International Financial Integration and Output Co-Movement

By Paul Berenberg-Gossler*

An emerging strand of the literature presents first indications that financial integration not only enhances risk sharing but also facilitates contagion to the real economy. This paper puts this emerging literature to a new level by systematically testing the effects of cross-border portfolio investment and bank loan holdings on output co-movement in a panel covering 31 economies from 2001-16. Employing a simultaneous equation framework, I combine traditional trade-gravity instruments with a new instrumental variable for financial integration. I exploit the fact that different communities of countries are integrated to different degrees. Overall, I find that portfolio and bank loan holdings have led to more and less output co-movement, respectively. Signs of portfolio investment integration effects differ for stock and bond holdings, and bond maturity. Greater output co-movement mostly stems from long-term bond holdings. I also investigate how these channels affected output co-movement during the global financial turmoil of 2008. The results suggest that greater bond and bank loan integration fed into greater co-movement prior to the crisis and reversed when country-level financial fragility was high. The stock market channel did not smooth this development.
JEL: E32, F15, G01
Keywords: Output Co-Movement, Financial Integration, Portfolio Investment, Loan integration, Financial Crises

Cross-border financial integration is typically associated with a range of favorable economic outcomes, most notably risk sharing. Important contributions to the literature have shown that greater cross-border financial integration dampens volatility in output co-movement (Kose, Terrones and Prasad, 2003; Obstfeld, 1994; Wincoop, 1999). Yet, an emerging body of the literature has found first indications that financial integration can also be associated with negative outcomes, such as facilitating contagion effects to the real economy originating from the US banking sector (Kalemli-Ozcan, Papaioannou and Perri, 2013) or from US portfolio investment holdings (Pyun and An, 2016).

This paper puts this emerging literature to a new level by systematically test-

* Berenberg-Gossler: Hertie School of Governance, Friedrichstrasse 180, 10117 Berlin., paul.berenberg-gossler@outlook.com. I thank Agnès Bénassy-Quéré, Franziska Bremus, Henrik Enderlein, Aurélien Eyquem, Maximilian Linek, and Jean Pisani-Ferry for helpful discussions, suggestions, and input. I also thank discussants, conference, and seminar participants at the T2M Conference, EEA Annual Meeting, IWH Halle, CEPII Paris, RCEF Rimini, and EconPol CESifo Munich for their valuable comments. I am grateful to the Hertie School of Governance for its financial support.

ing the effects of cross-border portfolio investment and bank loan holdings on output co-movement in a panel covering 31 economies from 2001-16. I find that portfolio investment integration has contributed to more co-movement because bond market integration effects have been larger than effects linked to stock market integration. This co-movement inducing effect of bond holdings stems mainly from bonds with long-term maturity dates. Bank loan integration has contributed to less co-movement implying that banks have retracted more assets from abroad than they invested. These findings come from one coherent framework and definitely confirm prior evidence on the overall positive relationship of portfolio investment holdings with co-movement (Imbs, 2006), the distinct negative and positive effects of stock and bond market integration (Davis, 2014), and the negative relationship of banking integration with co-movement (Kalemli-Ozcan, Papaioannou and Perri, 2013).

Additionally, I also test how these channels altered output co-movement in times of economic crises. I show that bond and bank loan effects reversed in presence of high financial fragility as shocks propagated across economies. While banks and investors accumulated loan and bond holdings abroad in tranquil times, they withdrew assets and sought safe havens when financial fragility increased. These results generalize preliminary evidence showing that effects of cross-border financial integration on output co-movement reversed between the US and the rest of the world during the Great Financial Crisie (GFC) of 2008.[1]

The empirical evidence suggests that different types of financial assets and financial fragility are crucial factors for output co-movement. This is because cross-border bank loan exposure and portfolio investment via stock and bond holdings are driven by different objectives. For instance, portfolio investors often use bonds to counterbalance volatility in stocks across their portfolio. Similarly, risk averse investors usually prefer short-term to long-term bonds. Moreover, asset holdings also depend on country-level financial fragility, e.g. financial stress, implying that changes in capital flows should affect individual economies differently. The findings indicate that due to the different objectives linked to cross-border specific types of asset holdings, they drive co-movement patterns in different directions.

My empirical strategy combines annual data on bilateral cross-border holdings in loans and portfolio investment from the BIS and the IMF among 31 economies over the 2001-16 period. To disentangle the main drivers of bilateral output co-movement, I use a simultaneous equation estimation framework. I regress indices of cross-border financial and real integration on indicators of GDP growth co-movement. Important contributions by Imbs (2004, 2006), Davis (2014) and Pyun and An (2016) have used comparable approaches for cross-sectional and panel data. The main identification challenge arises because financial market integration can affect output through multiple channels. To identify the causal

[1]For the US context see Pyun and An (2016) who show the reversal of investment portfolio integration effects and Kalemli-Ozcan, Papaioannou and Perri (2013) who demonstrate that greater bank integration leads to less co-movement in tranquil times, and contributes to crisis transmission in times of financial fragility.

impact of each channel on output co-movement I need one separate instrument per channel. To address this issue, I improve on a comprehensive set of instruments that have become standard in the literature. Specifically, I combine traditional trade-gravity instruments with a new instrumental variable approach for financial integration. I exploit the fact that cross-border financial integration is organized into different communities that are loosely linked to each other. I show that intra-community exposure across geographically close economies is strong but inter-community exposure to more distant communities is weak. Thus, I argue that capital restriction indicators for economies belonging to remote communities are exogenous to output co-movement, while still affecting financial integration indices because economies respond to global trends in capital market restrictions. Finally, I control for potential time trends and shocks common to all economies.

To interpret the empirical evidence, I examine effects of cross-border financial integration on co-movement through the guidance of three different theoretical mechanisms: (i) *Wealth effects* are linked to cross-border stock market integration which leads to greater risk sharing and output smoothing. Therefore, they tend to decrease output co-movement because the country owning stocks abroad has a temporary advantage of 'taking leisure' while the other works (Baxter and Crucini, 1995; Davis, 2014). (ii) *Balance sheet* effects involve bond market integration, which is at the origin of 'financial multiplier' effects of leveraged intermediaries. Because banks earn interest and non-interest income through lending and trading, a change of economic situation in one economy has two effects. First, to safeguard their trading portfolio, banks withdraw assets from risky economies. Second, banks adjust lending because they need to follow Basel II regulations and lower risk exposure. (iii) *Bank loan effects* affect co-movement indirectly or directly. Either they are the indirect result of changes in cross-country stock or bond market holdings, or they affect co-movement directly as banks simply adjust lending abroad. Different sequencing of these channels drives co-movement patterns in different directions across country-groups.

Given these theoretical underpinnings, the empirical evidence can be interpreted as an indicator of the relative size of *wealth*, *balance sheet*, and *bank loan* effects. Since portfolio investment integration has contributed to more co-movement across the total sample period, this suggests that the *balance sheet* effect linked to bond market integration has been larger than the *wealth effect* on average. *Bank loan effects* have contributed to less co-movement implying that banks have withdrawn more assets from abroad than they invested. Compared to previous evidence on *wealth* and *balance sheet* effects (Davis, 2014) and *bank loan integration* (Kalemli-Ozcan, Papaioannou and Perri, 2013), my estimates are obtained using one coherent framework and, thus, address potential omitted variable bias resulting from ignoring important components of financial integration. They also add up to previous research which usually applied simultaneous equation estimations to cross-sectional data using one specific wave of the CPIS

data.[2]

Additional evidence on the reversal of bond and bank loan effects in presence of high financial fragility implies a reversal of the *balance sheet* and *bank loan* effects as shocks propagate across economies. While banks and investors accumulate bond holdings and loans abroad in tranquil times the *balance sheet* and *bank loan* effects are both negative. With increasing financial fragility, they withdraw assets and seek safe havens which leads to a reversal of *balance sheet* and *bank loan* effects. Importantly, these findings generalize preliminary evidence showing that effects of investment portfolio and banking integration on co-movement reversed between the US and the rest of the world during the GFC of 2008 (Pyun and An, 2016; Kalemli-Ozcan, Papaioannou and Perri, 2013). However, contrary to Pyun and An (2016) my results indicate that stock market integration is not a determinant factor in smoothing output co-movement on a global scale. Thus, the findings suggest that greater cross-border financial integration may come at the cost of greater volatility in output co-movement in times of high financial fragility.

These results are robust to the inclusion of time fixed effects and hold when estimated with OLS, 2SLS, or 3SLS estimators. Although OLS estimates are downward biased, signs of effects are consistent across all estimators. The main results are also robust to a wide range of alternative indicators and instrumental variables. First, instead of using the dichotomous financial fragility indicator from Laeven and Valencia (2018), I repeat the analysis using continuous indicators on financial crises from Romer and Romer (2017) and Gandrud and Hallerberg (2017). Second, I use a different measure of output co-movement based on Morgan, Rime and Strahan (2004). Third, I use the usual instruments for financial market integration based on legal restrictions common to the business cycle synchronization literature. While I lose statistical significance, the results also hold in these specifications.

A vast literature has sought to explain the different theoretical and empirical mechanisms linking different factors to more or less output co-movement. Explanations currently range from trade relations (Frankel and Rose, 1998), specialization patterns (Kalemli-Ozcan, Sørensen and Yosha, 2003; Imbs, 2004), monetary integration (Fatás, 1997), to financial integration (Heathcote and Perri, 2003; Kose, Terrones and Prasad, 2003; Heathcote and Perri, 2004; Imbs, 2006; Kalemli-Ozcan, Papaioannou and Peydro, 2013; Davis, 2014; Pyun and An, 2016).

Overall, my results support the literature on the effects of financial integration on output co-movement but greatly improve on previous estimates. Specifically, I contribute to the literature in three ways. First, I combine data on bank system exposure and portfolio investment. Thus, I move beyond evidence on either international exposure of the banking system (Kalemli-Ozcan, Papaioannou and Perri, 2013) or portfolio investment (Imbs, 2004; Davis, 2014). While cross-border banking activities constitute the bulk of international finance (Lane and Milesi-

[2]See for instance Imbs (2004, 2006) and Davis (2014).

Ferretti, 2007), contributions by Gabaix (2011) and Acemoglu et al. (2012) have shown that even small actors can shape aggregate outcomes. Therefore, it is important to consider both portfolio investment and bank loan integration. Focusing solely on portfolio investment might also explain the difficulty of previous studies to generalize results to a global country-pair sample (Pyun and An, 2016). Second, I study financial integration effects in a global bilateral country-pair setting. This is important because financial networks that exclude the US gained importance over the last decade. I show that the reversal of the *balance sheet* and *loan effects* is a general phenomenon in times of high financial fragility. It took place on a global scale, even across country groups excluding the US. Third, I provide panel data evidence accounting for simultaneity. Due to data availability most existing studies had to rely on cross-sections. Using a panel structure increases accuracy and allows accounting for time dependent effects common to all economies. Finally, this paper is also the first to study short and long-term bond effects on co-movement.

The rest of the paper is organized as follows. The next section discusses the theoretical underpinnings of *wealth*, *balance sheet*, and *bank loan* integration effects. Then, I discuss the data in section II. Section III presents descriptive evidence showing that while the US is at the center of the world financial system other important secondary financial networks have evolved over the last decade. Based on this first empirical evidence, I build an econometric framework in section IV and explain identification and instrument choice. I specifically discuss exogeneity, time, and cross-country variation of instruments. Section V presents the first main result and section VI examines channels of crisis transmission. Section VII computes additional robustness checks and section VIII concludes.

I. Balance Sheet Dynamics

This section explains the three theoretical mechanisms underlying the interpretation of the empirical evidence. Using a very simple framework based on two economies' balance sheets, I explain how greater stock, bond, and bank loan integration can lead to more or less output co-movement via lending adjustments.[3]

Let a (home) and b (foreign) denote two representative banks in countries A (home) and B (foreign). All physical capital loans in this two-country economy to firms and households are made by those two banks. Figure 1 shows the simplified balance sheets of these two banks. The asset side of both banks is composed of loans, and stock and bond holdings in both home and foreign economies. Stock and bond holdings are defined in the broadest way possible. Stocks represent an ownership interest in an entity and bond holdings are any security representing a creditor relationship with another entity. Banks finance this loan and financial security portfolio with home and foreign deposits. Subscripts A and B denote the

[3]For simplicity, I restrict the analysis to bank balance sheet integration. Beyond depository-taking corporations, the CPIS data also covers central banks, general government, and other financial institutions such as mutual funds or insurers.

country where the entity is held. *Equity* denotes equity invested in bank a or b. I assume that the banks allocation decision is subject to home bias, e.g. the share of physical capital loans to domestic firms and households is greater than physical capital loans to foreign firms and households. Using this simple framework one can study the balance sheet dynamics of locally restricted and global shocks.

Figure 1. : Balance sheet dynamics

Country A

Bank a

Assets	**Liabilities**
$Loans_A$	$Deposits_A$
$Loans_B$	$Deposits_B$
$Stock_A$	$Equity_a$
$Stock_B$	
$Bond_A$	
$Bond_B$	

Country B

Bank b

Assets	**Liabilities**
$Loans_B$	$Deposits_B$
$Loans_A$	$Deposits_A$
$Stock_B$	$Equity_b$
$Stock_A$	
$Bond_B$	
$Bond_A$	

A locally restricted shock in country B leads to a loss in assets in bank b's balance sheet. Depending on the type of assets primarily affected capital market integration can lead to more or less output co-movement of countries A and B. Three different effects are notable. First, loan defaults in country B directly decrease the value of $Loans_B$. Compared to the initial situation the asset/debt ratio of the country B bank deteriorates. Bank b is constrained to reduce credit supply. The asset defaults also deteriorates the asset/debt ratio of the representative bank in country A, depending on the amount of physical capital loan defaults in B's economy. To decrease its asset/debt ratio, Bank a is constrained to pay off its assets in country B, resulting in less credit supply in country A. Thus, there is less credit provision in both countries which results in greater output co-movement. The shock in country A led to a contagion effect from A to B. Second, the local shock in country B lowers the value of $Bond_B$. Similarly, the loss in asset value in bank b's balance sheet means that this bank has to adjust its loans downward to keep the asset/debt ratio constant. The lower value of $Bond_B$ calls for similar

adjustments in country A. Both countries experience a credit crunch and output co-movement increases. Third, the locally restricted shock in B lowers the value of $Stock_B$. Bank b has again to adjust the asset side of its balance sheet. However, due to the higher liquidity of stocks bank A is not necessarily constrained by this event and is able to smooth consumption by efficient risk diversification. The loan adjustments are different in the representative economies which leads to less output co-movement across the country-pair.

A global shock affecting both economies can again lead to more or less output co-movement. First, if both economies are affected by the shock and experience loan defaults their output co-movement increases. Second, if the shocks affect the value of both bond assets bank a might decide not to pay off its assets placed in the foreign country in case it is deemed to be a safe haven. In this case, both countries will face different credit provision leading to lower output co-movement. Third, a global shock in both economies lowers the value of both stock holdings and, thus, increases co-movement. Thus, a sharp decrease of capital flows to and from country B would lead to more output co-movement with country A.

II. Data

I use five main datasets to test the theoretical mechanisms outlined in the previous section: World Development Indicator data (WDI), the Coordinated Portfolio Investment Survey (CPIS), Bank of International Settlements Locational Statistics (BIS), Direction of Trade Statistics (DOTS), and country-level indicators on financial crises.

A. World Development Indicator Data (WDI)

Based on WDI GDP data in current U.S. Dollars, I compute the following year-to-year measure of co-movement.

$$Synch_{ijt} = -|g_{it} - g_{jt}| \tag{1}$$

where g_{it} and g_{ij} indicate the log difference of annual GDP growth of countries i and j at t. Thus, I measure co-movement as the average similarity in GDP growth rates across the country-pair. A similar measure has been used by Kalemli-Ozcan, Papaioannou and Perri (2013) and many other researchers. A higher value of $Synch$ indicates more co-movement. Perfect co-movement is achieved at zero.

B. Coordinated Portfolio Investment Survey (CPIS)

The most suitable information available on bilateral bond/debt and stock/equity security holdings is the IMF's Coordinated Portfolio Investment Survey (CPIS). The CPIS indicates asset and liability stocks of bilateral portfolio assets of central banks, depository-taking corporations, general government, and other financial institutions such as mutual funds or insurers. It covers the 2001-2018 period

and comprises 58 economies.[4] Similar to a measure of trade intensity I sum cross-border assets and liabilities and normalize by the sum of the two countries' GDPs. This measure originates from Lane and Milesi-Ferretti (2003) and Kose, Terrones and Prasad (2003).

$$Bond_{ijt} = \frac{(AssDebtSec_{ijt} + LibDebtSec_{ijt})}{(GDP_{it} + GDP_{jt})} \tag{2}$$

$$Stock_{ijt} = \frac{(AssEQ_{ijt} + LibEQ_{ijt})}{(GDP_{it} + GDP_{jt})} \tag{3}$$

C. Bank of International Settlements Locational Statistics

I retrieve detailed country-tables from the Locational Banking Statistics database of the BIS. BIS statistics table A6.2 reports for each country all cross-border positions by location of banking office. Then, I compute a loan measure based on bilateral claims in loans and deposits from country i to country j.

$$Loan_{ijt} = \frac{(Claims_{\overrightarrow{ijt}} + Claims_{\overrightarrow{jit}})}{(GDP_{it} + GDP_{jt})} \tag{4}$$

Since the data are bilateral and liabilities are not always fully reported, I use the sum of claims from country i to j and j to i which I normalize by the sum of GDP. This measure originates from Epstein, Mukherjee and Ramnath (2016).

D. Direction of Trade Statistics (DOTS)

I follow Frankel and Rose (1998) and use a standard measure of bilateral trade intensity. I normalize imports (CIF) and exports (FOB) by the sum of the two countries GDPs. Data on bilateral exports and imports originate from the IMF's Direction of Trade Statistics database.

$$T_{ijt} = \frac{(X_{ijt} + M_{ijt})}{(GDP_{it} + GDP_{jt})} \tag{5}$$

E. Industry specialization measure from WDI

Following Pyun and An (2016), I compute a measure for similarity in the production structure or industry specialization. Based on WDI data, I take the sum

[4] As most of the previous studies, I cut the number of distinct country-pairs in the sample to 31, the lowest available number in the BIS data, to obtain a balanced country-pair panel.

of differences in the share of value added in agriculture, manufacturing, and services across each country-pair. Let $\frac{VA_{it}^d}{VA_{it}}$ denote the share of industry sub-sector d value added in country i total value added. $\frac{VA_{jt}^d}{VA_{jt}}$ is the equivalent for all j. D is the number of sectors. Thus, I compute the average differences across in the production structure across the country-pair.

$$S_{ijt} = \frac{1}{D}\sum_{d=1}^{D} |\frac{VA_{it}^d}{VA_{it}} - \frac{VA_{jt}^d}{VA_{jt}}| \tag{6}$$

F. *Financial Fragility*

I use additional data on financial fragility, which I proxy with indicators of country-level financial crises. The current literature offers dichotomous and continuous measures.

All main specifications use data from Laeven and Valencia (2018). I identify three different types of financial shocks: banking crises, currency crises and sovereign default. I add an aggregate 'financial crisis' dummy and set it to one if either of those crises occurred. If at least one bilateral counterpart in the pair is in crisis, I count the country-pair as affected. Laeven and Valencia (2018) define a country-year as in crisis when there is both significant distress in the banking system and policy-makers respond with significant interventions.[5] The data have shortcomings, but the indicators cover a maximum of different countries and are easy to update.

Second, the robustness checks repeat all estimations using continuous indicators originating from Romer and Romer (2017) and Gandrud and Hallerberg (2017).

III. Mapping Financial and Real Integration

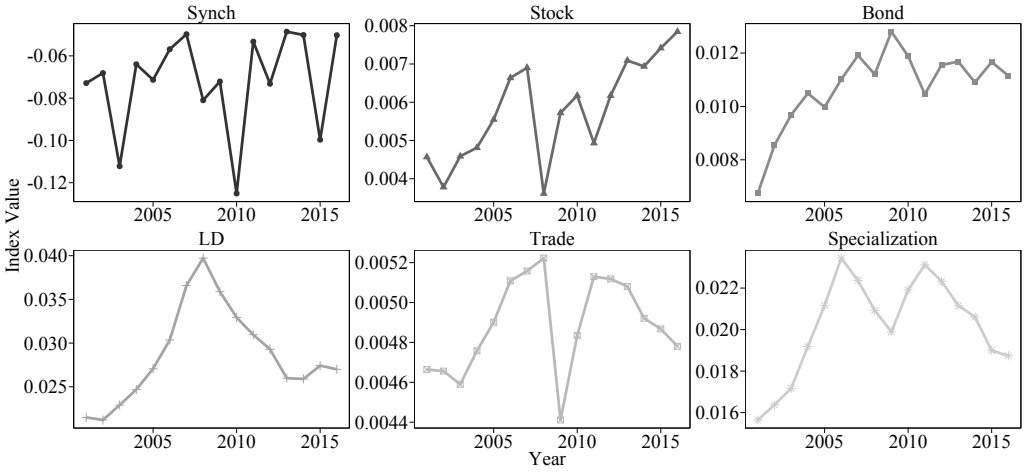
Using the CPIS and BIS data, I document two sets of facts on geographical and asset type dependency of cross-border financial integration. First, I show that there was a global aggregate trend towards greater cross-border financial integration, which stopped with the 2008 financial crisis. Second, using a network approach, I identify different communities based on the Girvan and Newman (2002) algorithm. The results show that cross-border financial and trade integration is still heterogeneous in nature and largely depends on geographical distance.

[5] 'Significant intervention' requires employment of at least three of the following six policies: deposit freezes/banking holidays, significant bank nationalizations, bank restructuring gross costs, extensive liquidity support, significant guarantees, and significant asset purchases.

A. A Clear Global Pattern

Figure 2 shows the development of the main variables of interest over time. Most endogenous variables have a clear pattern: Integration increased until the crisis years of 2008-10, dropped sharply, and recovered slowly afterwards. Starting in the left upper corner, the average level of GDP co-movement *Synch* closely followed this pattern. It increased until 2008, slumped, and recovered to pre-2008 levels in 2013. Cross-border stock market integration indices show a very similar pattern but only bounced bak to pre-crisis levels in 2015. Cross-border bond market integration suffered less from the 2008 shock but has not yet recovered to 2008 levels. The bank loan integration index is clearly hump-shaped. Since 2008 banks have consistently reduced cross-border exposure, a trend which only stabilized in 2013. Cross-border trade integration recovered quickly from the 2008 shock, while specialization indices experienced a minor double dip after the financial turmoil of 2008 and 2010.

Figure 2. : Endogenous Variables over time



Note: This figure plots the mean time series of the main endogenous variables across the total sample.

B. Detecting Community Structures

The aggregate figures suggest that cross-border integration indices follow a trend. They increased rapidly until the GFC of 2008, then dropped, and slowly recovered ever since. This section presents evidence that despite this global trend, cross-border financial market integration is still heterogeneous in nature. Applying the Girvan and Newman (2002) algorithm I identify community structures in the bilateral financial and trade networks formed by the cross-border integration measures. A community is defined as a set of nodes that are densely connected

internally but have few connections between groups.[6] The detected communities have two dimensions. First, they are based on geography. Cross-border financial integration increased among some country groups, such as the European economies, while it receded among others.[7] Second, communities vary depending on the type of integration indices and over time.

Figure 3 shows the results of the community detection algorithm applied to the main financial integration variables.[8] For each variable, I compare communities at the start and end of the sample. While group members and their interconnectedness change over time and depend on the type of asset integration, a group pattern can still be identified. Unsurprisingly, many communities intersect, particularly for the financial integration variables.

Figures 3b and 3b show that stock market integration has been marked by the emergence of Ireland as the European hub for equity investments. Via Great Britain, Ireland represents the main link to the United States in 2016.[9] The emergence of a European hub is also in line with Lane and Milesi-Ferretti (2007) who illustrated this shift in stock markets in favor of other Euro area countries. At the same time the economies in the sample have become more intertwined as the number of distinct communities reduced from four to three.

Eurozone bias has even been stronger in bond markets (figures 3c, 3d and Lane (2006)), where intra-European cross-border bond integration has increased since 2001. Yet, bond markets seem to be much more disconnected beyond certain sub communities compared to stock markets. There are four distinct groups that partly intersect. A large European group composed of Austria, Belgium, Spain, Italy, France, Germany, Netherlands, and Ireland. A second group comprising the United States, Japan, Australia, Canada, Hong Kong, South Korea and the Philippines. Greece, South Africa, and Brazil constitute a third group, which intersects with parts of the European group (Italy, France, Ireland, Great Britain). A fourth group is composed of the Scandinavian economies, Switzerland and Chile that intersects with Austria, Belgium, Germany, and Spain.

The community development in cross-border bank loan exposure shows again the emergence of the European community since the inception of the Euro in 2001. In 2001, bank loan exposure can be categorized into three communities. Figure 3e shows Scandinavian economies and Spain, Ireland, and Austria as two distinct

[6]Specifically, we form weighted networks based on the different integration indices. The Girvan and Newman (2002) algorithm identifies edges that are between communities and then removes them. Thus, at the end we are left with the communities themselves. This identification employs the betweenness centrality measure, which quantifies the number of times a node acts as a bridge along the shortest path between two other nodes.

[7]See for instance Martin and Rey (2000) and Portes and Rey (2005) for theoretical and empirical explanations for different geographical developments.

[8]Due to the bilateral nature of CPIS stocks, I cannot observe indirect asset flows, such as from Germany to the US via Ireland. However, plotting networks represents in part a remedy for this problem.

[9]Most likely, Ireland plays an even larger role since the CPIS data suffer from underreporting. Hobza and Zeugner (2014) report the severe under-reporting of equity flows to Luxembourg and Ireland in the CPIS data. They reveal that in 2007 only 60% of the reported portfolio stock liabilities reported by Luxembourg were declared as assets by other countries. For Ireland this ratio drops to 33%.

communities. The third large group comprises all the remaining economies. More than a decade later, figure 3f shows that a European community has emerged. It comprises France, Germany, Spain, Italy, Belgium, the Netherlands, and Austria. The community of Scandinavian economies (Denmark, Sweden, and Finland) is still clearly distinct. The third large group consists of the US, Australia, Japan, Canada, and the rest of advanced and emerging economies in the sample.

Figures 4a and 4b repeat the community detection analysis for cross-border trade integration. There are three communities, whose composition has not changed over time. First, there is the European trade network composed of European Union economies and Switzerland. Second, there are the Scandinavian economies. The remaining economies around the US, Canada, and Japan form the third community.

Overall, two observations are worth noting. First, the gross amounts of portfolio and bank loan assets have increased since 2001. Second, different sub communities can be well identified. These three to four large groups depend on geographical distance, the integration measure analyzed, and partly changed over time. The first group comprises the European economies, including Great Britain. For portfolio investment, Ireland is the main hub linking the first community to the second evolving around the US. The second community comprises the US, Australia, Canda, Japan, South Korea, and Hong Kong. A third community comprises emerging economies such as Brazil and Chile in the sample. In bank loans and trade integration, Scandinavian economies form another community apart. Depending on the type of integration index, there is also a fourth group comprising mainly emerging economies such as Brazil and South Africa. This community organization of cross-border financial integration portrayed conveys the need for a country-pair world sample when assessing effects induced by cross-border financial integration. While the US is undoubtedly one global player in capital markets, other countries play also important roles. The community detection analysis also shows that geographical distance is still a large factor defining cross-border exposure.

IV. Econometric Framework

Armed with the first descriptive evidence showing large cross-country heterogeneity in cross-border financial integration, this section outlines the econometric framework used to estimate *wealth*, *balance sheet*, and *loan* effects.

A. Identification Strategy

This paper estimates the effect of cross-border financial integration on output co-movement. The baseline relationship is the following (7).

$$Synch_{ijt} = \alpha_0 + \alpha_1 FIN_{ijt} + \alpha_2 Trade_{ijt} + \alpha_3 Spec_{ijt} \tag{7}$$

Where $Synch_{ijt}$ is an index of GDP growth co-movement between countries i and j at t. FIN comprises indices of cross-border financial integration such as portfolio investment (stock, bond), or loan integration. $Trade_{ijt}$ and $Spec_{ijt}$ are indices of bilateral trade intensity and industry specialization. Additionally, I also estimate a small variation of 7 by including a crisis indicator. $Crisis_{ijt}$ is an indicator of financial fragility across the country-pair. The relationship thus becomes 8.

$$(8) \quad Synch_{ijt} = \beta_0 + \beta_1 FIN_{ijt} + \beta_2 Crisis_{ijt}(FIN_{ijt}) + \beta_3 Trade_{ijt} + \beta_4 Spec_{ijt}$$

There are three well known identification challenges. First, equation (7) does not distinguish between direct and indirect effects of variables. For instance, α_1 might report both the direct and indirect effect of financial integration on output. Thus, estimates of α_1 might suffer from upward bias. This is likely, because countries with greater financial integration also trade more. I address this first challenge by using simultaneous equation estimation. Specifically, 3-Stage-Least-Squares (3SLS) estimation accounts for cross-equation correlation and yields more efficient estimates for simultaneous equation systems compared to 2SLS or OLS. Several other important contributions such as Imbs (2004, 2006), Davis (2014), and Pyun and An (2016) have used similar approaches.

Second, a shock global to all economies could simultaneously affect all economies. This could lead to false interpretations of signs on the role of financial integration on output co-movement. This could result in overestimating causal effects of financial market integration, even if the effect when accounting for global factors was zero. I overcome this second challenge by adding time year dummies that control for time trends common to all countries.

Once deciding on simultaneous equation estimation another challenge arises. To disentangle the direct and indirect channels I need one unique instrument per endogenous variable. Additionally, the rank condition states that for each equation in the system I need to exclude at least as many exogenous variables as I include endogenous variables (Hayashi, 2000).

Equation (9) states the full equation system linked to 8.

(9)

$$
\begin{cases}
Synch_{ijt} = \alpha_0 + \alpha_1 Stock_{ijt} + \alpha_2 Stock_{ijt} * Crisis_{ijt} + \alpha_3 Bond_{ijt} + \alpha_4 Bond_{ijt} * Crisis_{ijt} \\
+\alpha_5 LD_{ijt} + \alpha_6 LD_{ijt} * Crisis_{ijt} + \alpha_7 T_{ijt} + \alpha_8 S_{ijt} + \epsilon_{ijt} \\
\\
Stock_{ijt} = \beta_0 + \beta_1 Crisis_{ijt} + \beta_2 Bond_{ijt} + \beta_3 LD_{ijt} + \beta_5 T_{ijt} + \beta_6 S_{ijt} + \beta_7 X^{Stock}_{i,j,t} + u_{ijt} \\
Bond_{ijt} = \gamma_0 + \gamma_1 Crisis_{ijt} + \gamma_2 Stock_{ijt} + \gamma_3 LD_{ijt} + \gamma_4 T_{ijt} + \gamma_5 S_{ijt} + \gamma_6 X^{Bond}_{ijt} + v_{ijt} \\
LD_{ijt} = \zeta_0 + \zeta_1 Crisis_{ijt} + \zeta_2 Stock_{ijt} + \zeta_3 Bond_{ijt} + \zeta_4 T_{ijt} + \zeta_5 S_{ijt} + \zeta_6 X^{LD}_{ijt} + v_{ijt} \\
T_{ijt} = \theta_0 + \theta_1 Crisis_{ijt} + \theta_2 Stock_{ijt} + \theta_3 Bond_{ijt} + \theta_4 LD_{ijt} + \theta_5 S_{ijt} + \theta_6 X^{T}_{i,j,t} + w_{ijt} \\
S_{ijt} = \lambda_0 + \lambda_1 Crisis_{ijt} + \lambda_2 Stock_{ijt} + \lambda_3 Bond_{ijt} + \lambda_4 LD_{ijt} + \lambda_5 T_{ijt} + \lambda_6 X^{S}_{ijt} + e_{ijt}
\end{cases}
$$

Where $Stock_{ijt}$, $Bond_{ijt}$, LD_{ijt} are indicators of stock, bond and bank loan integration of countries i and j at t. $Crisis_{ijt}$ is a dummy indicator taking the value 1 if at least one country in the pair is in a financial crisis based on Laeven and Valencia (2018). $X^{Stock}_{ijt}, X^{Bond}_{ijt}, X^{LD}_{ijt}, X^{T}_{ijt}, X^{S}_{ijt}$ are vectors composed of exogenous variables, instruments, to identify the endogenous variables in the system. Coefficients α_1 to α_6 capture the direct effects of financial integration. Coefficients β, γ, ζ, θ, and λ capture the indirect effects. All specifications also include time fixed effects to account for time trends common to all countries.[10]

B. Instruments

To identify endogenous variables in system (9), I need instruments with cross-country and time variation. There is a rich literature proposing different instrumental variables (IV) for financial and real variables.

Instrumenting Cross-Border Financial Integration

Since Porta et al. (1997) many studies have used the relationship between legal institutions and financial development. I follow this practice and use data from Fernández et al. (2016), who provide a whole set of indicators covering country-level legal restrictions for different financial capital control measures.

Previous research mainly uses indices of legal restrictions associated to each country i and j in specific country-pairs (see for instance Pyun and An (2016)). While I do follow a similar approach as an additional robustness check, it does not seem likely that capital control restrictions across a country-pair are exogenous to measures of financial integration. This is because capital control measures are usually adopted as a policy response to stop capital out- or inflows generated by

[10] I do not include country-pair fixed effects as identification comes from variation in country-pair difference. Including country-pair fixed effects is also a question of what one wants to measure. Here I focus on local and global cyclical components of output co-movement driven by country-pair differences in financial integration.

output contagion. Instead, my approach exploits the fact that different communities are strongly integrated but loosely connected to outside communities. The descriptive evidence in section III established that financial integration is particularly strong among geographically close communities and subgroups that are sparsely linked to other geographically remote communities (cf. figure 3). Using this premiss, I match capital market restrictions based on geographical distance for each individual country i and j. Specifically, I compute geodesic distances across all 31 country-pairs in the sample. I then match each country i and j with the sum and absolute difference of capital control indices of the countries with the largest and second largest geographical distance. Figure 5 plots a map for each country and its distance matched counterpart. This approach has two major advantages. First, given the community structure of global financial integration, it is likely more exogenous to our dependent variable $Synch_{ijt}$, while it still affects our independent variables of financial integration as countries respond to global trends towards more or less capital market restrictions in order to continuously attract financial investment. Second, since for each country i and j I match capital control measures with the largest and second largest counterpart country, there is large cross-country variation.

For the different financial variables of interest, I use the corresponding indicators from Fernández et al. (2016). Thus, stock and bond market are instrumented by an index on equity and bond restrictions. Bank loan integration is instrumented by loan restrictions. Each of these variables are continuous on a scale from zero to one.

Instrumenting Trade Integration

The unique IV for bilateral trade is a dummy on regional trade agreements. The underlying identifying assumption, common in the literature, is that regional trade agreements affect cross-border trade intensity independently of other drivers of output. This instrument has been used by many important papers in the literature.

Instrumenting Industry Specialization

I instrument specialization with the respective economy's level of development. Imbs and Wacziarg (2003) have shown that development is a determinant of specialization pattterns. Rich economies are more diversified and, therefore, experience higher co-movement. Poor economies specialize in different primary products. I follow their argument and instrument specialization with the log product and absolute difference of bilateral per capita GDP.

Common Instrumental Variables

Beyond these unique instruments, I also include three sets of common IV. These common IV capture main differences across country-pairs affecting endogenous

variables. The first set of common instruments comprises variables from the trade-gravity literature. Portes and Rey (2005) show that these variables explain determinants of cross-border capital flows. Common instruments come from CEPII and include population weighted physical distance between countries i an j and a dummy on common official language. I also include indices on five different types of geographical contiguity originating from Stinnett et al. (2002). The second set of common IV considers exchange rate differences. Economies with a hard peg should experience greater co-movement in the short term. To reflect this, I use the *fine peg* index by Ilzetzki, Reinhart and Rogoff (2017). This classification distinguishes between 15 different exchange rate arrangements. I instrument stock, bond, loan, and trade with the average pet classification index across the country-pair. The third set comprises year dummies that account for global time trends affecting all economies similarily.

Time and Cross-Sectional Variation of Instruments

Identification works in two directions. First, there is time variation for the main instruments that ensures identification over the panel. Figure 6 plots the annual percentage point variation of the main instruments across the total sample. All instruments vary considerably over time. Second, variables from the trade-gravity literature, such as geographical continuity, only have very little to no yearly variation. Yet, they provide cross-sectional within variation.

V. Main Result: Asset Types Matter

In this section I show that different types of cross-border holdings affect output co-movement differently. First, I report the results of applying our baseline relationship 7 over the 2001-16 period distinguishing between portfolio and bank loan integration. Next, I successively dissect portfolio investment into its main components and compare specific effects. I conclude that greater portfolio investment integration leads to more co-movement overall, but its components have distinct effects that work in opposite directions. Greater stock and short-term bond market integration decreases co-movement, while greater long-term bond integration increases co-movement. Greater bank loan and bilateral trade integration also leads to more co-movement. Economies that are more specialized experience less co-movement.

A. Portfolio Investment vs. Bank Loan Integration

To get a first sense on how integration effects on output co-movement differ for portfolio investment and bank loan integration, I apply the baseline relationship 7 to the full panel data set over the 2001-16 period. Table 1 shows the results of this exercise. Columns (1) and (2) show benchmark coefficient estimates from simple OLS. Columns (3) and (4) show the first stage estimates of the whole

simultaneous equation system using 2SLS and successively adding time fixed effects. Columns (5) and (6) estimate the system using 3SLS. Coefficients across all columns show coherent signs and are statistically significant. While the magnitude of signs slightly changes in between the baseline OLS, 2SLS, 3SLS estimators and depend on the inclusion of year fixed effects, the results are consistent. Overall, portfolio investment contributed to more co-movement, bank loan integration to less. Trade integration and specialization patterns have the usual signs found in the literature. Economies that have greater bilateral trade integration experience more output co-movement. Specialization partly offsets this effect. These first results consolidate and confirm results of two previously separated strands of the literature that focus on effects of either bank loan integration (Kalemli-Ozcan, Papaioannou and Perri, 2013) or portfolio investment (Imbs, 2006; Davis, 2014).

B. Stock vs. Bond market integration

Next, I dissect the aggregate portfolio investment index into its two main components: stock and bond market integration. Previous research indicates that stock and bond market integration effects have opposite effects on output co-movement because they follow different objectives (Davis, 2014; Pyun and An, 2016). Table 2 shows the result of this exercise. Cross-border stock and bond market integration are instrumented with the distance matched indices of equity and bond market restrictions described in section IV.B. Dissecting portfolio investment integration into its two main component, stock and bond market integration, shows two opposite effects. Consistent with theory, economies that have larger bilateral stock market integration experience less co-movement while bond market integration induces co-movement. Coefficient estimates for bond market integration are consistently larger than output smoothing effects of cross-border stock market integration. Thus, they amount to the overall co-movement inducing effect of portfolio investment in table 1. Greater cross-border bank loan integration still leads to less co-movement but the effect is conditional on the inclusion of time fixed effects. The real integration indices trade and specialization still lead to more and less co-movement, respectively. What is the co-movement inducing effect of bond market integration based on? The next section sheds light on this question by dissecting bonds into two groups based on their maturity date.

C. Additional evidence: Short vs. Long-Term Debt

This section further dissects bond market integration into two different indices based on the bond's maturity date. Theoretically, short-term bonds tend to have lower credit and interest rate risks than long-term bonds which implies that they should hold up better when market conditions are unfavorable. The CPIS data separates cross-border debt instrument holdings into short and long-term. The CPIS (2018) specifies that money market instruments with maturities of less than one year should be reported as short-term debt securities. Thus, short-term

cross-border bond market integration can be reasonably assumed to be (mostly) composed of money market instruments.

Fortunately, Fernández et al. (2016) provide distinct capital restriction measures for bonds and money market instruments. To identify the distinct effects of short and long-term bonds, I thus expand the simultaneous equation system of equations (7) by separating the bond market indicator into short and long-term bonds. Each sub indicator is instrumented with the distance matched sum and absolute difference of money market and bond market restrictions. Table 3 shows two important results. First, short-term bonds indeed reduce output co-movement, while long-term bonds have the opposite effect. Second, including short and long-term bond integration measures significantly reduces the precisions of cross-border stock market effects. Comparing columns (3) and (5) to (4) and (6) also shows that once accounting for short-term bond market integration, the sign of stock market integration is only slightly significant at the $p < 0.05$ level when including time-fixed effects. Additionally, compared to previous estimates significant coefficient estimates of stock market integration in columns (4) and (6) switched signs. Although we have to take these results only as a rough approximation, they have two implications. First, most of the output smoothing effect across economies is actually provided for by the short-term bond market integration channel. Second, the stock market channel is highly dependent on specific time periods. Thus, the stock market channel might matter less than previously thought. I leave this avenue for future research.

VI. Comparing Channels of Crisis Transmission

This section investigates the role of cross-border financial integration in times of low and high financial fragility. I interact crisis data from Laeven and Valencia (2018) with indicators of cross-border financial integration. The results point to *capital flight* during the 2008 financial turmoil, which was particularly pronounced for bond and bank-loan integration indices. Greater bond and bank loan integration fed into greater co-movement prior to the crisis and reversed when country-level financial fragility was high. The stock market channel did not smooth this development.

A. Portfolio Investment vs. Loan Integration

Table 4 repeats the estimations from table 1 and interacts financial integration indices with a crisis dummy based on Laeven and Valencia (2018). Results indicate that the shock was mainly transmitted via the portfolio investment integration channel. Overall, columns (3) - (6) indicate that once the financial crisis dummy switches on, it leads to more co-movement. However, different channels affect co-movement differently. Greater portfolio investment has led to greater co-movement prior and after the financial crises. During times of financial turmoil, it has led to less co-movement. Bank loan integration was not a determinant

factor prior to the crisis and only marginally contributed to less co-movement in crisis times.

B. Stock vs. Bond

Table 5 investigates the different roles of cross-border stock, bond, and bank loan integration in times of low and high financial fragility. Separating portfolio investment into stock and bond effects significantly increases accuracy. Three results emerge from this exercise.

First, stock market effects were not significant for the 31 economies of our sample. Second, consistent with prior US centered evidence (Pyun and An, 2016) greater bond market integration has led to more co-movement in tranquil times, and more output co-movement n crisis times. Third, contrary to previous evidence in the literature the loan market channel worked in the same direction as the bond market channel. Where does this difference come from? Notably Kalemli-Ozcan, Papaioannou and Perri (2013), has shown the opposite effect between the US and the rest of the world. Countries with closer ties to the US experienced greater co-movement during the 2007-2009 crisis via the bank loan crisis transmission channel, financial turmoil lead to less co-movement. The difference in signs is consistent with a *flight to safety* effect in bank loans. While cross-border bank loan exposure increased prior to the crisis, heightening financial fragility lead to a repatriation of bank loans. Since, I consider the average global crisis effects across 31 economies and not just for the US. In this light our results seem coherent with theory.

VII. Robustness

A. Alternative IV Approach

As an additional robustness check, I repeat all estimations by using the directly related capital control measures for each country-pair. That is, I repeat all estimations using the same IV as in Pyun and An (2016).

VIII. Conclusion

This paper studies the role of cross-border financial integration on output co-movement using bilateral panel data on 31 economies over the 2001-16 period. The first first descriptive part shows that cross-border financial integration is strong across geographically close economies that are sparsely linked to more remote communities. Exploiting this fact, I propose a new instrumental variable approach for estimating the effect of cross-border financial integration on output co-movement. I match bilateral country pairs with capital restriction measures of the two most remote counterparts. Given the community structure of financial integration our new IV is likely more exogenous than previously used measures but still plausibly affects financial integration measures itself. Combining the new

IV with standard instruments, I follow standard practice in the literature and use a simultaneous equation system framework as in Imbs (2004, 2006); Davis (2014); Pyun and An (2016).

Our results contribute to the literature on financial integration effects. Previously, most evidence dealt with portfolio and bank loan integration separately. With the exception of Pyun and An (2016), there also no panel perspective on portfolio investment effects yet.

I find that integration in different financial assets has had different effects on output co-movement. I confirm previous estimates on the negative relationship between cross-border greater bank loan integration and output co-movement (Kalemli-Ozcan, Papaioannou and Perri, 2013), while greater portfolio investment integration has a positive relationship with co-movement. Portfolio investment effects also differ between stock and bond market integration, which led to less and more output co-movement respectively. Consistent with theory, the positive relationship between greater bond market integration and higher output co-movement mostly stems from long-term bonds. Short-term bonds consistently reduce bilateral co-movement.

Moreover, I also study how these different channels affected co-movement in times of financial crises. I generalize previous results of the literature (Pyun and An, 2016) and find that greater bond market integration largely contributed to higher co-movement in the boom period. Bank loan integration effects were also positively related to output co-movement in the last decades' boom periods, while they induced less co-movement during the bust. I only find limited evidence that stock market integration helped smooth these developments.

REFERENCES

Acemoglu, Daron, Vasco M Carvalho, Asuman Ozdaglar, and Alireza Tahbaz-Salehi. 2012. "The network origins of aggregate fluctuations." *Econometrica*, 80(5): 1977–2016.

Baxter, Marianne, and Mario J. Crucini. 1995. "Business Cycles and the Asset Structure of Foreign Trade." *International Economic Review*, 36(4): 821.

CPIS, Guide. 2018. *Coordinated Portfolio Investment Survey Guide (Third Edition).* International Monetary Fund.

Davis, J. Scott. 2014. "Financial integration and international business cycle co-movement." *Journal of Monetary Economics*, 64: 99–111.

Epstein, Brendan, Rahul Mukherjee, and Shanthi Ramnath. 2016. "Taxes and international risk sharing." *Journal of International Economics*, 102: 310–326.

Fatás, Antonio. 1997. "EMU: Countries or regions? Lessons from the EMS experience." *European Economic Review*, 41(3-5): 743–751.

Fernández, Andrés, Michael W. Klein, Alessandro Rebucci, Martin Schindler, and Martín Uribe. 2016. "Capital Control Measures: A New Dataset." *IMF Economic Review*, 64(3): 548–574.

Frankel, Jeffrey A., and Andrew K. Rose. 1998. "The Endogenity of the Optimum Currency Area Criteria." *The Economic Journal*, 108(449): 1009–1025.

Gabaix, Xavier. 2011. "The Granular Origins of Aggregate Fluctuations." *Econometrica*, 79(3): 733–772.

Gandrud, Christopher, and Mark Hallerberg. 2017. "The Measurement of Real-Time Perceptions of Financial Stress: Implications for Political Science." *British Journal of Political Science*, 1–13.

Girvan, M., and M. E. J. Newman. 2002. "Community structure in social and biological networks." *Proceedings of the National Academy of Sciences*, 99(12): 7821–7826.

Hayashi, Fumio. 2000. *Econometrics. 2000.* Vol. 1, Princeton University Press.

Heathcote, Jonathan, and Fabrizio Perri. 2003. "Why has the US economy become less correlated with the rest of the world?" *American Economic Review*, 93(2): 63–69.

Heathcote, Jonathan, and Fabrizio Perri. 2004. "Financial globalization and real regionalization." *Journal of Economic Theory*, 119(1): 207–243.

Hobza, Alexandr, and Stefan Zeugner. 2014. "Current accounts and financial flows in the euro area." *Journal of International Money and Finance*, 48: 291–313.

Ilzetzki, Ethan, Carmen Reinhart, and Kenneth Rogoff. 2017. "Exchange Arrangements Entering the 21st Century: Which Anchor Will Hold?" National Bureau of Economic Research.

Imbs, Jean. 2004. "Trade, finance, specialization, and synchronization." *Review of Economics and Statistics*, 86(3): 723–734.

Imbs, Jean. 2006. "The real effects of financial integration." *Journal of International Economics*, 68(2): 296–324.

Imbs, Jean, and Romain Wacziarg. 2003. "Stages of Diversification." *American Economic Review*, 93(1): 63–86.

Kalemli-Ozcan, Sebnem, Bent E. Sørensen, and Oved Yosha. 2003. "Risk Sharing and Industrial Specialization: Regional and International Evidence." *American Economic Review*, 93(3): 903–918.

Kalemli-Ozcan, Sebnem, Elias Papaioannou, and Fabrizio Perri. 2013. "Global banks and crisis transmission." *Journal of International Economics*, 89(2): 495–510.

Kalemli-Ozcan, Sebnem, Elias Papaioannou, and Jose-Luis Peydro. 2013. "Financial regulation, financial globalization, and the synchronization of economic activity." *The Journal of Finance*, 68(3): 1179–1228.

Kose, M. Ayhan, Marco Terrones, and Eswar Prasad. 2003. "Volatility and Comovement in a Globalized World Economy: An Empirical Exploration." *IMF Working Papers*, 03(246): 1.

Laeven, Luc, and Fabian Valencia. 2018. "Systemic Banking Crises Revisited." *IMF Working Papers*, 18(206): 1.

Lane, Philip R. 2006. "Global Bond Portfolios and EMU." *SSRN Electronic Journal*.

Lane, Philip R., and Gian-Maria Milesi-Ferretti. 2003. "International Financial Integration." *IMF Working Papers*, 03(86): 1.

Lane, Philip R., and Gian Maria Milesi-Ferretti. 2007. "The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004." *Journal of International Economics*, 73(2): 223–250.

Martin, Philippe, and Hélène Rey. 2000. "Financial integration and asset returns." *European Economic Review*, 44(7): 1327–1350.

Morgan, Donald P., Bertrand Rime, and Philip E. Strahan. 2004. "Bank Integration and State Business Cycles." *Quarterly Journal of Economics*, 119(4).

Obstfeld, Maurice. 1994. "Risk-Taking, Global Diversification, and Growth." *The American Economic Review*, 1310–1329.

Porta, Rafael La, Florencio Lopez-De-Silanes, Andrei Shleifer, and Robert W. Vishny. 1997. "Legal Determinants of External Finance." *The Journal of Finance*, 52(3): 1131.

Portes, Richard, and Hélène Rey. 2005. "The determinants of cross-border equity flows." *Journal of International Economics*, 65(2): 269–296.

Pyun, Ju Hyun, and Jiyoun An. 2016. "Capital and credit market integration and real economic contagion during the global financial crisis." *Journal of International Money and Finance*, 67: 172–193.

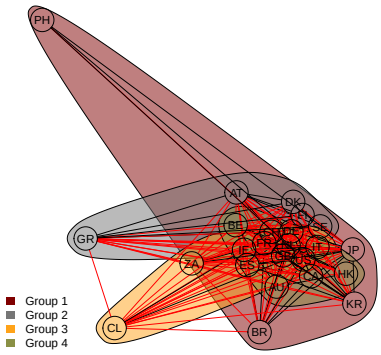
Romer, Christina D., and David H. Romer. 2017. "New Evidence on the Aftermath of Financial Crises in Advanced Countries." *American Economic Review*, 107(10): 3072–3118.

Stinnett, Douglas M., Jaroslav Tir, Paul F. Diehl, Philip Schafer, and Charles Gochman. 2002. "The Correlates of War (Cow) Project Direct Contiguity Data, Version 3.0." *Conflict Management and Peace Science*, 19(2): 59–67.

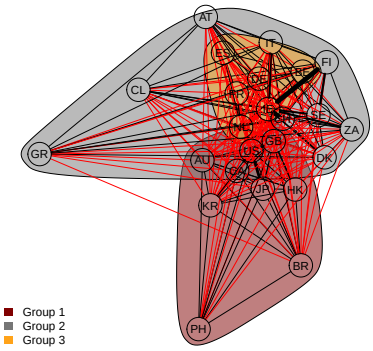
Wincoop, Eric van. 1999. "How big are potential welfare gains from international risksharing?" *Journal of International Economics*, 47(1): 109–135.

Figure 3. : Detecting community structure in financial networks

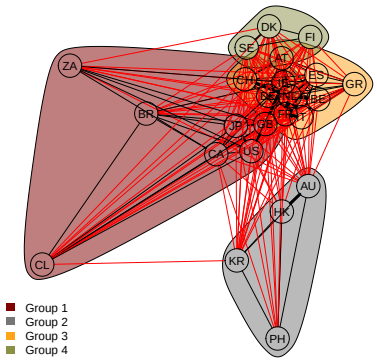
(a) Stock – 2001



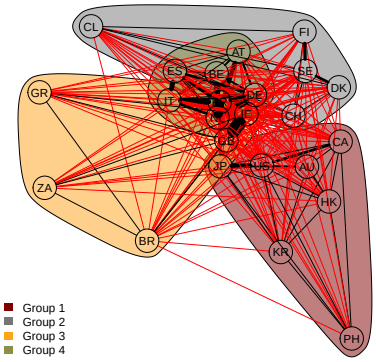
(b) Stock – 2016



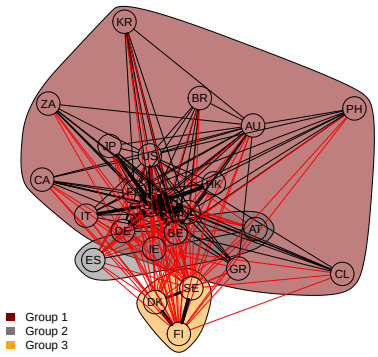
(c) Bond – 2001



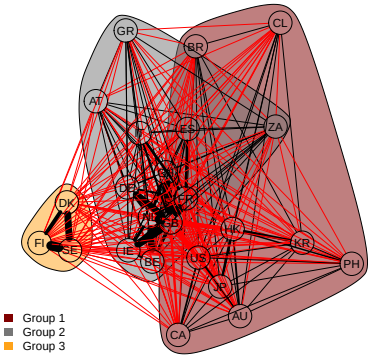
(d) Bond – 2016



(e) Loans – 2001



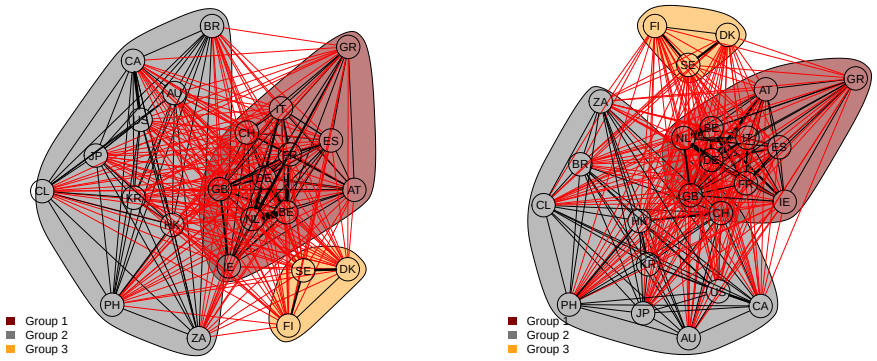
(f) Loans – 2016



Note: Using the Girvan and Newman (2002) community structure detection algorithm, this figure plots the community structure for the main endogenous variables of interest. Node links are proportional to the integration indices across each country-pair.

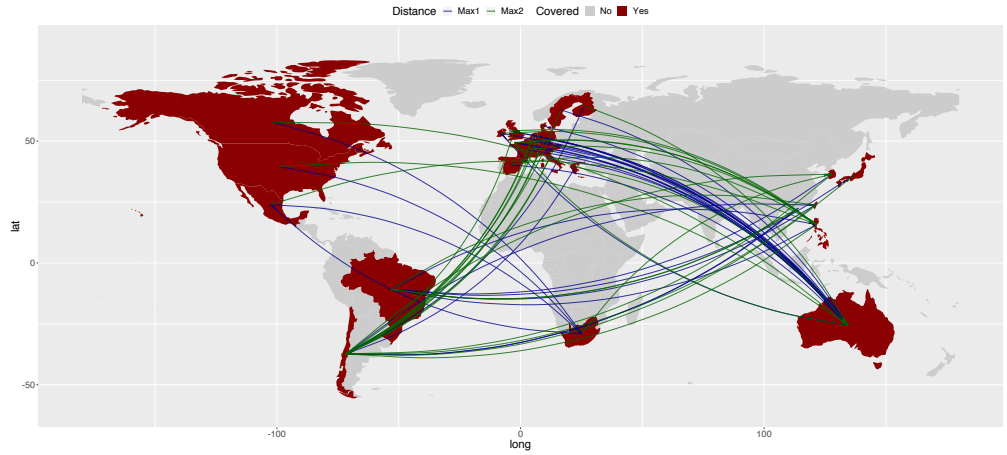
Figure 4. : Detecting community structure in trade networks

(a) Trade – 2001 (b) Trade – 2016



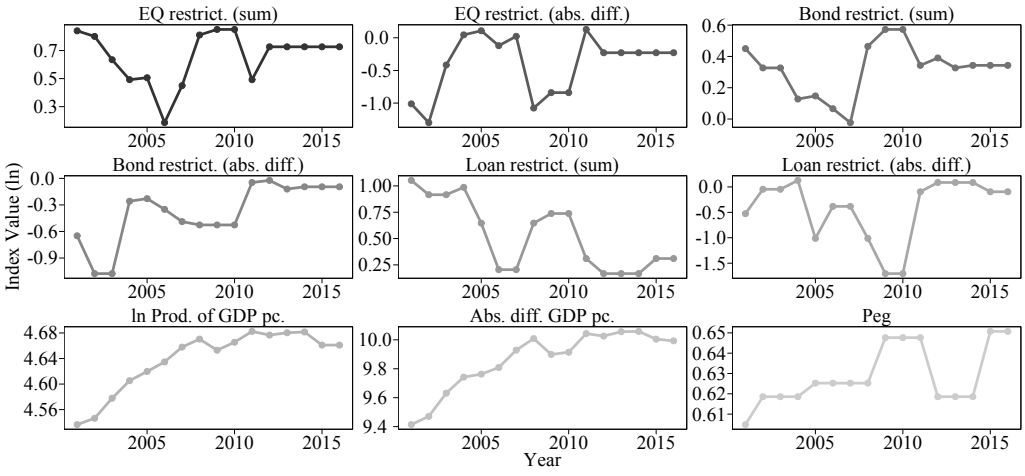
Note: Using the Girvan and Newman (2002) community structure detection algorithm, this figure plots the community structure for the main endogenous variables of interest. Node links are proportional to the integration indices across each country-pair.

Figure 5. : Matching country-level legal restrictions based on distance



Note: Gray states have zero observations. Max1 and Max2 designate the greatest distance for each country.

Figure 6. : Variation of instruments



Note: This figure plots the natural logarithm of different instrumental variables for the total sample of 31 economies. Equity, bond, and loan restriction indices originate from Fernández et al. (2016). The Peg index originates from Ilzetzki, Reinhart and Rogoff (2017).

Table 1—: Effect of financial and real integration on output co-movement, first stage

Dependent variable: GDP growth co-movement						
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 3SLS	(6) 3SLS
(Intercept)	−0.07***	−0.07***	−0.06***	−0.07***	−0.06***	−0.07***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Portfolio Inv.	0.27***	0.24***	0.95***	0.50***	0.95***	0.56***
	(0.04)	(0.03)	(0.09)	(0.09)	(0.09)	(0.08)
LD	−0.03**	−0.02**	−0.19***	−0.18***	−0.20***	−0.19***
	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)	(0.03)
Trade	1.09***	1.06***	1.62***	2.95***	1.68***	2.91***
	(0.09)	(0.09)	(0.29)	(0.25)	(0.29)	(0.25)
Spec	−0.70***	−0.76***	−1.06***	−0.86***	−1.08***	−0.93***
	(0.04)	(0.04)	(0.13)	(0.12)	(0.13)	(0.12)
Time FE	No	Yes	No	Yes	No	Yes
R^2	0.09	0.19	–	–	–	–
Adj. R^2	0.08	0.19	–	–	–	–
Num. obs.	8449	8449	30894	30894	30894	30894
RMSE	0.06	0.06	–	–	–	–

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

This table reports the first stage estimates from simulatenous equation regressions using different estimators. The outcome in all columns is an index of bilateral GDP growth co-movement. A positive (negative) coefficient means that the higher cross-border financial market integration the higher (lower) co-movement. The unique instrument for portfolio investment are based on the distance matched averages of the equity and bond market restriction indices for each country i and j. The unique instrument for LD is the distance matched index on credit restrictions. The unique instrument for trade is a regional trade agreement dummy. Specialization is instrumented with the absolute difference of per capita GDP and the log product of GDP per capita across the country-pair. Common instruments include population weighted physical distance, geographical contiguity, common official language, and exchange rate regime differences. For details see section IV.B

Table 2—: Effects of cross-border stock and bond market integration, first stage

Dependent variable: GDP growth co-movement						
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 3SLS	(6) 3SLS
(Intercept)	-0.06^{***}	-0.07^{***}	-0.07^{***}	-0.07^{***}	-0.08^{***}	-0.08^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Stock	-0.27^{**}	-0.38^{***}	-1.06^{***}	-0.56^{*}	-1.57^{***}	-0.68^{**}
	(0.09)	(0.09)	(0.30)	(0.25)	(0.29)	(0.25)
Bond	0.49^{***}	0.52^{***}	1.37^{***}	0.91^{***}	1.66^{***}	1.02^{***}
	(0.06)	(0.05)	(0.15)	(0.13)	(0.15)	(0.13)
LD	-0.02^{*}	-0.01	-0.05	-0.09^{**}	-0.02	-0.10^{**}
	(0.01)	(0.01)	(0.04)	(0.03)	(0.04)	(0.03)
Trade	0.84^{***}	0.79^{***}	1.52^{***}	2.19^{***}	1.45^{***}	2.27^{***}
	(0.10)	(0.09)	(0.30)	(0.25)	(0.30)	(0.25)
Spec	-0.74^{***}	-0.79^{***}	-0.29	-0.48^{**}	0.23	-0.27
	(0.05)	(0.04)	(0.16)	(0.15)	(0.16)	(0.15)
Time FE	No	Yes	No	Yes	No	Yes
R^2	0.10	0.21	–	–	–	–
Adj. R^2	0.10	0.20	–	–	–	–
Num. obs.	7569	7569	35628	35628	35628	35628
RMSE	0.06	0.06	–	–	–	–

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

This table reports the first stage estimates from simulatenous equation regressions using different estimators. The outcome in all columns is an index of bilateral GDP growth co-movement. A positive (negative) coefficient means that the higher cross-border financial market integration the higher (lower) co-movement. The unique instruments for stock and bond market integration are based on the distance matched averages of the equity and bond market restriction indices for each country i and j. The unique instrument for LD is the distance matched index on credit restrictions. The unique instrument for trade is a regional trade agreement dummy. Specialization is instrumented with the absolute difference of per capita GDP and the log product of GDP per capita across the country-pair. Common instruments include population weighted physical distance, geographical contiguity, common official language, and exchange rate regime differences. For details see section IV.B

Table 3—: Effect of cross-border financial integration on output co-movement conditional on short- and long-term debt, first stage

Dependent variable: GDP growth co-movement						
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 3SLS	(6) 3SLS
(Intercept)	-0.06^{***}	-0.07^{***}	-0.09^{***}	-0.09^{***}	-0.11^{***}	-0.10^{***}
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Stock	-0.24^{*}	-0.35^{***}	0.57	0.81^{*}	0.55	0.76^{*}
	(0.10)	(0.09)	(0.40)	(0.33)	(0.38)	(0.33)
Bond LT	0.61^{***}	0.61^{***}	2.48^{***}	2.19^{***}	3.19^{***}	2.71^{***}
	(0.07)	(0.06)	(0.24)	(0.22)	(0.23)	(0.22)
Bond ST	-0.63^{*}	-0.42	-10.28^{***}	-9.93^{***}	-13.31^{***}	-11.69^{***}
	(0.29)	(0.28)	(1.41)	(1.28)	(1.32)	(1.26)
LD	-0.01	-0.01	-0.08	-0.10^{**}	-0.09^{*}	-0.11^{**}
	(0.01)	(0.01)	(0.04)	(0.04)	(0.04)	(0.04)
Trade	0.66^{***}	0.62^{***}	1.51^{***}	1.82^{***}	1.68^{***}	1.91^{***}
	(0.10)	(0.10)	(0.32)	(0.28)	(0.32)	(0.27)
Spec	-0.73^{***}	-0.78^{***}	0.05	-0.04	0.91^{***}	0.59^{**}
	(0.05)	(0.05)	(0.22)	(0.21)	(0.20)	(0.19)
Time FE	No	Yes	No	Yes	No	Yes
R^2	0.11	0.21	–	–	–	–
Adj. R^2	0.11	0.20	–	–	–	–
Num. obs.	5904	5904	33747	33747	33747	33747
RMSE	0.06	0.06	–	–	–	–

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

This table reports the first stage estimates from simulatenous equation regressions using different estimators. The outcome in all columns is an index of bilateral GDP growth co-movement. A positive (negative) coefficient means that the higher cross-border financial market integration the higher (lower) co-movement. The unique instruments for stock, short-term, and long-term bond market integration are based on the distance matched averages of the equity, money market, and bond market restriction indices for each country i and j. The unique instrument for LD is the distance matched index on credit restrictions. The unique instrument for trade is a regional trade agreement dummy. Specialization is instrumented with the absolute difference of per capita GDP and the log product of GDP per capita across the country-pair. Common instruments include population weighted physical distance, geographical contiguity, common official language, and exchange rate regime differences. For details see section IV.B

Table 4—: Crisis transmission via cross-border financial integration I, first stage

Dependent variable: GDP growth co-movement						
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 3SLS	(6) 3SLS
(Intercept)	−0.07***	−0.07***	−0.09***	−0.09***	−0.09***	−0.09***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Crisis	−0.00	0.00	0.25***	0.20***	0.21***	0.18***
	(0.00)	(0.00)	(0.04)	(0.03)	(0.04)	(0.03)
Portfolio Inv.	0.23***	0.19***	1.65***	1.23***	2.09***	1.21***
	(0.04)	(0.04)	(0.49)	(0.30)	(0.49)	(0.30)
LD	−0.00	0.00	0.16	0.16	−0.18	0.07
	(0.01)	(0.01)	(0.23)	(0.12)	(0.23)	(0.12)
Trade	1.07***	1.05***	1.52*	2.60***	1.92**	2.86***
	(0.09)	(0.09)	(0.63)	(0.51)	(0.63)	(0.51)
Spec	−0.70***	−0.75***	−1.00***	−0.79**	−1.03***	−0.81**
	(0.04)	(0.04)	(0.30)	(0.25)	(0.30)	(0.25)
Crisis:Portfolio Inv.	0.20*	0.25**	−6.37*	−5.38***	−7.89**	−5.06***
	(0.09)	(0.09)	(2.49)	(1.41)	(2.47)	(1.41)
Crisis:LD	−0.09***	−0.09***	−1.14	−1.10**	−0.12	−0.89*
	(0.02)	(0.02)	(0.84)	(0.41)	(0.84)	(0.41)
Time FE	No	Yes	No	Yes	No	Yes
R^2	0.09	0.20	–	–	–	–
Adj. R^2	0.09	0.19	–	–	–	–
Num. obs.	8449	8449	32700	32700	32700	32700
RMSE	0.06	0.06	–	–	–	–

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

This table reports the first stage estimates from simulatenous equation regressions using different estimators. The outcome in all columns is an index of bilateral GDP growth co-movement. A positive (negative) coefficient means that the higher cross-border financial market integration the higher (lower) co-movement. The unique instruments for stock, short-term, and long-term bond market integration are based on the distance matched averages of the equity, money market, and bond market restriction indices for each country i and j. The unique instrument for LD is the distance matched index on credit restrictions. The unique instrument for trade is a regional trade agreement dummy. Specialization is instrumented with the absolute difference of per capita GDP and the log product of GDP per capita across the country-pair. Common instruments include population weighted physical distance, geographical contiguity, common official language, and exchange rate regime differences. For details see section IV.B

Table 5—: Crisis Transmission via cross-border financial integration II, first stage

Dependent variable: GDP growth co-movement						
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 3SLS	(6) 3SLS
(Intercept)	-0.06^{***}	-0.07^{***}	-0.11^{***}	-0.10^{***}	-0.10^{***}	-0.10^{***}
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Crisis	-0.01^{*}	0.00	0.19^{***}	0.15^{***}	0.20^{***}	0.15^{***}
	(0.00)	(0.00)	(0.04)	(0.03)	(0.04)	(0.03)
Stock	-0.35^{***}	-0.42^{***}	-1.72	-0.90	-1.33	-0.70
	(0.10)	(0.09)	(1.51)	(0.68)	(1.49)	(0.68)
Bond	0.49^{***}	0.47^{***}	1.67^{*}	1.67^{***}	1.39^{*}	1.67^{***}
	(0.06)	(0.06)	(0.72)	(0.38)	(0.71)	(0.38)
LD	0.01	0.01	0.58^{*}	0.39^{**}	0.57^{*}	0.34^{**}
	(0.01)	(0.01)	(0.25)	(0.12)	(0.25)	(0.12)
Trade	0.78^{***}	0.77^{***}	1.88^{*}	1.67^{**}	2.11^{**}	1.77^{***}
	(0.10)	(0.09)	(0.76)	(0.51)	(0.75)	(0.51)
Spec	-0.74^{***}	-0.78^{***}	0.11	0.03	-0.21	-0.08
	(0.05)	(0.04)	(0.45)	(0.30)	(0.45)	(0.30)
Crisis:Stock	0.03	-0.01	3.70	-3.01	3.34	-3.23
	(0.25)	(0.24)	(8.27)	(2.69)	(8.15)	(2.68)
Crisis:Bond	0.25^{*}	0.31^{**}	-2.26	-2.67^{*}	-2.19	-3.03^{*}
	(0.12)	(0.12)	(2.76)	(1.34)	(2.71)	(1.33)
Crisis:LD	-0.10^{***}	-0.10^{***}	-2.56^{**}	-1.49^{***}	-2.64^{**}	-1.37^{***}
	(0.02)	(0.02)	(0.91)	(0.37)	(0.90)	(0.37)
Time FE	No	Yes	No	Yes	No	Yes
R^2	0.10	0.21				
Adj. R^2	0.10	0.21				
Num. obs.	7569	7569	35628	35628	35628	35628
RMSE	0.06	0.06				

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

This table reports the first stage estimates from simulatenous equation regressions using different estimators. The outcome in all columns is an index of bilateral GDP growth co-movement. A positive (negative) coefficient means that the higher cross-border financial market integration the higher (lower) co-movement. The unique instruments for stock, short-term, and long-term bond market integration are based on the distance matched averages of the equity, money market, and bond market restriction indices for each country i and j. The unique instrument for LD is the distance matched index on credit restrictions. The unique instrument for trade is a regional trade agreement dummy. Specialization is instrumented with the absolute difference of per capita GDP and the log product of GDP per capita across the country-pair. Common instruments include population weighted physical distance, geographical contiguity, common official language, and exchange rate regime differences. For details see section IV.B

Table 1—: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
GDP Co-Movement	9,600	−0.072	0.065	−0.472	−0.105	−0.020	−0.000
Portfolio Inv.	8,912	0.016	0.025	0.000	0.001	0.018	0.244
Stock	8,288	0.006	0.010	0.000	0.000	0.007	0.092
Bond	8,208	0.011	0.018	−0.000	0.001	0.012	0.166
Bond LT	7,578	0.010	0.017	−0.000	0.001	0.012	0.134
Bond ST	6,356	0.001	0.003	−0.001	0.000	0.001	0.045
LD	9,392	0.029	0.089	0.000	0.000	0.011	0.969
Trade	9,591	0.005	0.008	0.000	0.001	0.004	0.109
Spec	9,264	0.020	0.016	0.000	0.007	0.031	0.096
Crisis	9,600	0.118	0.322	0	0	0	1

Figure 1. : Sample Coverage