta_t + \varepsilon_{i,t} \tag{4}$$

where $\Delta logC_{i,t}$ is the growth rate of aggregate consumption, $\Delta logY_{i,t}$ the growth rate of aggregate output, α_i and δ_t are respectively country and time fixed effects, and $\varepsilon_{i,t}$ is the error term, for $i = 1 \ldots N$ and $t = 1 \ldots T$. As integration increases, the dependence between domestic consumption and output should decrease. Therefore, a value of β_y equal to zero stands for perfect risk sharing, as a country's consumption growth is totally uncorrelated with its output growth. Our series is in line with European Central Bank (2020), reporting values close to zero for the periods pre- and post-World Financial and Sovereign Debt crises. On the contrary, during those time periods, the series shows a significant increase, indicating the rejection of the perfect risk sharing hypothesis.

Lastly, the "Equity Intensity" indicator is constructed by using time series data coming from the IMF database, now by taking international investment positions for EU27 mem-

ber states. To obtain our indicator, firstly, we compute the share of foreign direct and portfolio equity investment over the total investment for both assets and liabilities and then compute their average. This variable aims to give additional information on the type of integration observed. Financial markets can be more integrated also by increasing cross-border debt holdings, hence by taking advantage of profitable sovereign bond spreads. This series, on the contrary, focuses solely on the development of "good" integration, namely the one coming from cross-border equity holdings. As a matter of fact, economic developments leading to a structural financial integration should be reflected by a higher and more proportional increase in cross-border equity investment rather than debt. We compute first differences for all the endogenous variables and leave the financial integration indicator in levels [2]. We do not include more typical variables used in FAVAR settings, like interest rates, inflation or unemployment (see for instance Bernanke et al. (2005), Korobilis (2013) or Koop & Korobilis (2014)), as our aim is not to identify the effect of fiscal or monetary policy shocks on financial integration, but rather to disentangle its cyclical and structural components.

2.3 Auxiliary dataset

The auxiliary dataset includes a total of 81 series, of which 44 quantity (cross-border asset holding) and 37 price (asset price convergence) measures of financial integration. It can be further divided into six sub-groups, whose respective averages are plotted in figure 2. The series come from the ECB Statistical Data Warehouse and Thomson Reuters Datastream, and have been transformed and standardised in order to extract a time series able to grasp the development of financial integration in the European Union. The price series are the inverse normal cumulative density probability of the relative price to book ratio compared to the EU average for all EU economies. Financial and non-financial stocks are considered

[2] Augmented Dickey-Fuller tests confirm the presence of a unit root in all the endogenous variables of the state equation. Thus, they are all $I(1)$.

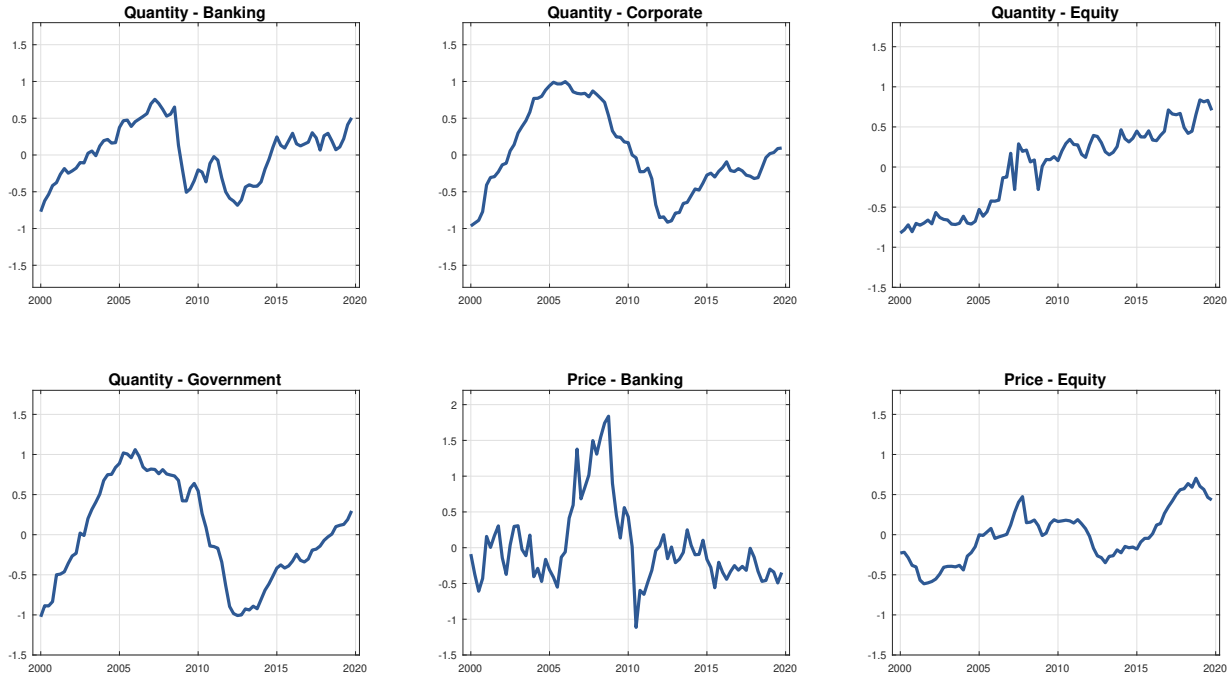

Figure 2: *Auxiliary dataset.*
Average values for each financial integration quantity and price measure sub-group.

separately for each economy. For 14 EU economies, Inverse Chi-Square cumulative density probabilities of the average bank interest rate are compared to the EU average for all EU economies. We do not use the information on corporate debt markets as it is unavailable for most countries. We also do not use information on government bond markets as policy is often used to ensure that these markets co-move, and so they might dominate the indicator if included. The quantity series are the shares of non-domestic bank debt, corporate debt, government debt and equity held by domestic monetary financial institutions for 11 EU countries. By taking the inverse density functions for the price series and having the quantity series built as shares ensures that all the raw series are between zero and unity. Thus, they have the interpretation that an increase implies greater integration of that country. Finally, we transform the raw series so that they are all mean zero with unit variance.

3 Business Cycle and Financial Integration

In this section, we analyse the financial integration series extracted from our auxiliary dataset and discuss its development during its selected period. Furthermore, we discuss the chosen identification strategy to disentangle movements in the financial integration indicator due to the economic business cycle and to structural changes in the European Union.

3.1 The estimated indicator

Figure 3 shows the estimated financial integration indicator, together with recession bars corresponding to an interpretation of the Reference Turning Points indicator developed by the Organisation of Economic Development (OECD) for EU27 countries. The indicator is defined so that an increase implies greater integration.

The figure shows that the indicator broadly rose through the early 2000s, then it declined from slightly before the World Financial crisis to some quarters after the Sovereign Debt crisis and has risen again in recent years. The decline during the period associated with the two crises is considerable and more abrupt than the gains before and after. As a matter of fact, our indicator shows that financial integration in the EU at the end of the sample is still only around the levels of the mid-2000's. The substantial variability in the indicator is at odds with the view of a structural upward trend in financial integration in Europe. It suggests a significant contribution resulting from the boom-bust component.

3.2 The identification strategy

In order to provide valuable insights on the type of integration of European financial markets, we identify two different shocks; a structural shock impacting financial integration in a long-lasting manner and boom-bust shock underpinning the cyclical component. We follow the methodology of Arias et al. (2018) who provide an efficient algorithm for imposing

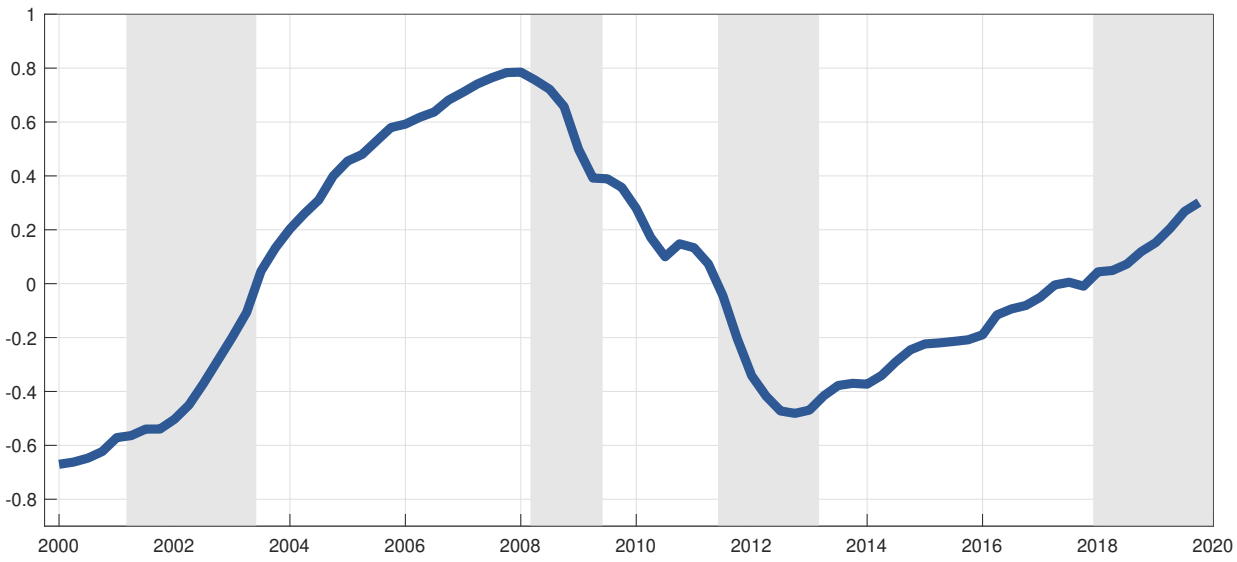

Figure 3: *Financial integration indicator*
The solid blue line is the estimated financial integration indicator, whereas the grey bars are EU recession periods according to the Reference Turning Points indicator of the OECD.

a combination of short-run and the long-run sign and zero restrictions on the variables of the state equation. They extend the identification algorithm for structural vector autoregressions developed by Rubio-Ramírez et al. (2010) by also allowing for zero restrictions. Table 1 shows the details of our preferred identification strategy, whose restrictions are all set only on impact responses.

Table 1: *Identification strategy of the structural FAVAR model*

	Boom/Bust		***True Integration***	
(*Variable/shock horizon*)	*Short-run*	*Long-run*	*Short-run*	*Long-run*
Financial Integration Indicator	+	0		+
Output	+	0		
Cross-Border Financial Flows	+			+
Sigma Convergence				-
Risk Sharing				-
Equity Intensity	-			+

The first one, which we call "Boom/Bust" shock, describes the behaviour of the business cycle, characterised by swings in economic activity, which lead to no permanent effect on

our endogenous variables. Financial integration and output are assumed to increase in the short-run, but to be zero in the long-run. Cross-border financial flows are assumed to increase and the equity intensity to decrease. This shock can be interpreted as an extension of the demand shock identified in Blanchard & Quah (1989), where disturbances have only temporary effects on output. We remain agnostic on the effect of this shock on both sigma convergence and risk sharing. The second shock is what we call "True Integration", as we want to characterise the behaviour of financial integration as structural to the economy. We identify it by remaining agnostic on the effect of all the variables in the short-run but by imposing sign restrictions in the long-run. The shock positively impacts the financial integration indicator, cross-border financial flows and equity intensity. Note how, contrary to the first shock, the last variable is expected to increase here. As explained in section 2.2, as the equity intensity indicator captures the idea of a solid and structural integration, in turn, it is reasonable to think of this process as something that reduces financial fragmentation, not by purchasing cross-border debt, but especially by increasing cross-border equity holdings. This shock should also decrease disparities among EU countries and the extent to which they absorb the risk of their common financial market in the long run. Thus, given how the two indicators are built, its impact is negative on both of them. Lastly, we maintain an agnostic approach to the effect of this shock on output, both in the short and the long-run.

4 Estimation results

In this section, we analyse the results of the estimation exercise in light of our identification scheme and see the effect of both shocks on the endogenous variables of the state equation. We also dig deeper into the main drivers of financial integration, shading light on whether the European Union is building a structural and solid financial integration among its member states or whether its evolution is mainly linked to business cycle dynamics.

4.1 Impulse response function analysis

Firstly, we employ impulse response functions to analyse the dynamic effect of the two estimated shocks on our selected variables. Figure 4 shows the impact of the "Boom/Bust" shock on all our endogenous variables and the estimated factor. The shock significantly increases financial integration on impact and reaches a pick of around 5.6×10^{-3} after one quarter, which accounts to a 0.17% increase from the last observed value of the series. Output increases as well and reaches a pick of around 0.12% after one quarter from the shock. Note how both responses are very short-lived and converge to the steady state after

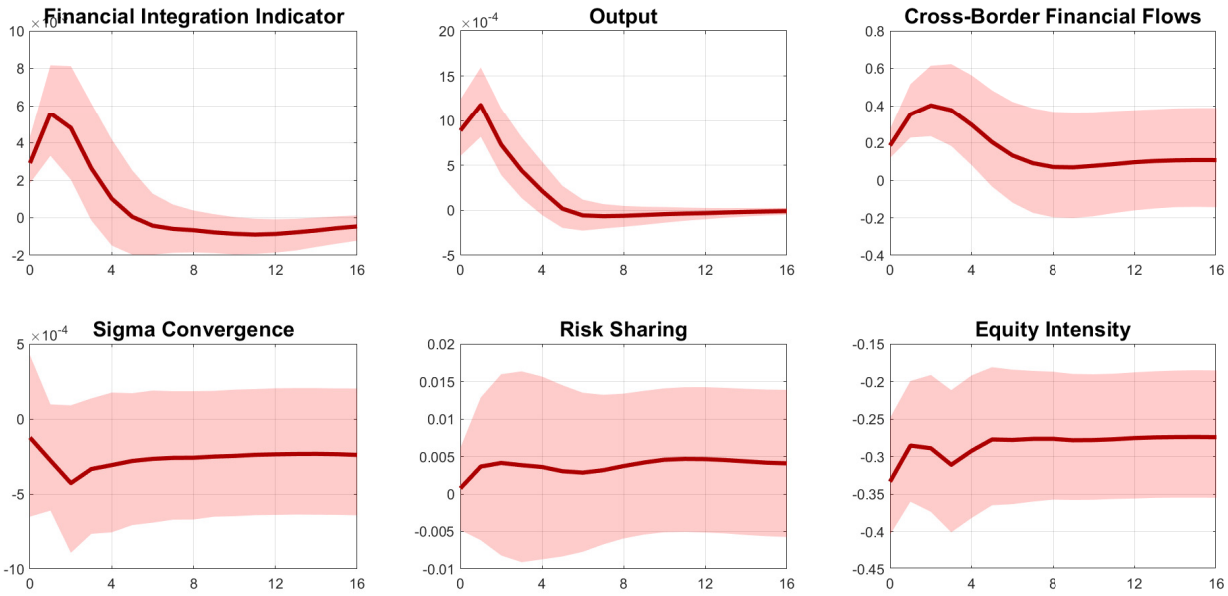

Figure 4: *Impulse Response Functions - Boom/Bust shock*
The solid red line is the posterior median response of each variable to the "Boom/Bust" shock, whereas the red shaded area corresponds to the 20% *and* 80% *posterior percentiles.*

around one year from the shock. This is consistent with the identification of the demand shock by Blanchard & Quah (1989), where no long-term effect on GDP is expected. Furthermore, this shock does not seem to give a long-lasting push to financial integration and cross-border financial flows, which also decay to zero after around a year. In addition, no significant effect is exerted on both the sigma convergence and the risk sharing indicators, to which our identification is agnostic, and equity intensity decreases even in the longer-term, possibly due to a higher propensity of investors to purchase foreign debt rather than

equity.

Figure 5 refers to the impulse response functions following the "True Integration" shock, showing significant differences from the previous one. Financial integration grows more smoothly and reaches a pick of 0.04 after around one year and a half, accounting for around a 13% increase from the last observed value of the series. The response is always

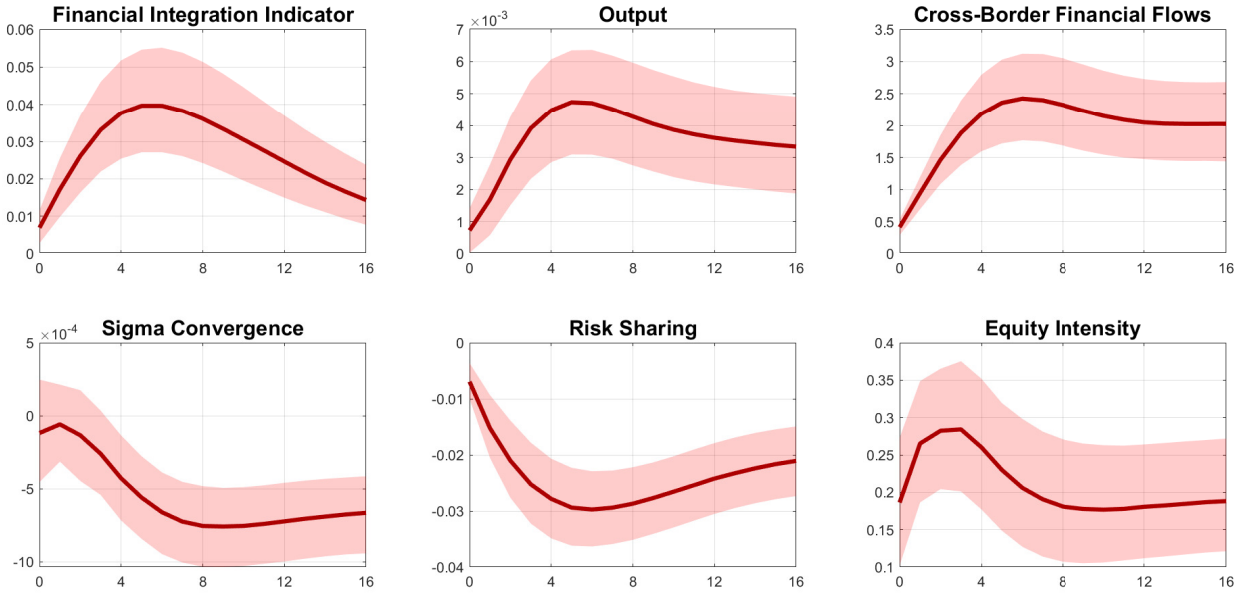

Figure 5: *Impulse Response Functions - True Integration shock*
The solid red line is the posterior median response of each variable to the "True Integration" shock, whereas the red shaded area corresponds to the 20% *and* 80% *posterior percentiles.*

positive and significant and approaches its steady state only at the end of the horizon period, i.e. five years, exhibiting a more long-lasting shock effect. Output behaves in a very similar fashion, with a 0.5% growth picking after around five quarters, yet showing a much higher persistence. Note how the response on this variable is stronger than the one following the "Boom/Bust" shock, albeit the agnosticism set both in the short and the long-run. Cross-border financial flows also increase more persistently, reaching a pick around six times larger than the previous shock. In addition, contrary to the previous shock, "True Integration" produces significant responses to the sigma convergence and the risk sharing indicators. The former is negative and significant in the long-run, indicating a reduction in income disparities, and the latter is also negative and significant for the whole

response horizon, showing evidence of an increased cross-country financial risk absorption. Lastly, equity intensity grows significantly, suggesting a strengthened financial integration through increased cross-border equity holdings.

These results highlight the relevance of enhancing a more structural financial integration among European countries in a policy-oriented perspective. The benefits of decreased financial fragmentation translate not only into a higher risk absorption capacity by the system but also in increased output and decreased income disparities, hence providing benefits also in the real sector.

4.2 Counterfactual analysis and structural reforms

After showing the beneficial impact of a growing structural financial integration, we now try to assess where the European Union stands in light of the two identified shocks. As a matter of fact, the impulse response function analysis showed that fragmentation in financial markets can decrease as a consequence of a solid and equity-based integration, but also by following business cycle dynamics.

Figure 6 shows the estimated counterfactual of the financial integration indicator without the two identified shocks in table 1. On the left panel is displayed the actual series together with what the series would have been if there had been no "Boom/Bust" shock. The counterfactual series looks quite different, as it is flatter than the actual one. Both the upward trend prior to the World Financial crisis and the Sovereign Debt crisis, and the downward trend during the crises are less strong in magnitude, showing that business cycle dynamics are an important driver of the historical evolution of financial integration. The right panel refers to the second shock, showing the actual series together with its counterfactual. Surprisingly the two series almost overlap for the whole estimation period, albeit to a lesser extent from the post-Sovereign Debt crisis onwards. This might be

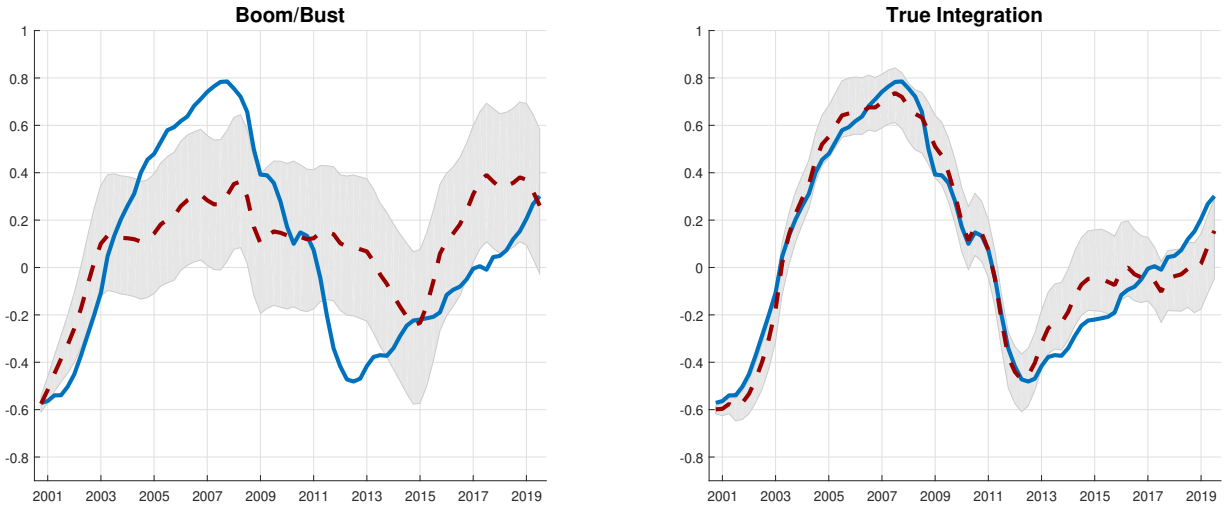

Figure 6: *Counterfactual of the Financial Integration indicator*
The solid blue line is the estimated financial integration indicator; the dashed red lines are the counterfactual of the series without the respective shocks, together with the 20% *and* 80% *posterior percentiles in grey.*

evidence of a process leading towards a strengthened structural integration that has started only in recent years.

In order to give a more precise view of the magnitude of the shocks, we show in figure 7 the same counterfactual by also adding the estimated quarterly shock contributions so that the value of the counterfactual and the corresponding bar sum to the actual series. Note how the impact of the "Boom/Bust" shock on the left panel is much greater with respect to the "True Integration" shock, on the right panel. Nevertheless, the second shock seems to become increasingly more relevant to the historical evolution of the series from 2013 onwards. Nonetheless, the business cycle is still the main driver of the development of financial integration.

These results appear to be evidence that the factors driving financial integration in the European Union since the start of the EMU are mainly related to the economic business cycle. The growth dynamics following the Sovereign Debt crisis seem to be increasingly driven by structural factors with respect to the previous years. While on the one hand, the lower level of the indicator in the first non-overlapping region might derive from some long-lasting effects of the Sovereign Debt Crisis, on the other hand, the positive shock from

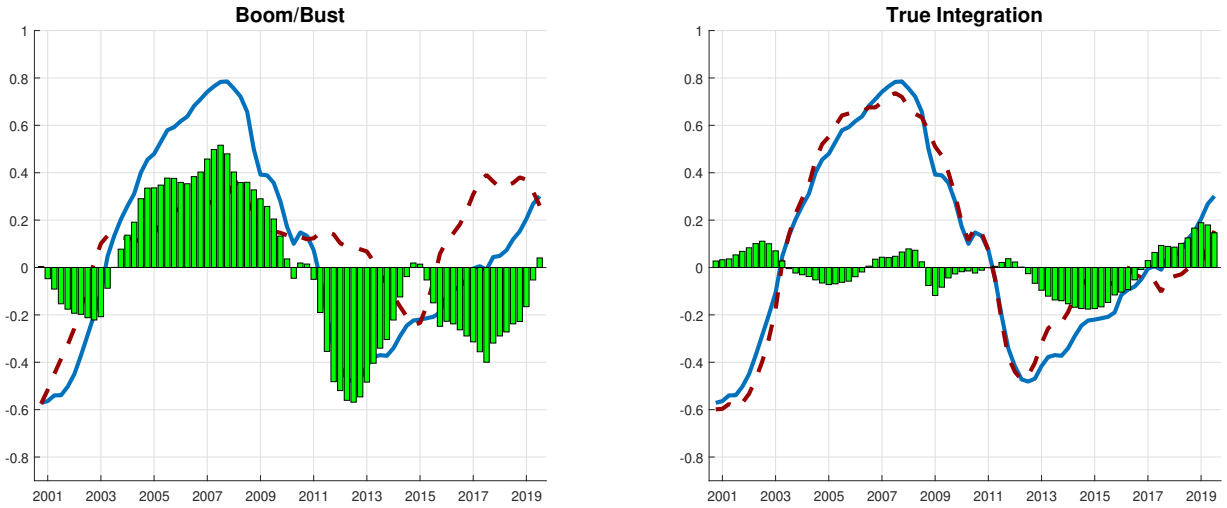

Figure 7: *Shock contribution to Financial Integration*
The solid blue line is the estimated financial integration indicator; the dashed red lines are the counterfactual of the series without the respective shocks, and the green bars are the estimated quarterly shock contributions.

2017 might be a result of the new structural policies implemented by the EU as well as the setup of European wide institutions, such as the three European supervisory agencies, the ESRB and the ESM.

As early predicted by Coeure (2013), the implementation of the EU banking union in 2012 as a response to the Sovereign Debt crisis might be the major source of the increasing contribution of the "True Integration" shock on our estimated series. This call for banking policy integration resulted in the establishment of the Single Supervisory Mechanism (SSM) and the Single Resolution Mechanism (SRM) in 2014. The former has the purpose of enhancing financial stability and integration by implementing common supervisory rules across EU countries, and the latter, including the Single Resolution Fund (SRF), takes care of the resolution of entities going under the supervision of the European Central Bank (ECB). Also, on the legislative side, the implementation of the Single Rulebook, governing EU laws regarding the financial sector, contributes to this structural shift. The implementation of the Capital Requirements Directive IV (CRD IV) is among the critical steps in this respect, as it implements Basel III. In a more general framework of recent micro and macroprudential policies design, this international regulatory accord aims to

restrain systemic risk and contagion mechanisms of EU financial institutions.

Nevertheless, our conclusion that cyclical effects, rather than structural changes, explain most of the movements of financial integration since 2000 sharply contrasts with results from the 1990s. Lane (2008) surveys this literature and strongly suggests that there was significant structural financial integration in the 1990s. This should not be that surprising, though, as sizeable structural policy changes, such as the EMU and the enlargement of the EU to include the accession countries, were announced in the 1990s. Thus, financial markets might have anticipated it by incorporate them in that period.

5 Conclusions

We build a financial integration indicator for the EU. It embodies information coming both from price (asset price convergence) and quantity (cross-border asset holdings) series. We then identify "Boom/Bust" and "True Integration" shocks in a FAVAR setup in order to disentangle structural trend from cyclical pattern and analyse the impact of both types of integration on macro-financial variables. The indicator sharply increases from the establishment of the EMU, peaks around 2008 and only troughs around 2013, hence experiencing a significant decline throughout the time of the World Financial crisis and the Sovereign Debt crisis, before increasing again until the end of our sample period. Our estimations show that boom/bust shocks have short-lived effects while having a positive impact on the indicator as well as some macro-financial variables. De jure financial integration fosters risk absorption and reduces income divergences among European countries. Our counterfactual analysis suggests that business cycle dynamics have been the main driver of the evolution of financial integration in the EU. However, true integration shocks have become relatively more prevalent and supportive in recent years. This possibly reflects the strengthening of the European financial architecture following the Sovereign Debt crisis, the setup of the ESM, ESRB with the three regulatory agencies and the progress of the banking union. As

we provide some support to the view that the European economy benefits from a stronger financial integration, our results highlight the role of designing policies aimed at fostering it based on sound and structural factors. Encouraging a solid and structural integration process, as envisaged in the context of CMU 2.0, would support further convergence among EU countries.

Appendix: Data series

Tables 2 and 3 list the time series used in the auxiliary dataset $\boldsymbol{Y_t}^a$ and in the main dataset $\boldsymbol{Y_t}^m$ respectively. The series are on quarterly frequency, spanning the period 2000:Q1 - 2019:Q4. The quantity series of the are taken from the ECB Statistical Data Warehouse, whereas the price series are from Thomson Reuters Datastream. The variables comprising the main dataset are computed with authors's calculations and estimates, apart from the series OUTPUT, coming from Eurostat. Table 2 contains: the series number, series mnemonic, country and series description. Table 3: the series number, series mnemonic, tcode and series description. The transformation codes are: 1 - no transformation; 2 - first difference.

Table 2: *Series used for the auxiliary dataset* $\boldsymbol{Y_t}^{\boldsymbol{a}}$

Quantity, Banking			
#	*Mnemonic*	*Country*	*Description*
1	ZbankAT	Austria	Share of holdings of debt securities issued by other Euro Area Member States MFI reported by MFI excluding ESCB in each Country (stock) over total holdings
2	ZbankBE	Belgium	
3	ZbankFI	Finland	
4	ZbankFR	France	
5	ZbankDE	Germany	
6	ZbankGR	Greece	
7	ZbankIE	Ireland	
8	ZbankIT	Italy	
9	ZbankNL	Netherlands	
10	ZbankPT	Portugal	
11	ZbankES	Spain	
Quantity, Corporate			

12	ZcorpAT	Austria	Share of holdings of debt securities issued by other Euro Area Member States non-MFI reported by MFI excluding ESCB in each Country, (stock) over total holdings
13	ZcorpBE	Belgium	
14	ZcorpFI	Finland	
15	ZcorpFR	France	
16	ZcorpDE	Germany	
17	ZcorpGR	Greece	
18	ZcorpIE	Ireland	
19	ZcorpIT	Italy	
20	ZcorpNL	Netherlands	
21	ZcorpPT	Portugal	
22	ZcorpES	Spain	
		Quantity, Equity	
23	ZequAT	Austria	Share of holdings of shares and other equities reported by MFI excluding ESCB in each Country (stock) over total holdings
24	ZequBE	Belgium	
25	ZequFI	Finland	
26	ZequFR	France	
27	ZequDE	Germany	
28	ZequGR	Greece	
29	ZequIE	Ireland	
30	ZequIT	Italy	
31	ZequNL	Netherlands	
32	ZequPT	Portugal	
33	ZequES	Spain	
		Quantity, Government	
34	ZgovAT	Austria	Share of holdings of debt securities issued by other EA Member States General Government reported by MFI excluding ESCB in each Country (stock) over total holdings of debt securities
35	ZgovBE	Belgium	
36	ZgovFI	Finland	
37	ZgovFR	France	
38	ZgovDE	Germany	
39	ZgovGR	Greece	
40	ZgovIE	Ireland	
41	ZgovIT	Italy	
42	ZgovNL	Netherlands	
43	ZgovPT	Portugal	
44	ZgovES	Spain	
		Banking market, mortgage rates	
45	BMmorAT	Austria	Bank interest rates loans to households for consumption (new business)
46	BMmorFR	France	
47	BMmorGR	Greece	
48	BMmorIE	Ireland	
49	BMmorPT	Portugal	
50	BMmorES	Spain	
		Banking market, corporate rates	
51	BMcorAT	Austria	

52	BMcorFR	France	Bank interest rates loans to corporations (new business)
53	BMcorIE	Ireland	
54	BMcorPT	Portugal	
55	BMcorES	Spain	
		Equity, non-financial corporations	
56	EnfcAT	Austria	Equity: Weighted average price-to-book ratio of non-financial corporations
57	EnfcBE	Belgium	
58	EnfcCZ	Czechia	
59	EnfcDE	Germany	
60	EnfcDK	Denmark	
61	EnfcES	Spain	
62	EnfcFR	France	
63	EnfcHU	Hungary	
64	EnfcIT	Italy	
65	EnfcNL	Netherlands	
66	EnfcPL	Poland	
67	EnfcPT	Portugal	
68	EnfcSE	Sweden	
		Equity, financial corporations	
69	EfcAT	Austria	Equity: Weighted average price-to-book ratio of financial corporations
70	EfcBE	Belgium	
71	EfcCZ	Czechia	
72	EfcDE	Germany	
73	EfcDK	Denmark	
74	EfcES	Spain	
75	EfcFR	France	
76	EfcHU	Hungary	
77	EfcIT	Italy	
78	EfcNL	Netherlands	
79	EfcPL	Poland	
80	EfcPT	Portugal	
81	EfcSE	Sweden	

Table 3: *Series used in the main dataset* $\mathbf{Y_t^m}$

#	*Mnemonic*	*Tcode*	*Description*
82	INTEG	1	Financial integration indicator
83	OUTPUT	2	Seasonal and calendar-adjusted chain-linked GDP volumes
84	FINFLOWS	2	Average cross-border financial flows, percentage of GDP
85	SIGMA	2	Sigma convergence index
86	RISK	2	Risk sharing index
87	EQUITY	2	Equity intensity index

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PDF: ISBN 978-92-861-5408-9