Spillovers to Emerging Markets during Global Financial Crisis

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At the heart of the debate on how the 2007–09 global financial crisis spread from the United States to the rest of the world lies the global banks. Using a large sample, composed of advanced and emerging economies since the 1980s, Abiad and others (2013) show that the effect of financial linkages on output comovements during normal times is the opposite of the effect during crises. During tranquil periods, increased financial linkages induce greater output divergence, since capital is better able to move to where it is most productive.[1] During the global financial crisis, financial linkages contributed to the spread of financial stress across borders, but other factors such as global panic, increased uncertainty and wake-up calls that changed investors' perceptions acted as a common shock and played a much larger role in increasing output synchronization.

In this paper, we explore the main channels that caused the transmission of the global crisis from advanced countries to emerging markets. Since this crisis was not an emerging market crisis, it is important to understand how it spilled over to these economies: whether via conventional linkages like banking and trade or through the means of a global panic. Understanding the mechanisms is more important than ever in light of the potential spillovers from upcoming changes in U.S. monetary policy.[2] For our empirical analysis, we use a unique bilateral panel data set of cross-border banking linkages from the Bank for International Settlements (BIS) for 17 advanced

1. These results were first established by Kalemli-Özcan, Papaioannou and Peydro (2013) and Kalemli-Özcan, Papaioannou and Perri (2013), using data for advanced countries only.

2. In May–June of 2013, indications of tapering by the U.S. Federal Reserve caused a massive capital outflow from emerging markets.

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and 11 emerging economies, with data on their business cycles. Our data starts in 1977 and ends in 2012, thus covering several episodes of financial crises, including the 2007-09 global crisis. Emerging market data start in the late 1980s or early 1990s for most of our emerging markets.

A key challenge is to isolate spillovers from shocks that are common to all countries. There is a lack of systemic evidence linking financial globalization with output decline. This finding could reflect the fact that there are no spillovers via financial linkages or that the 2007–09 global crisis might have been a large common shock. For example, Acharya and Schnabl (2010) show that all big international banks had positions with similar risk profiles before the crisis, making the rollover of their debt quite hard when they started experiencing losses and hence causing a large common financial shock. Perri and Quadrini (2011) argue that the strong correlation of both financial and real aggregates across developed countries points to a large global confidence shock. Since common shocks and contagion may be observationally similar, it is quite hard to separate one from another in an empirical setting (Reinhart and Rogoff, 2009). The panel structure of our data allows us to identify common shocks and then to relate financial integration to the part of economic activity that is not explained by the common shock.

We start our analysis using the total sample, which includes all the country pairs and thus all three sets of linkages: namely, advanced-to-advanced, advanced-to-emerging and emerging-to-emerging linkages. Our first finding is that during periods without large financial crises, increases in bilateral banking linkages are associated with more divergent output cycles. This result is in line with the recent evidence in Abiad and others (2013), who uses a similar but smaller sample, and also with the evidence in Kalemli-Özcan, Papaioannou and Peydro (2013), who only uses advanced-to-advanced country pairs. This negative relation turns positive during the recent global financial crisis period. Previous studies also show a partial positive effect of financial linkages on synchronization during global crisis, but they document the total effect of financial linkages to be negative.[3] This is thus the first paper that shows evidence consistent with the idea of transmission of global financial crisis via financial linkages worldwide.

3. See Abiad and others (2013); Kalemli-Özcan, Papaioannou and Perri (2013).

Next, we omit advanced-to-advanced country pairs and use only advanced-to-emerging and emerging-to-emerging pairs. In this sample, we find no effect of financial linkages on spillovers during normal times or crisis times. This is an important result since this sample explicitly allows for advanced-to-emerging linkages and crisis transmission through such linkages. The results suggest that those linkages are not first order for the transmission or synchronization. This could be due to the fact that those linkages are not as deep as the ties between advanced economies. When we limit the sample to emerging-to-emerging market pairs (now also excluding advanced-to-emerging linkages), we find that emerging markets that are financially linked more closely to each other comove more during the crisis. This results holds when we condition on common shocks and trade linkages. In light of the previous set of findings, our interpretation of these results is that heightened uncertainty and investor panic during large crises can cause a synchronized retreat in emerging markets, where the effect of such a common shock will be amplified more for more financially linked emerging markets.

Theoretical models make opposing predictions on the association between financial integration and the synchronization of economic activity, depending on whether real or financial shocks are the source of the fluctuations. In a financially integrated world, if firms in certain countries are hit by a negative (positive) real shock, both domestic and foreign banks decrease (increase) lending in these countries and increase (decrease) lending in the unaffected countries, thereby causing a further divergence of output growth.[4] In contrast, if the negative (positive) shock is to the efficiency of the banking sector, globally operating banks pull out funds from all countries, transmitting the domestic banking shock internationally, which makes the business cycles of the two countries more alike.[5]

Empirically, the literatures on the correlates of business cycle synchronization and on how contagion spreads evolved separately. The business cycle synchronization literature focuses on long-term averages and tries to identify the effect of financial integration and other (mostly bilateral) factors on business cycle synchronization using cross-country variation. This literature generally finds a

4. See Backus, Kehoe and Kydland (1992); Obstfeld (1994), Holmstrom and Tirole (1997); Morgan, Rime and Strahan (2004); Heathcote and Perri (2004).

5. See Holmstrom and Tirole (1997); Morgan, Rime and Strahan (2004); Calvo (1998); Calvo and Mendoza (2000); Allen and Gale (2000); Mendoza and Quadrini (2010); Olivero (2010); Devereux and Yetman (2010).

positive relation between financial integration and synchronization, independent of whether the sample includes financial crisis episodes.[6] Yet, recent work by Kalemli-Özcan, Papaiannou and Peydro (2013) shows that in a sample of developed countries before 2007, when financial crises were rare (or absent for most countries), within-country-pair increases in cross-border financial linkages are associated with less synchronized output cycles.[7] In contrast, the contagion literature limits its focus to crises periods, primarily in emerging markets. Overall this body of work provides compelling evidence that crises spread contagiously from the origin, mostly via financial linkages.[8]

The existing empirical evidence, based on macroeconomic data, on whether the recent global financial crisis spread via financial linkages from the United States to the rest of the world is, thus far, inconclusive. In particular, Rose and Spiegel (2010, 2011) find no role for international financial linkages in transmitting the crisis for either developed or emerging markets. In contrast, VAR analysis provides supporting evidence. Employing global VARs, Helbling and others (2010) find that the U.S. credit market shocks had a significant impact on the evolution of global growth in the latest episode. Chudik and Fratszcher (2011), again using a global VAR approach, find that while the tightening of financial conditions was a key transmission channel for advanced economies, for emerging markets it was mainly the real side of the economy that suffered due to the collapse of worldwide economic activity.

Using microeconomic data from banks, Cetorelli and Goldberg (2011) find that the lending supply in emerging markets was affected through a contraction in cross-border lending by foreign banks. Raddatz and Schmukler (2012) use microeconomic data on mutual funds to study how investors and managers behave and transmit shocks across countries. The paper finds that both investors and managers respond to country returns and crises and adjust their investments substantially. Their behavior tends to be procyclical and thus amplifies the cycle. These findings are consistent with our results.

6. See Otto, Voss and Willard (2001); Baxter and Kouparitsas (2005); Kose, Prasad and Terrones (2004); Rose (2010).

7. See also Kalemli-Özcan, Sørensen and Yosha (2001); García-Herrero and Ruiz (2008).

8. Kaminsky and Reinhart (2000); Kaminsky, Reinhart and Végh (2003); Cetorelli and Goldberg (2011).

The remainder of the paper is structured as follows. Section 1 presents the empirical methodology and discusses our data on output synchronization and international banking linkages. Section 2 reports the empirical results. Section 3 concludes.

1. Methodology and Data

We estimate variants of the following regression equation:

$$Synch_{ijt} = \alpha_{ij} + \lambda_t + \beta Linkages_{ijt-1} + \gamma Post_t \times Linkages_{ijt-1} + X'_{ijt}\Phi + \varepsilon_{ijt}, \quad (1)$$

where $Synch_{ijt}$ is a time-varying bilateral measure reflecting the synchronization of output growth between countries i and j in period (quarter) t. We use gross domestic product (GDP) data from the Organization for Economic Cooperation and Development (OECD) statistical database to construct growth rates. $Linkages_{ijt-1}$ measures cross-border banking activities between country i and country j in the previous period/quarter. $Post_t$ is an indicator variable for the crisis period that switches to one in several quarters after 2007:3 and/or 2008:2, when the financial crisis in the U.S. mortgage market started unfolding. All specifications include country-pair fixed effects (α_{ij}), as this allows us to account for time-invariant bilateral factors that affect both financial integration and business cycle synchronization (such as trust, social capital, geography, and so on).[9] We also include time fixed effects (λ_t), to account for shocks that are common to all countries. In some specifications, we replace the time fixed effects with country-specific time trends ($trend_i$ and $trend_j$), to shed light on the importance of common global shocks versus country-specific shocks. We also estimate specifications including both time fixed effects and country-specific time trends to better capture common shocks and hard-to-observe country-specific output dynamics. We control for other factors, such as the level of income, population and

9. Kalemli-Özcan, Papaioannou and Peydro (2013) show that accounting for country-pair fixed effects is fundamental. Both the literature on the correlates of cross-border investment (for example, Portes and Rey, 2005; Guiso, Sapienza and Zingales, 2009; Buch, 2003; Papaioannou, 2009) and the literature on the determinants of output comovement (for example, Baxter and Kouparitsas, 2005) show that time-invariant factors related to geographic proximity, trust and cultural ties are the key robust correlates of financial integration and output synchronization.

bilateral trade.[10], However, since most of the usual correlates of output synchronization are either time invariant (such as distance or information asymmetry proxies) or slowly moving over time (such as similarities in production and bilateral trade), no other variable enters the specification with a significant point estimate, with the exception of lagged GDP per capita and population.

1.1 Output Synchronization

We measure business cycle synchronization (*Synch*) with the negative of divergence in growth rates, defined as the absolute value of GDP growth differences between country i and j in quarter t:

$$Synch_{ijt} \equiv -\left|\left(\ln Y_{it} - \ln Y_{it-1}\right) - \left(\ln Y_{jt} - \ln Y_{jt-1}\right)\right| , \tag{2}$$

This index, which follows Giannone, Lenza and Reichlin (2010), is simple and easy to grasp. In addition, it is not sensitive to various filtering methods that have been criticized on different grounds (Canova, 1998, 1999). In contrast to correlation measures more commonly used in cross-country studies, this synchronization index does not (directly at least) reflect the volatility of output growth and, therefore, allows us to identify the impact of banking integration on the covariation of output growth. Another benefit of this index is that, as we do not have many post-crisis observations, the rolling-average correlation measures are not very well estimated (Doyle and Faust, 2005).[11]

10. In all panel specifications, we cluster standard errors at the country-pair level to account for arbitrary heteroskedasticity and autocorrelation within each country pair. (Bertrand, Duflo and Mullainathan, 2004).

11. For robustness and for comparability with the work of Morgan, Rime and Strahan (2004) on the impact of banking integration on the evolution of business cycles across states in the United States, we also experimented with an alternative (though similar) synchronization measure, with similar results. To construct the Morgan, Strahan and Rime (2004) synchronization index, we first regress GDP growth separately for country i and j on country fixed effects and period fixed effects and take the residuals that reflect how much GDP and its components differ in each country and year compared to average growth in that year (across countries) and the average growth of this country over the estimation period. The absolute value of these residuals reflects fluctuations with respect to the cross-country and across-year mean growth. Second we construct the business cycle synchronization proxy as the negative of the divergence of these residuals, taking the absolute difference of residual growth.

1.2 International Banking Linkages

To construct the bilateral financial linkage measures, we use proprietary data from the Bank for International Settlements (BIS) locational banking statistics database. The database reports investments from banks located in up to 40 countries (the reporting area) into more than 200 countries (the *vis-à-vis* area) on a quarterly basis from the late 1970s to the present, although data for around 20 reporting-area countries are available only in the past decade or so. We use 17 advanced and 11 emerging economies.[12]

We never replace data, meaning that if a country pair has data, then both countries are reporting. That is, both countries must have reported their assets and liabilities in order to be included in our data on financial linkages. If only one country reported, the data are not included in our sample. This gives us limited variation in the case of emerging economies, but better measurement and more reliability.

The data are originally collected from domestic monetary authorities and supervisory agencies and include all of banks' on-balance-sheet exposure, as well as some off-balance-sheet items. The database follows the locational principle and thus also includes lending to subsidiaries and affiliates. Therefore, the locational banking statistics more accurately reflect the international exposure of countries (and banks) than the BIS consolidated statistics database, which nets out lending and investment to affiliated institutions. The statistics mainly capture international bank-to-bank debt instruments, such as interbank loans and deposits, credit lines, and trade-related lines of credit. The data also cover bank investment in equity-like instruments, as well as foreign corporate and government bonds.[13]

While not without drawbacks, our data offer important advantages over other international investment databases, which are essential for understanding the impact of financial globalization on the transmission of the recent crisis. First, the BIS statistics have

12. See the appendix for a list of the advanced and emerging economies.

13. Assets include mainly deposits and balances placed with nonresident banks, including a bank's own related offices abroad. They also include holdings of securities and participation (that is, permanent holdings of financial interest in other undertakings) in nonresident entities. Data also include trade-related credit, arrears of interest and principal that have not been written down and holdings of banks own issues of international securities. They also cover portfolio and direct investment flows of financial interest in enterprises.

by far the most extensive time coverage of all similar database on cross-border investment holdings. For example, the Coordinated Portfolio Investment Survey (CPIS) database maintained by the International Monetary Fund (IMF) reports bilateral cross-border financial flows and stocks only after 1999. Second, the data report bilateral financial linkages between each country in the world and the United States, where the crisis originated. This allows us to investigate the direct impact of the credit shock in the United States on the rest of the world. The main limitation of our data set is that it reports the aggregate international exposure only of the banking system.[14] As such, our data set does not include portfolio investment by mutual funds and the shadow financial system (hedge funds), foreign direct investment (FDI) and other international transactions (Lane and Milesi-Ferretti, 2007). Nevertheless, cross-border banking activities was by far the largest component of cross-border investment in the 1980s and the 1990s, and even now it accounts for the bulk of international finance. The country-level aggregate statistics of Lane and Milesi-Ferretti (2008) indicate that the stock of cross-border banking is currently more than 50 percent of total international holdings (including FDI and portfolio investment), and it was more than two-thirds in the 1980s and 1990s.

As long as there is a high correlation between international banking and other forms of portfolio investment (such as equity flows, FDI and debt flows), our estimates will not be systematically biased. According to the latest vintage of the Lane and Milesi-Ferretti data set of aggregate country-level foreign holdings, the correlation of total debt, portfolio debt, banking, FDI and equity in levels (expressed either as a share of total assets or as a share of GDP) is in the range of 0.75–0.99. Other country-pair data sets on foreign capital holdings also suggest a strong correlation between the various types of international investment. For example, Kubelec and Sa (2010) document that the correlation between our BIS data and the IMF CPIS bilateral debt data, which has a broader coverage of debt assets and liabilities, is 80 percent.

We use two measures of cross-border banking activities or linkages ($Linkages_{ij,t-s}$). First, we use the sum of bilateral assets and

14. Another limitation is that the BIS does not distinguishes between traditional banking activities, equity investment and holdings of international debt. Therefore, we cannot examine the effects of the different types of financial integration on output synchronization.

liabilities between countries *i* and *j* over the sum of the two countries' GDP in each quarter:[15]

$$\frac{Linkages}{GDP} = \frac{Assets_{ijt} + Liabilities_{ijt} + Assets_{jit} + Liabilities_{jit}}{GDP_{it} + GDP_{jt}}.$$

Second, we use the share of bilateral assets and liabilities between countries *i* and *j* over the sum of the total external assets and liabilities of each country in each quarter:

$$\frac{Linkages}{Total\ Linkages} =$$

$$\frac{Assets_{ijt} + Liabilities_{ijt} + Assets_{jit} + Liabilities_{jit}}{Tot\_Assets_{it} + Tot\_Liabilities_{it} + Tot\_Assets_{jt} + Tot\_Liabilities_{jt}}$$

Likewise we measure banking exposure to the U.S. financial system with the sum of bilateral assets and liabilities of each country pair *vis-à-vis* the United States over the sum of the two countries' GDP in each quarter and over the sum of total external assets and liabilities of the two countries in each quarter. The results are similar for both measures. Table 1 provides descriptive statistics for the variables employed in the empirical analysis.

15. We also used flows, with similar results. We prefer working with stocks, because theoretically it is more appealing. Changes in stocks may not solely reflect increased/decreased investment, as stocks (assets and liabilities) may change due to valuation effects arising from movements in the exchange rate or the market value of international investment.

Table 1. Descriptive Statistics: All Country Pairs

Variable	*No. obs.*	*Mean*	*Std. dev.*	*Min.*	*Max.*	*p1*	*p5*	*p25*	*p50*	*p75*	*p95*	*p99*
Pairwise correlation of GDPa	154,188	0.1798	0.2987	−0.8898	0.9657	−0.4771	−0.2983	−0.0299	0.1666	0.3858	0.6992	0.8344
Synchronization of GDP	191,295	−6.1358	6.7029	−101.7878	−0.0001	−32.1779	−17.8464	−7.9830	−4.3090	−1.9634	−0.3896	−0.0787
Linkages/GDP	21,467	0.0583	0.1206	0.0000	1.2926	0.0001	0.0004	0.0031	0.0135	0.0534	0.2646	0.6439
Linkages/total linkages	24,854	0.0247	0.0373	0.0000	0.3958	0.0001	0.0004	0.0027	0.0093	0.0291	0.1047	0.1785
U.S. linkages/GDP	19,878	0.4412	0.4884	0.0243	3.8989	0.0507	0.0771	0.1586	0.2873	0.4885	1.4796	2.6249
U.S. linkages/total linkages	22,398	1.2317	0.1961	1.0192	4.9590	1.0427	1.0719	1.1189	1.1677	1.2993	1.5502	1.8913

Note: The pairwise correlation of GDP is the correlation of real GDP growth estimated using 20 quarterly No. observations.

2. Empirical Results

First, we run simple difference-in-differences type specifications in the period just before and during the recent financial crisis. There are no other emerging market crises that are relevant for the period used. Specifically, focusing on our total sample over the period 2002–12, we split the sample into two five-year periods, and for each time span we estimate the correlation of real per capita GDP growth between each country pair using quarterly data over 20 quarters. The pre-crisis period is 2002:4–2007:3, and post-crisis period is 2007:4–2012:3.

We regress the correlation in output growth on a bilateral index of banking integration based on the total assets and liabilities of banks in the two countries at the beginning of each period, allowing the coefficient on the banking integration measure to differ in the two periods. As we condition on country-pair fixed effects, these specifications examine whether within-country-pair increases in banking integration are associated with a lower or higher degree of business cycle synchronization; by allowing the coefficient on banking integration to differ at the beginning of each period, we examine whether this association changed during the recent crisis. All specifications also include the log of the product of the two countries' GDP at the beginning of each period and the log of the product of the two countries' population.

Tables 2 and 3 reports the results. They are based on the same specifications, where the only difference is the measure of financial linkages. In table 2 the financial linkage variable is normalized by the total linkages of the countries in the pair *vis-à-vis* the rest of the world, whereas in table 3 the financial linkages between the pairs are normalized by the GDP of the countries in the pair. We use two different samples. The first sample is composed of all countries and hence includes all advanced-to-advanced, advanced-to-emerging and emerging-to-emerging country pairs. As shown in columns (1) through (3), the coefficient on the second period time effect (the crisis dummy variable), which captures the effect of the financial crisis on output synchronization, is positive and highly significant. This reflects the fact that correlations increased tremendously in 2007–09. Our estimate suggests that output growth correlations increased by around 0.4–0.5 during the recent crisis period relative to the five years before. Second, the coefficient on banking integration in the simple specification in columns (1) through (3) is negative and highly significant. This suggests

that conditional on shocks that are common to all countries, within-country-pair increases in banking integration are associated with less synchronized output cycles. Third, when we allow the coefficient on banking integration to differ in the two five-year periods via an interaction effect, we find a positive and significant coefficient of the interaction between banking linkages and the second period dummy variable: this implies that country pairs that were strongly integrated via the international banking system at the start of the 2007–09 crisis experienced more synchronized contractions during the crisis.

While the partial effect of financial integration on output synchronization during the recent crisis is positive, the total effect is negative. Thus the crisis has just made the relation between financial integration and output synchronization less negative, a result that is also found by Abiad and others (2013) and Kalemli-Özcan, Papaioannou and Perri (2013). This total effect will turn positive below, when we run more flexible specifications with a larger time dimension.

Columns (4) through (6) show the results for our second sample, which only includes advanced-to-emerging and emerging-to-emerging country pairs and hence omits all advanced-to-advanced linkages. The results change drastically. While the coefficient on the second period time effect (the crisis dummy variable) is still positive and highly significant, indicating that output growth correlations increased by around 0.6–0.8, nothing else is significant anymore. Of course, we lose a lot of observations. In fact, a sample that is composed of only emerging-to-emerging country pairs cannot be used in the specification of tables 2 and 3 given the few observations (we practically have two time periods in a country-pair fixed-effects estimation) It is possible that the original results are all driven by advanced country linkages, but it is also possible that there is not enough time variation to run this restrictive country-pair fixed-effects specifications. We therefore turn to our main specification, as described in the previous section, to sort this out.

Panel B of tables 2 and 3 shows the same specifications without country-pair fixed effects. The crisis dummy variable is still highly positively significant in both samples, and the total effect of financial linkages turns positive in the advanced country sample. This mimics the typical finding in the literature that when country-pair effects are not used, the identification is biased since it is based on cross-sectional variation.[16]

16. The endogeneity problem manifests itself clearly in sign reversal when one uses country-pair fixed effects or not.

Table 4 reports our benchmark estimates from our main regression equation, using data from the whole period (1977-2012). We use three samples. Our first sample includes all country pairs. The estimates in column (1) are in line with the simple difference-in-differences estimates reported in tables 2 and 3, where we used the correlation of GDP growth as the dependent variable and focused on the periods just before and during the recent financial crisis. In tranquil times, there is a significantly negative association between banking integration and output synchronization.

The coefficient on banking integration changes sign when we focus on the recent financial crisis period, defined as the period from 2008 to 2009. The estimate on the interaction term between bilateral banking activities and the recent crisis period implies that during the crisis years, an increased degree of banking integration was followed by more synchronized cycles.

In column (2) we include time (quarter) fixed effects to account for common global shocks, while in columns (3) and (4) we include bilateral trade linkages and their interaction with the crisis dummy variable. In all these specifications, the coefficient on banking integration continues to enter with a negative and significant estimate; the coefficient changes sign and turns positive (and significant) in the recent crisis period. The coefficient on goods trade is small and statistically indistinguishable from zero.[17] Most importantly, conditioning on goods trade does not affect the coefficient on banking integration both during tranquil periods and during the recent financial crisis.[18]

An important change from the previous results is that the total effect of financial integration is now positive. Hence in the sample of all country pairs, financial linkages act as a channel of contagion under a global financial shock. This finding supports the idea that the global financial crisis was transmitted from the United States to the rest of the world via financial linkages, whereas the evidence in the literature thus far is mixed (even our own table 2, which uses less time variation, does not have this result).

17.. The bilateral trade index is the sum of the logs of real bilateral exports and imports between the two countries in each quarter. Data are from the OECD monthly statistical database on trade.

18.. Rose and Spiegel (2004) and Aviat and Coeurdacier (2007) show that trade has a significantly positive effect on business cycle synchronization. Yet in the high-frequency quarterly dimension, there is no significant within-country correlation between goods trade and business cycle synchronization. The negative effect of trade at the time of crisis might be due to switching trade partners.

Table 2. Bilateral Financial Linkages and Output Correlations: Total Linkage Measure

Variable	*All country pairs*			*Emerging-emerging and emerging-advanced country pairs*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	All	*All*	*No LUX, CHE*	*All*	*All*	*No LUX, CHE*
A. With country-pair fixed effects						
Crisis indicator	0.3801***	0.4484***	0.4716***	0.6366***	0.8184***	0.5978**
	(0.0555)	(0.0672)	(0.0716)	(0.1951)	(0.2666)	(0.2703)
Linkages/Total linkages	−0.0529*	−0.0585**	−0.0690**	0.0119	0.0050	−0.0139
	(0.0281)	(0.0281)	(0.0291)	(0.0529)	(0.0533)	(0.0531)
Linkages/Total linkages x Crisis		0.0213*	0.0229*		0.0375	0.0119
		(0.0120)	(0.0129)		(0.0375)	(0.0387)
Country-pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.690	0.694	0.716	0.688	0.694	0.712

Table 2. (continued)

Variable	*All country pairs*			*Emerging-emerging and emerging-advanced country pairs*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	All	*All*	*No LUX, CHE*	*All*	*All*	*No LUX, CHE*
B. Without country-pair fixed effects						
Crisis indicator	0.3754***	0.4047***	0.4256***	0.4344***	0.3336**	0.2615
	(0.0174)	(0.0540)	(0.0593)	(0.0375)	(0.1652)	(0.1672)
Linkages/Total linkages	0.0214***	0.0184**	0.0201**	–0.0077	0.0027	0.0072
	(0.0066)	(0.0086)	(0.0094)	(0.0133)	(0.0211)	(0.0215)
Linkages/Total linkages x Crisis		0.0059	0.0068		–0.0156	–0.0277
		(0.0100)	(0.0108)		(0.0249)	(0.0252)
Country-pair fixed effects	No	No	No	No	No	No
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.667	0.669	0.683	0.655	0.648	0.663
No. observations	535	535	443	193	193	172
Country pairs	310	310	260	138	138	124

* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
*** Statistically significant at the 1 percent level.
Note: The table reports panel (country-pair) fixed-effect coefficients estimated in two non-overlapping five-year periods: 2002:4–2007:3 and 2007:4–2012:3. The dependent variable is the pairwise correlation of real per capita GDP growth between country i and country j in each of the two periods. The crisis indicator equals one in the second period (and zero in the first-period). Financial integration is measured by the log of the share of the stock of bilateral assets and liabilities between countries i and j in quarter t relative to the sum of the two countries' external assets and liabilities in the entire world at the beginning of each period (linkages/total linkages). Columns (3) and (6) omit Luxembourg and Switzerland. All specifications include the log of the product of the two countries' GDP at the beginning of each period and the log of the product of the two countries population. Heteroskedasticity-robust standard errors are reported in parentheses.

Table 3. Bilateral Financial Linkages and Output Correlations: GDP Measure

Variable	*All country pairs*			*Emerging-emerging and emerging-advanced country pairs*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	All	*All*	*No LUX, CHE*	*All*	*All*	*No LUX, CHE*
A. With country-pair fixed effects						
Crisis indicator	0.4121***	0.4260***	0.4558***	0.6291***	0.7060***	0.4938**
	(0.0551)	(0.0582)	(0.0625)	(0.1941)	(0.2378)	(0.2407)
Linkages/GDP	−0.0431	−0.0457*	−0.0615**	0.0072	0.0073	−0.0111
	(0.0266)	(0.0269)	(0.0289)	(0.0552)	(0.0555)	(0.0556)
Linkages/GDP x Crisis		0.0069	0.0105		0.0173	−0.0116
		(0.0093)	(0.0105)		(0.0306)	(0.0337)
Country-pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.689	0.689	0.711	0.688	0.690	0.712

Table 3. (contined)

Variable	All country pairs			Emerging-emerging and emerging-advanced country pairs		
	(1) All	(2) All	(3) No LUX, CHE	(4) All	(5) All	(6) No LUX, CHE
B. Without country-pair fixed effects						
Crisis indicator	0.3688***	0.3478***	0.3640***	0.4333***	0.2851**	0.1996
	(0.0172)	(0.0397)	(0.0464)	(0.0375)	(0.1378)	(0.1488)
Linkages/GDP	0.0218***	0.0248***	0.0255***	0.0028	0.0190	0.0237
	(0.0055)	(0.0072)	(0.0080)	(0.0111)	(0.0179)	(0.0192)
Linkages/GDP x Crisis		−0.0045	−0.0038		−0.0236	−0.0373*
		(0.0081)	(0.0089)		(0.0212)	(0.0223)
Country-pair fixed effects	No	No	No	No	No	No
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.667	0.666	0.68	0.654	0.641	0.657
No. observations	535	535	443	193	193	172
Country pairs	310	310	260	138	138	124

* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
*** Statistically significant at the 1 percent level.
Note: The table reports panel (country-pair) fixed-effect coefficients estimated in two non-overlapping five-year periods: 2002:4–2007:3 and 2007:4–2012:3. The dependent variable is the pairwise correlation of real per capita GDP growth between country i and country j in each of the two periods. The crisis indicator equals one in the second period (and zero in the first-period). Financial integration is measured by the log of the share of the stock of bilateral assets and liabilities between countries i and j in quarter t relative to the sum of the two countries' GDPs at the beginning of each period (linkages/GDP), external assets and liabilities in the entire world at the beginning of each period (linkages/total linkages). Columns (3) and (6) omit Luxembourg and Switzerland. All specifications include the log of the product of the two countries' GDP at the beginning of each period and the log of the product of the two countries population. Heteroskedasticity-robust standard errors are reported in parentheses.

Table 4. Bilateral Financial Linkages and GDP Synchronization

	All country pairs				*Emerging-emerging and emerging-advanced country pairs*				*Emerging-emerging country pairs*			
Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
A. With country-pair fixed effects												
Crisis indicator	−0.1999				−0.8906				9.2281**			
	(0.5255)				(1.5697)				(3.5849)			
Linkages/ Total	−0.3220***	−0.2297***	−0.2299***	−0.2377***	−0.0007	0.1221	0.1129	0.1073	−0.0811	0.0428	0.0536	−0.1060
Linkages	(0.0738)	(0.0751)	(0.0784)	(0.0783)	(0.1092)	(0.0971)	(0.0974)	(0.0973)	(0.3394)	(0.2920)	(0.2837)	(0.2888)
Linkages/Total	0.4070***	0.3863***	0.3793***	0.4976***	0.2878	0.3016	0.3107	0.3781	2.2282***	1.9027***	1.8741***	2.5836***
Linkages x Crisis	(0.1046)	(0.1020)	(0.1024)	(0.1170)	(0.2490)	(0.2513)	(0.2505)	(0.2616)	(0.6488)	(0.6461)	(0.6352)	(0.7329)
Trade			0.0041	0.0058			0.0270**	0.0220*			−0.2512**	−0.2743*
			(0.0057)	(0.0060)			(0.0133)	(0.0125)			(0.1218)	(0.1413)
Trade x Crisis				−0.0178***				−0.0217**				−0.7192**
				(0.0048)				(0.0085)				(0.2780)
Country–pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.184	0.256	0.260	0.261	0.201	0.357	0.358	0.358	0.294	0.424	0.424	0.432

Table 4. (continued)

	All country pairs				*Emerging-emerging and emerging-advanced country pairs*				*Emerging-emerging country pairs*			
Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
B. Without country-pair fixed effects												
Crisis indicator	0.2385				−1.0570				8.7852**			
	(0.5303)				(1.5346)				(4.0291)			
Linkages/ Total	0.2279***	0.2245***	0.1567***	0.1490**	0.2253***	0.2448***	0.2195***	0.2130**	0.1254	0.1205	0.1428	0.1193
Linkages	(0.0545)	(0.0535)	(0.0577)	(0.0577)	(0.0849)	(0.0832)	(0.0831)	(0.0832)	(0.1567)	(0.1384)	(0.1439)	(0.1385)
Linkages/Total	0.4849***	0.4715***	0.4685***	0.5725***	0.2958	0.3166	0.3146	0.3899	2.2977***	1.9360**	1.9210**	2.2762***
Linkages x Crisis	(0.1037)	(0.1009)	(0.1011)	(0.1156)	(0.2435)	(0.2481)	(0.2478)	(0.2580)	(0.7418)	(0.7025)	(0.6935)	(0.7546)
Trade			0.0109***	0.0122***			0.0116***	0.0139***			−0.0128	0.0043
			(0.0029)	(0.0031)			(0.0025)	(0.0031)			(0.0831)	(0.0902)
Trade x Crisis				−0.0158***				−0.0245**				−0.3436
				(0.0043)				(0.0097)				(0.2498)
Country–pair fixed effects	No	No	No	No	No	No	No	No	No	No	No	No
R squared (within)	0.049	0.117	0.122	0.123	0.057	0.241	0.243	0.243	0.189	0.348	0.349	0.350

Table 4. (continued)

	All country pairs				*Emerging-emerging and emerging-advanced country pairs*				*Emerging-emerging country pairs*			
Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
Time fixed effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country trends	Yes	No	No	No	Yes	No	No	No	Yes	No	No	No
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. observations	19,866	19,866	18,871	18,856	4,894	4,894	4,893	4,892	434	434	433	432

* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
*** Statistically significant at the 1 percent level.
Note: The table reports panel (country-pair) coefficients estimated using 17 advanced economies (we exclude Luxembourg and Switzerland) and 11 emerging markets, which would correspond to up to (28x27)/2=378 country pairs in the full sample and (11*10)/2=55 country pairs in the emerging markets sample. A given country does not necessarily report to all other countries in the sample, which is especially true among emerging markets, for which only 26 out of 55 possible country pairs have bilateral financial linkage data. For the advanced countries, the data run from 1977:1 to 2012:4, although for some countries data only start in the 1980s, while for the emerging economies, the data run from 2000:4 to 2012:4, with emerging-emerging country-pair data starting at 2002:4 and five countries reporting only after 2005. The dependent variable (GDP synchronization) is minus one times the absolute value of the difference in the growth rate of GDP between countries i and j in quarter t. Financial integration is measured by the log of the share of the stock of bilateral assets and liabilities between countries i and j in the previous quarter relative to the sum of the two countries' external assets and liabilities in the entire world in the previous period (linkages/total linkages). The crisis indicator variable equals one between 2008:3 and 2009:2 (and zero otherwise). All specifications also include the log of the product of the two countries' GDP at the beginning of each period and the log of the product of the two countries population. The specifications in columns (3), (7), and (11) also include the sum of the logs of real bilateral exports and imports between countries i and j in the previous quarter (trade). The specifications in columns (1), (5), and (9) include country-specific linear time-trends. The specifications in columns (2), (3), (4), (6), (7), (8), (10), (11), and (12) include time fixed-effects. Standard errors adjusted for panel-specific (country-pair) autocorrelation and heteroskedasticity are in parentheses.

The results change in our second sample, when we remove the advanced-to-advanced country pairs from the sample and focus on advanced-to-emerging and emerging-to emerging-pairs. There are no significant results in this sample. Finally, when we focus only on emerging-to-emerging links (columns 9–12 in table 4), we find that financial linkages have a positive effect on spillovers during times of crisis. This result is consistent with work by Alvarez and De Gregorio (2013), who show that countries in Latin America that are financially open did not weather the crisis well relative to countries that are less financially open. It is also consistent with Raddatz and Schmukler (2012), who show that mutual funds were a source of instability during the global financial crisis.

Panel B of table 4 runs the same specifications without country-pair fixed effects, again relying on cross-country variation only. As before, the negative normal-time effect of financial linkages disappears for advanced countries, as expected. For advanced-to-emerging and emerging-to emerging pairs, trade becomes an important source of transmission in these cross-sectional specifications, and the effect of total financial linkages is positive. The results mimic cross-sectional results from the literature on the positive effect of trade and finance on international business cycle synchronization. This is clearly a spurious result due to the inability to control for country-pair fixed factors. Given the limited set of time series variation in the emerging-to emerging sample, the results with and without country-pair fixed effects are not that different.

The recent financial crisis started with the problems in the U.S. subprime market in the summer of 2007 and intensified in 2008 when Bear Stearns and Lehman Brothers (and many other banking institutions) experienced massive losses. In table 5, we examine whether output synchronization during the recent financial crisis has been stronger among country pairs that had stronger linkages to the U.S. banking system relative to the pairs that have weaker connections. Controlling for direct exposure to the United States has no major effect on our evidence in table 4, in any of our samples. The coefficient on U.S. banking linkages during the recent financial crisis is negative, highlighting the different timing of countries entering the crisis. Rose and Spiegel (2010), using alternative cross-sectional techniques and data, fail to find a systematic correlation between international linkages to the United States and the magnitude of the recessions across countries in 2007-09. On the other hand, we believe that this negative result is an artifact of measurement

(and hence only reflects the timing), since most of the linkages to the United States are via intermediaries. In fact, Kalemli-Özcan, Papaiannou and Perri (2013) show that when we use a broader measure of exposure to the United States—incorporating not only the banking activities of each country pair with the United States, but also linkages to the Cayman Islands, Bermuda, Panama and the Channel Islands—the coefficients on the U.S. linkage measures enter significantly. We do not have the same data to employ here.

For the advanced-to-emerging and emerging-to emerging pairs, U.S. linkages do not matter in general except at the bottom specifications, where we do not use country-pair fixed effects. Here such pairs move with the United States during regular times, a result that again reflects global factors. Finally, table 6 presents specifications with host and partner country fixed effects. Results are similar to the case of no country-pair fixed effects, given that cross-sectional variation is used instead of within-country-pair variation over time.[19]

Can endogeneity concerns explain these results? The answer is no, since the first-order endogeneity will come from country-pair and time effects, as shown in Kalemli-Özcan, Papaioannou and Peydro (2013), and those effects are accounted for here.[20] Reverse causality could be present, but it is not straightforward how that could explain sign reversal during normal and crisis times in certain samples and not in others, unless there is a change in the nature of the shocks that only applies to certain countries and not to others.[21]

19.. Results with country*time fixed effects can be done only for advanced countries, as shown in Kalemli-Özcan, Papaioannou and Peydro (2013). Emerging pairs soak up most of the variation, given the limited country pairs over time.

20.. Sign reversals show that first-order endogeneity problem is due to country-pair factors.

21.. Kalemli-Özcan, Papaioannou and Peydro (2013) perform an instrumental variable (IV) analysis for their advanced country sample using changes in financial laws. We cannot use this strategy here since these changes are specific to European countries. Their analysis shows that reverse causality is not a major concern, as opposed to accounting for country-pair fixed characteristics and common shocks.

Table 5. Bilateral Financial Linkages, U.S. Financial Linkage and GDP Synchonization

	All country pairs		*Emerging-emerging and emerging-advanced country pairs*		*Emerging-emerging country pairs*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Variable	*All*	*All*	*All*	*All*	*All*	*All*
A. With country-pair fixed effects						
Linkages/Total linkages	−0.3514***	−0.2627***	−0.0369	0.0869	−0.0567	0.0601
	(0.0731)	(0.0733)	(0.1215)	(0.1100)	(0.3497)	(0.2957)
Linkages/	0.4183***	0.3980***	0.4328	0.4449	2.2431***	1.9178***
Total linkages x Crisis	(0.1095)	(0.1067)	(0.2712)	(0.2716)	(0.6732)	(0.6568)
U.S. linkages/	2.6349**	2.8041**	0.0492	1.9425	−2.0470	−1.6913
Total linkages	(1.1141)	(1.2408)	(2.4574)	(2.1346)	(3.0137)	(4.4470)
U.S. linkages/	−3.9913**	−3.5548**	−4.0564	−3.9058	1.6858	1.3063
Total linkages x Crisis	(1.7688)	(1.7448)	(2.4896)	(2.5107)	(5.1091)	(5.2640)
Crisis indicator	0.5798		0.8297		8.6904**	
	(0.6425)		(1.9684)		(3.8309)	
Country-pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.191	0.266	0.209	0.373	0.295	0.424

Table 5. (continued)

	All country pairs		*Emerging-emerging and emerging-advanced country pairs*		*Emerging-emerging country pairs*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Variable	*All*	*All*	*All*	*All*	*All*	*All*
B. Without country-pair fixed effects						
Linkages/Total linkages	0.2321***	0.2334***	0.1847**	0.2012***	0.1174	0.1096
	(0.0577)	(0.0569)	(0.0759)	(0.0729)	(0.1622)	(0.1420)
Linkages/	0.4609***	0.4456***	0.3753	0.4036	2.3400***	1.9751***
Total linkages x Crisis	(0.1096)	(0.1064)	(0.2563)	(0.2598)	(0.7507)	(0.7064)
U.S. linkages/	1.5816***	1.5265**	3.0137***	3.0606***	0.8229	0.9349
Total linkages	(0.6005)	(0.6152)	(0.6999)	(0.6653)	(1.0461)	(1.0810)
U.S. linkages/	−3.9304**	−3.4810**	−4.5327*	−4.2796*	3.3189	1.9285
Total linkages x Crisis	(1.7301)	(1.7105)	(2.4155)	(2.4413)	(4.4653)	(4.3516)
Crisis indicator	0.7798		0.2595		7.9993**	
	(0.6641)		(1.8516)		(3.8491)	
Country-pair fixed effects	No	No	No	No	No	No
R squared (within)	0.052	0.124	0.073	0.267	0.191	0.350

Table 5. (continued)

	All country pairs		*Emerging-emerging and emerging-advanced country pairs*		*Emerging-emerging country pairs*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Variable	*All*	*All*	*All*	*All*	*All*	*All*
Time fixed effects	No	Yes	No	Yes	No	Yes
Country trends	Yes	No	Yes	No	Yes	No
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes
No. observations	17,273	17,273	4,305	4,305	434	434

* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
*** Statistically significant at the 1 percent level.

Note: The table reports panel (country-pair) coefficients estimated using 17 advanced economies (we exclude Luxembourg and Switzerland) and 11 emerging markets, which would correspond to up to (28x27)/2=378 country pairs in the full sample and (11*10)/2=55 country pairs in the emerging-emerging sample. A given country does not necessarily report to all other countries in the sample, which is especially true among emerging economies, for which only 26 out of 55 possible country pairs have bilateral financial linkage data. For the advanced countries, the data run from 1977:1 to 2012:4, although for some countries data only start in the 1980s, while for the emerging economies, the data run from 2000:4 to 2012:4, with emerging-emerging country-pair data starting at 2002:4 and five countries reporting only after 2005. The dependent variable (GDP synchronization) is minus one times the absolute value of the difference in the growth rate of GDP between countries i and j in quarter t. Financial integration is measured by the log of the share of the stock of bilateral assets and liabilities between countries i and j in the previous quarter relative to the sum of the two countries' external assets and liabilities in the entire world in the previous period (linkages/total linkages). We measure U.S. linkages by the log of the share of the stock of bilateral assets and liabilities between each country and the United States in the previous quarter relative to the sum of the two countries' external assets and liabilities in the entire world in the previous period (U.S. linkages/Total linkages). The crisis indicator variable equals one between 2008:3 and 2009:2 (and zero otherwise). All specifications also include the log of the product of the two countries' GDP at the beginning of each period and the log of the product of the two countries population. Specifications in columns (1), (3) and (5) include country-specific linear time-trends. The specifications in columns (2) (4), and (6) include time fixed-effects. Standard errors adjusted for panel-specific (country-pair) autocorrelation and heteroskedasticity are in parentheses.

Table 6. Bilateral Financial Linkages and Output Correlations

	All country pairs			*Emerging-emerging and emerging-advanced country pairs*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Sample	*All*	*All*	*No LUX, CHE*	*All*	*All*	*No LUX, CHE*
A. With host-country fixed effects						
Crisis indicator	0.3756***	0.4069***	0.4318***	0.4598***	0.4119**	0.3370**
	(0.0176)	(0.0534)	(0.0585)	(0.0399)	(0.1685)	(0.1705)
Linkages/Total linkages	0.0183***	0.0150*	0.0152	–0.0158	–0.0110	–0.0053
	(0.0069)	(0.0089)	(0.0095)	(0.0153)	(0.0226)	(0.0231)
Linkages/		0.0062	0.0074		–0.0074	–0.0204
TotalLinkages x Crisis		(0.0099)	(0.0106)		(0.0253)	(0.0256)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.668	0.67	0.685	0.655	0.653	0.667

Table 6. (continued)

	All country pairs			*Emerging-emerging and emerging-advanced country pairs*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Sample	*All*	*All*	*No LUX, CHE*	*All*	*All*	*No LUX, CHE*
B. With partner-country fixed effects						
Crisis indicator	0.3854***	0.4301***	0.4509***	0.4112***	0.4683***	0.3810***
	(0.0179)	(0.0527)	(0.0567)	(0.0356)	(0.1459)	(0.1466)
Linkages/TotalLinkages	0.0049	–0.0000	0.0043	–0.0027	–0.0086	–0.0005
	(0.0070)	(0.0089)	(0.0093)	(0.0120)	(0.0190)	(0.0192)
Linkages/		0.0089	0.0102		0.0089	–0.0050
TotalLinkages x Crisis		(0.0099)	(0.0104)		(0.0220)	(0.0220)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls (GDP, population)	Yes	Yes	Yes	Yes	Yes	Yes
R squared (within)	0.672	0.674	0.69	0.655	0.658	0.67
No. observations	535	535	443	193	193	172
Country pairs	310	310	260	138	138	124

* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
*** Statistically significant at the 1 percent level.
Note: The table reports panel (country-pair) fixed-effect coefficients estimated in two nonoverlapping five-year periods: 2002:4–2007:3 and 2007:4–2012:3. The dependent variable is the pairwise correlation of real per capita GDP growth between country i and country j in each of the two periods. The crisis indicator equals one in the second period (and zero in the first period). Financial integration is measured by the log of the share of the stock of bilateral assets and liabilities between countries i and j in quarter t relative to the sum of the two countries' external assets and liabilities in the entire world at the beginning of each period (linkages/total linkages). Columns (3) and (6) omit Luxembourg and Switzerland. All specifications include the log of the product of the two countries' GDP at the beginning of each period and the log of the product of the two countries population. Heteroskedasticity-robust standard errors are reported in parenthesis.

3. Conclusion

We study the role of global banks in transmitting the global crisis to emerging markets. We use quarterly data on country-pair banking linkages from a sample of 17 developed countries and 11 emerging markets between 1977 and 2012 to examine the effect of cross-border banking integration on business cycle synchronization. We find that while the relationship between banking linkages and output synchronization was negative for almost all of the years before the recent crisis, the partial correlation turned positive during the recent crisis. However, this result is mainly driven by advanced-to-advanced linkages, which is consistent with the theory that with more complete financial markets, financial integration creates divergence under real shocks (normal times), and convergence under financial or credit shocks (shocks to financial sector).

When we focus on a sample of only emerging-to-emerging pairs, the negative effect in normal times disappears, consistent with the existence of frictions in the international financial markets that hinder capital flows. The crisis-times effect (that is, the positive relation between output comovement and financial linkages conditional on the period of global financial crisis) stays positive. These results are conditional on controlling for bilateral trade links and removing financial centers from the data. Our interpretation is that there was contagion among the emerging markets that are financially linked, although the crisis did not seem to be transmitted to them from advanced economies via financial linkages. One explanation for this may be that increased uncertainty led to investor panic and a synchronized slowdown in emerging markets, where such a common shock was amplified more for the countries that are more financially linked. However, because there are few observations, the predictive power is low when we restrict the sample to emerging markets.

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APPENDIX A

Country-Pair Data

To construct the bilateral financial linkage measures, we use proprietary data from the Bank for International Settlements (BIS) locational banking statistics database. The database reports investments from banks located in up to 40 countries (the reporting area) into more than 200 countries (the *vis-à-vis* area) on a quarterly basis from the late 1970s to the present. For our sample, we use 17 advanced and 11 emerging economies, as follows:

—Advanced economies (excluding Luxembourg and Switzerland): Australia, Austria, Belgium, Canada, Denmark, Germany, Finland, France, Ireland, Italy, Japan, Netherlands, Portugal, Spain, Sweden, the United Kingdom and the United States.

—Emerging markets: Brazil, Chile, Cyprus, Greece, India, Indonesia, South Korea, Malaysia, Mexico, South Africa and Turkey.

We never replace data, meaning that if a country pair has data, then both countries are reporting. That is, both countries must have reported their assets and liabilities in order to be included in our data on financial linkages. If only one country reported, the data are not included in our sample.

To explain further, the 11 emerging countries in the sample start reporting in the following quarters: Brazil (2002:4), Chile (2002:4), Cyprus (2008:4), Greece (2003:4), India (2001:4), Indonesia (2010:4), South Korea (2005:1), Malaysia (2007:4), Mexico (2003:4), South Africa (2009:3) and Turkey (2000:4). This yields 26 country pairs among those countries for which we have any data: TUR-ZAF, TUR-CYP, TUR-KOR, TUR-IDN, GRC-CYP, ZAF-BRA, ZAF-CHI, ZAF-MEX, ZAF-CYP, ZAF-IND, ZAF-IDN, ZAF-KOR, ZAF-MYS, BRA-CHI, BRA-MEX, BRA-KOR, CHI-IND, CHI-KOR, CYP-IND, CYP-KOR, IND-IDN, IND-KOR, IND-MYS, IDN-KOR, IDN-MYS and KOR-MYS.

So, 11 countries would initially give us (11*10)/2=55 country pairs, and we have data for about half of those. Given the average data availability for emerging markets, we have 434/26=16.7 quarters on average per country pair, or a little bit over four years. The emerging-to-emerging country pair data start in 2002:4, with BRA-CHI and CHI-IND. Although Turkey starts reporting in 2000:4, it only reports linkages to advanced economies, and the first country pair involving Turkey and another emerging market is TUR-KOR

in 2005:1. However, we have much more data for emerging-to-advanced country pairs (4,894 observations versus 434 observations on emerging-to-emerging linkages), since the advanced countries almost always report (see tables 2 through 6).

When we have all country pairs (17 or 19 advanced economies and 11 emerging economies), we could potentially have up to (30x29)/2=435 country pairs, but we only have 310 given some missing years. With 310 country pairs, we could have up to 620 observations in tables 2, 3 and 6, but we only have 535, again given missing years. The missing years are due to differences in initial reporting dates. In tables 4 to 6, with all pairs, we should have (28x27)/2=378 country pairs, but we only have 260, given missing years. Since we have 30 years and hence 120 quarters, we should have around 30,000 observations, but again given missing years we have around 20,000 in the full sample. The other samples will have a similar comparison.