# Banking sectors' international interconnectedness: Implications for consumption risk sharing in Europe

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# Banking sectors' international interconnectedness: Implications for consumption risk sharing in Europe

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**Abstract**

Cross-border asset and liability holdings allow countries to insulate their consumption streams from idiosyncratic output shocks, i.e. consumption risk sharing. By contrast, banks' international interconnectedness spread the U.S. subprime mortgage crisis to various economies with adverse macroeconomic consequences. This paper evaluates the partial impact of banks' cross-border links on the ability of their host countries to share consumption risk internationally. It shows that the impact of banks' links to the non-bank sector in the rest-of-the-world on consumption risk sharing is negligible while strong interbank links are associated with relatively little consumption risk sharing of banks' host countries.

**JEL**: E2, F15, G15

**Keywords**: banking sector, cross-border assets, consumption risk sharing, interconnectedness, systemic risk

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# 1 Introduction

The past two decades witnessed a tremendous increase in cross-border asset holdings (Lane and Milesi-Ferretti, 2007) which helped countries to diversify output shocks and thus to smooth consumption. Countries with relatively large cross-border asset holdings achieve more consumption risk sharing, i.e. they better insulate their idiosyncratic consumption growth from idiosyncratic output shocks, than countries with little cross-border asset holdings (Sørensen et al., 2007; Artis and Hoffmann, 2008, 2011).

Are more cross-border links always associated with better diversification of risk? We know that international interbank connections contributed to the proliferation of the U.S. subprime mortgage crisis to various other countries and the associated adverse macroeconomic consequences (see e.g. Brunnermeier, 2009). Hence, on the one hand, cross-border assets and liabilities of banks could expose countries to risk in the international financial system with rather destabilising effects on their consumption streams. On the other hand, they could be associated with better diversification of risk on average. They could just reflect another instance of cross-border linkages between countries that proved beneficial for international risk sharing.

This paper provides an account of the partial impact of banks' cross-border assets and liabilities on international consumption risk sharing. It regards a sample of nine European countries which are quite similar in terms of business cycle characteristics but markedly distinct in terms of banking sectors' international links. The sample spans the time period from 1980Q1 to 2009Q4. The paper introduces a measure of banks' international interconnectedness and uses the panel regression approach by Sørensen et al. (2007) to show that a high degree of international interconnectedness of banks with banks in the rest-of-the-world is associated with a low ability of their host country to diversify output and hence to smooth consumption. This finding is statistically significant and robust to a range of controls. It is not a product of the recent crisis period even though this period motivated the theoretical

and empirical contributions that guided both the construction of the measure of banking sectors' international interconnectedness as well as the hypotheses to be tested in the empirical analysis of this paper.

With respect to the construction of the measure of banking sectors' international interconnectedness two guidelines emerge from the recent literature. First, recently Cetorelli and Goldberg (2010, 2011) as well as Schnabl (2012) show that it is important to not only incorporate information about links of domestic banks to foreign banks but also the links of domestic banks to their affiliates in foreign countries in order to examine how shocks on advanced countries' banking sectors affect emerging market economies. Second, Drehmann and Tarashev (2011) point out that banks' roles as lenders as well as borrowers in interbank markets could matter for the assessment of their systemic importance and hence banks' exposure and contribution to systemic risk.

With respect to the hypotheses concerning the potential impact of banking sectors' international interconnectedness on consumption risk sharing also two guidelines emerge from the recent theoretical literature. First, Kollmann et al. (2011) introduce a global bank in a two-country model that provides loans to entrepreneurs in both countries. They show that typical business cycle shocks in one country do not materially affect the other country in this setting. Shocks have to be large to impact both countries significantly. Translated in the context of the consumption risk sharing analyses of this paper, banks' links to non-banks do not necessarily have to affect the ability of countries to share consumption risk internationally in the long run. Typical business cycle shocks could be too small. Second, Mendoza and Quadrini (2010) develop a theoretical model that features a financial sector with capital constraints and cross-border links between financial institutions. In their model relatively small unanticipated asset price shocks on financial institutions in one country can cause balance sheet shocks on foreign countries' financial institutions. This leads to adverse macroeconomic outcomes in the country where the shock originated as well as in the rest-of-

the world. Adrian et al. (2010) provide empirical support for the Mendoza and Quadrini (2010) model. They show that financial intermediaries balance sheet adjustment in the US helps to explain asset price movements and macroeconomic dynamics. They also show that capital constrained financial intermediaries amplify asset price shocks. Hence, banks' links with other banks should matter for consumption risk sharing in the long run as even small asset price shocks can cause adverse effects for the real economy.

This paper remains agnostic about the specific nature of shocks that are transmitted through international interbank linkages. Cetorelli and Goldberg (2010) show that liquidity shocks on internationally active banks in advanced economies can explain macroeconomic distress in emerging economies. Mendoza and Quadrini (2010) regard country-specific asset price shocks that are disseminated through the international banking system to explain why distress in one country's banking sector can lead to a global drop in asset prices and a global recession whereas Kollmann et al. (2011) consider shocks related to banks' credit portfolio for that purpose. Ultimately, all of these shocks are transmitted through an internationally interconnected banking sector and result in adverse macroeconomic outcomes in the countries that host these internationally interconnected banks. This is not tantamount to saying that banks' cross-border asset and liabilities do not carry any macroeconomic benefits. As Cetorelli and Goldberg (2011) as well as Schnabl (2012) show, the presence of foreign banks and the lending they provide helped to insulate credit in developing countries from monetary policy shocks. In addition, the evidence presented in this paper results from a reduced-form model such that the main results of this paper should not be interpreted as a causal relation.

The remainder of the paper is organized as follows. Section 2 briefly highlights related literature. Section 3 describes the measure of banks' interconnectedness and the data used in this study. Section 4 introduces the econometric specification. Section 5 presents the empirical results. Finally, section 6 concludes.

## 2 Related literature

This paper is related to the empirical literature concerned with the role of banks and lending in regional and international risk sharing. While bank lending and borrowing is important in regional risk sharing (see e.g. Hoffmann and Shcherbakova-Stewen, 2011, and the literature surveyed therein), the role of cross-border credit in general (Sørensen and Yosha, 1998) and bank loans for international risk sharing appears to be limited. Fratzscher and Imbs (2009) show that banks' foreign loans only marginally significantly help to diversify consumption risk internationally over the period from 1999 to 2003. A high share of foreign bank loans in a country's international investment position even seems to increase the susceptibility of idiosyncratic consumption risk to idiosyncratic income shocks. Taking a long-run view, incorporating information about all assets and liabilities and distinguishing between counterparty sectors, this paper complements Fratzscher and Imbs (2009). Moreover, Hoffmann and Nitschka (2012) highlight that the securitization of mortgage related domestic debt and hence the opportunity to trade such country-specific risk internationally had a beneficial impact on international consumption risk sharing. However, they also stress that this beneficial impact varied over time and basically ceased to exist in 2008 when credit dried up. Related to the main finding of Hoffmann and Nitschka (2012), Leibrecht and Scharler (2012) show that marketability of risks rather than the size or importance of the banking sector in a country matters for international risk sharing.

## 3 Measure of banks' international interconnectedness and data

The first part of this section provides information about the construction of the measure of banks' international interconnectedness used in this paper. The second part informs about the country sample, sample period and data employed to construct the international interconnectedness measure and to estimate the impact of banks' international interconnectedness on international consumption risk sharing.

### 3.1 Measure of banks' international interconnectedness

The construction of the measure of banks' international interconnectedness follows the approach of Lane and Milesi-Ferretti (2001, 2003, 2007) to measure financial integration in terms of gross values. Therefore, I define country k banking sector's interconnectedness as $ic_t^{k,X} = \frac{(FA+FL)_t^{k,X}}{GDP_t^k}$ where FA denotes asset holdings of banks located in country k vis-à-vis the rest-of-the-world, FL is the respective liability counterpart and X represents the sectoral distinction, i.e. all sectors, bank sector or non-bank sector.

The construction of the interconnectedness measure reflects theoretical insights from Drehmann and Tarashev (2011) who point out that banks' role as lenders as well as borrowers could be important in considering their systemic importance and hence their exposure as well as their contribution to systemic risk. Furthermore, the main results of Kollmann et al. (2011) leave the impression that banks' links to non-banks in other countries affect the ability of countries to share consumption risk internationally if the shocks are large. Typical business cycle shocks do not. However, the main results of Mendoza and Quadrini (2010) suggest that the international dissemination of small unanticipated asset price shocks among internationally interconnected financial institutions can lead to adverse macroeconomic outcomes in the countries that are linked through the financial sector. Hence, the distinction between cross-border links of banking sectors vis-à-vis banks and non-banks should matter for the assessment of the impact of banking sectors' international interconnectedness on international consumption risk sharing.

To provide an impression of the time variation and cross-sectional dispersion of the measure of banking sectors' interconnectedness, table 1 presents the mean, the minimum and the maximum of $ic_t^{k,X}$ for the beginning and for the end of the sample period. The descriptive statistics show clearly that banking sectors' international interconnectedness considerably

varies over time and across countries. In addition, these statistics show that the international links are dominated by links to other banks.

Table 1 shows that at the beginning of the sample period the sum of banks' foreign assets and liabilities amounted to approximately two times of quarterly GDP on average if all sectors are taken into account as banks' counterparties. At the end of the sample period, this ratio rose significantly to about nine times of quarterly GDP. Furthermore, a comparison of the minimum and the maximum of $ic_t^{k,X}$ at the beginning and at the end of the sample period clearly shows that banking sectors' international interconnectedness varies strongly between countries. At the beginning of the sample period the minimum of $ic_t^{k,X}$ is at about 0.5 times GDP. The maximum is at about five times GDP. At the end of the sample period this cross-sectional dispersion is more pronounced in absolute terms. The minimum is at three times GDP. The maximum lies at 20 times GDP. In addition, the comparison of the descriptive statistics distinguished by sectors reveals two further insights. First, the main characteristics of $ic_t^{k,X}$, strong growth over time and pronounced cross-sectional dispersion, pertain to both the non-bank and the bank sector. Second, the amounts of assets and liabilities vis-à-vis the bank sector are considerably larger than the amounts of assets and liabilities vis-à-vis the non-bank sector. [2]

**[about here: Table 1]**

Finally, figure 1 depicts the point-in-time cross-sectional average of banking sectors' international interconnectedness over the whole sample period from 1980 to 2009, distinguished by counterparty sector, to show that the growth in international interconnectedness did not happen monotonically but was rather slow until the middle of the 1990s. Then we observe a tremendous increase, in particular in interbank interconnectedness, to its peak in 2007 and 2008 and the fall in international interconnectedness in the aftermath

[2] This data is available on my website http://sites.google.com/site/tnitschka/

of the Lehman crash. This fall is more pronounced for interbank links than for links to the non-bank sector.

**[about here: Figure 1]**

### 3.2 Data

*Banks' cross-border assets and liabilities*

Since Cetorelli and Goldberg (2010) show that links of domestic banks to their affiliates in foreign countries are important in explaining how liquidity shocks on advanced economies' banks affected emerging economies, the inclusion of assets and liabilities against own affiliates in foreign countries is important for the empirical results. Hence, the residence of banks, not the nationality, matters for this study. Therefore, I use data on banks' gross cross-border assets and liabilities in current US dollars from the BIS locational banking statistics, freely available on the BIS website www.bis.org, to construct the interconnectedness measure. For these statistics, the BIS collects quarterly balance sheet data on cross-border assets and liabilities vis-à-vis more than 150 countries from banks located in the reporting area (45 countries). These assets and liabilities take the form of bank deposits, loans and debt securities but also equity. They are measured on immediate borrower basis as they are typically reported on balance sheets.[3] In addition, the locational banking statistics report these assets and liabilities as amounts outstanding at the end of quarter. Both domestically and foreign owned banking offices in the reporting countries report gross cross-border asset and liabilities on an unconsolidated basis, i.e. cross-border holdings vis-à-vis own affiliates are also included in the recorded asset and liability holdings. This inclusion would not be possible with data from the consolidated banking statistics of the BIS. The guidelines to the BIS locational banking statistics, freely available on the BIS website, provide more detailed information about the differences between the locational and the consolidated banking statistics.

[3] Suppose A gives a loan to B that is guaranteed by C. On immediate borrower basis, this transaction is reported as exposure of A to B. On ultimate risk basis, this transaction is reported as exposure of A to C.

More specifically, this paper uses quarterly gross on-balance sheet asset and liabilities from table 2a „External positions of banks in individual reporting countries vis-à-vis all sectors in all currencies“ and table 2b „External positions of banks in individual reporting countries vis-à-vis all non-bank sector in all currencies“ to calculate the measure of bank sectors' international interconnectedness vis-à-vis the non-bank and all sectors in the rest-of-the-world. The differences between positions of tables 2a and 2b can be attributed to assets and liabilities vis-à-vis the bank sector.

*Countries and sample period*

The countries under study are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom. This choice of countries reflects the attempt to work with a sample of countries that is relatively similar in terms of business cycle characteristics but at the same time features stark differences in the degree of international interconnectedness of banks located in these countries. It is the impact of banks' international interconnectedness on the reaction of consumption to output that is of main interest in this study. The sample period runs from the first quarter of 1980 to the fourth quarter of 2009.

*Consumption, GDP and US dollar exchange rates*

Quarterly, real consumption and real GDP per capita are calculated from the IMF's Financial Statistics. Aggregate consumption and GDP are obtained by normalizing price indices of all countries to 100 in 1998Q4 and translating GDP of each country in 1998Q4 euro values.

To calculate the interconnectedness measure for each country, quarterly GDP is denominated in current US dollars with the respective end of quarter US dollar exchange rates. The source of the exchange rates is the IMF's Financial Statistics.

*Measure of international asset price and business cycle movements*

In the empirical assessments of the role of banks' interconnectedness, I control for swings in global asset prices as Hoffmann and Shcherbakova-Stewen (2011) show that risk sharing among federal states in the United States varies with asset price movements. It is hence

important to control for this aspect also in the international context. Therefore, I use the deviation of industrial production from trend of the countries under study as control variable. The use of this variable is motivated by the main results of Cooper and Priestley (2009) who show that the production gap is not only a prime business cycle variable but also a powerful predictor of both stock and bond market returns.

To obtain this production gap, I follow Cooper and Priestley (2009) and regress the natural logarithm of each of the sample countries' quarterly and seasonally adjusted industrial production index from the IMF's Financial Statistics on a linear and quadratic time trend, i.e.

$$ip_t^k = \alpha + \beta trend + \gamma trend^2 + \varepsilon_t^k \quad (1)$$

with $ip_t^k$ the log industrial production index of country *k* at time *t, trend* denoting a time trend. The residual of this regression, $\varepsilon_t^k$, is the production gap as defined in Cooper and Priestley (2009) and e.g. also employed in Fuhrer and Rudebusch (2004). The production gap, $\varepsilon_t^k$, is henceforth denoted $gap_t^k$.

Since the production gap is a prime business cycle indicator, it could also be interpreted as not only controlling for expected asset returns but also for other business cycle characteristics of the sample countries that are not captured in the idiosyncratic GDP growth rates.

# 4 Econometric specification

The empirical results of this paper are based on the consumption risk sharing regression proposed by Sørensen et al. (2007):

$$\Delta\tilde{c}_t^k = \beta_U(t) \times \Delta\tilde{y}_t^k + \mu + \delta^k + \tau_t + \varepsilon_t^k \quad (2)$$

where $\Delta\tilde{c}_t^k$ is idiosyncratic consumption growth of country *k* at time *t* and $\Delta\tilde{y}_t^k$ idiosyncratic GDP growth respectively. Asdrubali et al. (1996) as well as Sørensen and Yosha (1998) show that $1-\beta_U$ can be interpreted as measure of consumption risk sharing, i.e. $\beta_U$ measures that fraction of GDP shocks that is not smoothed through cross-border ownership of assets,

international transfers or saving and is hence reflected in consumption growth. In the basic risk sharing regressions, such as equation (2), the regression coefficient $\beta_U$ typically varies between 0 and 1. An estimate of 0 reflects that idiosyncratic consumption growth is independent from idiosyncratic GDP growth, such that risk sharing is perfect. All diversifiable, idiosyncratic risks are actually diversified. Only global, common, shocks affect consumption. Conversely, an estimate of $\beta_U = 1$ is tantamount to saying that no idiosyncratic risks are diversified. All idiosyncratic GDP shocks have a direct impact on consumption. Sørensen and Yosha (1998) provide evidence for the importance of various channels through which GDP shocks can be smoothed internationally. They find that savings account for most of the smoothing of GDP shocks internationally. Interestingly, this smoothing via savings is due to domestic saving and not through net exports.

Following Sørensen et al. (2007) I allow $\beta_U$ to vary linearily with country-specific and time-variant characteristics by parameterizing

$$\beta_U(t) = \beta_0 + \beta_1 i\tilde{c}_t^{k,X} + \beta_2 gap_t^k + \beta_3 trend \tag{3}$$

with $i\tilde{c}_t^{k,X}$ the measure of the international interconnectedness of banks in country k relative to average interconnectedness of banks with residence in the sample countries. As described above, X represents the sectoral distinction, i.e. all sectors, bank sector or non-bank sector. To proxy for growth in cross-border assets in general, the regressions include also an interaction of *trend,* denoting a time trend, with idiosyncratic GDP. The variable $gap_t^k$ represents the deviation of industrial production from a linear and quadratic time trend to proxy for expected asset returns (Cooper and Priestley, 2009). This control is primarily motivated by Hoffmann and Sherbakova-Stewen (2011) who show that consumption risk sharing among US federal states depends is influenced by asset price cycles.

The final estimate equation obeys

$$\Delta\tilde{c}_t^k = \beta_0 \Delta\tilde{y}_t^k + \beta_1 (i\tilde{c}_t^{k,X} \times \Delta\tilde{y}_t^k) + \beta_2 (gap_t^k \times \Delta\tilde{y}_t^k) + \beta_3 (trend \times \Delta\tilde{y}_t^k) + \gamma_1 ic_t^{k,X} + \gamma_2 gap_t^k + \mu + \delta^k + \tau_t + \varepsilon_t^k \quad (4)$$

where the first four terms follow from plugging equation (3) into the basic risk sharing regression equation (2). The coefficients $\beta_1$, $\beta_2$ and $\beta_3$ of the interaction terms measure the impact of the variables of interest on international consumption risk sharing. A positive coefficient suggests that this variable has a negative impact on risk sharing as it increases the value of $\beta_U$. Conversely, a negative value indicates a beneficial impact on international risk sharing.

Following the recommendations of Ozer-Balli and Sørensen (2011) for panel regressions with interaction terms, the "main terms" $i\tilde{c}_t^{k,X}$ and $gap_t^k$ are also included on their own, i.e. not interacted with any other variable. In addition, I control for country-fixed effects ($\delta^k$) to allow for cross-sectional differences in consumption growth rates and a common time effect ($\tau_t$) to allow for cross-sectional dependencies that may not be eliminated by using idiosyncratic growth rates. The results, however, are not sensitive to the inclusion or exclusion of the country-specific and time fixed effects. In addition, the results remain qualitatively unaffected if I use one-quarter lagged values of the interconnectedness measure, i.e. $i\tilde{c}_{t-1}^{k,X}$ instead of the contemporaneous values. These latter results are not reported but available upon request.

# 5 Empirical results

## 5.1 Baseline results

The baseline results of this paper are obtained from equation (4). Banks' international interconnectedness is measured by the sum of their cross-border assets and liabilities divided by GDP of their residence country. Following Petersen (2009) standard errors of the estimates are clustered by countries. Table 2 summarizes the results.

Panel A presents the results if we regard the interconnectedness of banks in country *k* vis-à-vis the rest-of-the-world and all sectors. Line 1 of panel A gives the estimate of the regression of idiosyncratic consumption growth on idiosyncratic GDP and the interaction of GDP with the interconnectedness measure only. Focusing just on the estimate of $\beta_0$ alone, about 80% of consumption risk among the countries under study remains uninsured. The interaction term of interconnectedness is positive and significant meaning that the more cross-border links of banks' located in a particular country, the worse this country's diversification of GDP shocks. Controlling additionally for interaction of GDP with a simple time trend, however, the interaction term of interconnectedness is still positive but statistically insignificant as the second line of panel A shows. Adding the interaction with $gap_t^k$ to control for asset price fluctuations or potential other business cycle related dynamics does not alter this observation. This interaction term itself is negative, a negative production gap forecasts high expected returns, but insignificant. Here and in the subsequent regressions of table 2, the coefficients $\gamma$ for the main terms $i\tilde{c}_t^{k,X}$ and $gap_t^k$ are statistically insignificant and hence not reported for expositional purposes.

Panel B of table 2 displays the corresponding baseline regression estimates if only banks' assets and liabilities vis-à-vis the non-bank sector of the rest-of-the-world are regarded. Irrespective of the particular specification of the baseline regressions, the interaction term of banks' interconnectedness with GDP growth is always positive but statistically and economically not significantly different from zero. The partial impact of banks' links to non-banks on the ability of their host countries to achieve consumption risk sharing is negligible.

Panel C of table 2, however, paints a different picture. Panel C reports the baseline regression results when just interbank cross-border asset and liabilities are considered. Here the interaction term of interbank interconnectedness is positive, varying between 0.12 and 0.15, and statistically significant at least at the 90% confidence level according to t-statistics based

on clustered standard errors. In words, strong links of banks located in a particular country with banks in the rest-of-the-world, are associated with less consumption risk sharing by their host countries. This finding stands in marked contrast to the evidence provided for banks' links with non-banks in panel B of table 2.

**[about here: Table 2]**

These baseline results are consistent with the theoretical guidance provided by Kollmann et al. (2011) and Mendoza and Quadrini (2010). Kollmann et al. (2011) regard a two-country model with a globally operating bank that grants loans to entrepreneurs in both countries. In this model, shocks in one country have to be large to affect the other country. Their main results suggest that banks' links to non-banks in other countries do not necessarily affect the ability of countries to share consumption risk internationally if the shocks are rather "typical" business cycle shocks. This interpretation of the Kollmann et al. (2011) model in the consumption risk sharing context is what the results presented in panel B of table 2 suggest. The international links of banks to non-banks in foreign countries are not statistically significantly linked to their host countries' ability to achieve consumption risk sharing over the long-run. Mendoza and Quadrini (2010) regard a model that features cross-border links between financial institutions. Their main results suggest that the international dissemination of even small but unanticipated asset price shocks among internationally interconnected financial institutions can lead to adverse macroeconomic outcomes in the countries that are linked through the financial sector. Moreover, Adrian et al. (2010) provide evidence for this channel by showing that banks' balance sheet rebalancing provides important information about the future path of asset prices and even amplifies asset price shocks. Financial intermediaries balance sheet variables are also useful to explain macroeconomic dynamics. The baseline results presented in table 2 hence suggest that this channel, amplification of asset price shocks by financial intermediaries and associated adverse impact on the real economy, matters for international consumption risk sharing.

## 5.2 Robustness Checks

### *5.2.1 Asset or liability based measure of bank sectors' interconnectedness*

The results reported in table 2 rely on the use of a measure of interconnectedness that relates gross cross-border asset and liabilities of bank sectors to GDP of the respective country. This section assesses if the distinction between pure asset or pure liabilities measures of bank sectors' interconnectedness alters any of the main conclusions drawn above.

The paper uses the same regression specification as in equation (4) but separately examines a pure asset- and a pure liability-based measure of interconnectedness. Table 3 presents the results for the asset-based measure, table 4 delivers the corresponding results for the liability-based measure.

In sum, the regression estimates presented in the two tables broadly confirm the conclusions drawn from table 2. Countries with bank sectors that are relatively tightly linked with other countries' bank sectors happen to share less risk internationally than countries that host banks with little interbank links. Banks' links with the non-bank sector do not influence risk sharing. The statistical significance of the estimates falls when controlling for a time trend interaction and the interaction of $gap_t^k$ with idiosyncratic GDP. Though the significance levels drop, the differences between banks' links to banks or non-banks remain stark and clearly visible in the estimates of the respective interaction terms.

**[about here: Table 3]**

**[about here: Table 4]**

### *5.2.2 Impact of recent crisis period?*

According to the estimates provided so far, international interconnectedness between banks is associated with less diversified GDP shocks and hence with more volatile consumption in those countries that host banks with strong interbank links. This interpretation of the results presented in tables 2 to 4, however, could be the outcome of the recent crisis period. It is possible that it does not pertain to earlier periods. In fact, the theoretical papers that guide this

analysis are motivated by the recent crisis (Kollmann et al., 2011; Mendoza and Quadrini, 2010). In addition, Hoffmann and Nitschka (2012) show that the securitization of mortgage-related risks through mortgage-backed securities improved international risk sharing. But they also provide evidence for time-variation of this beneficial impact of securitization on international consumption risk sharing. In 2008 this beneficial impact ceased to exist.

To assess if a similar logic applies to the present context, I run the baseline regression focused on international interbank linkages for the time period from 1980Q1 to 2006Q4 thus excluding the current crisis period. Table 5 presents the results for all varieties of interconnectedness measures, i.e. assets and liabilities (A+L), assets only (A) and liabilities only (L).

**[about here: Table 5]**

Irrespective of the specific measure of interconnectedness, it is apparent that the interaction term with idiosyncratic GDP is positive and statistically significant at the 90% and 95% confidence level. The finding that interbank cross-border asset and liability holdings is negatively associated with the ability of their host countries' to share consumption risks internationally is not driven by the latest crisis period. It is rather a long-run observation among the European countries under study. The point estimates of the interaction term even suggest that the partial impact of interbank interconnectedness on risk sharing is stronger than in the full sample period. Apart from fewer observations, a potential reason for this finding is that the growth rate in banks' foreign assets and liabilities vis-à-vis the rest-of-the-world varied considerably across countries up to the end of 2007. After the Lehman turmoil in Q3 2008 the amount of banks' cross-border assets and liabilities dropped strongly in almost all countries which lowered the cross-sectional differences in banks' international interconnectedness.

### *5.2.3 Main results dependent on single countries?*

Since the sample under consideration consists of only nine countries, it is possible that single countries materially affect the main results presented so far. This could be particularly true for countries that host a lot of foreign banks because the BIS locational statistics reports banks' international claims based on the residence and not on the nationality of a bank. A German bank branch in the UK, for instance, is included in the interconnectedness measure of banks in the UK. I evaluate this possibility by subsequently taking out one of the sample countries and run the baseline regressions presented in table 2 for the remaining eight countries. It turns out that none of the countries alone is responsible for the regression results reported so far. For the sake of brevity, table 6 only reports the regression results when the UK is excluded from the sample. The UK is the country with highest degree of banks' interconnectedness among all the countries in the sample and over the entire sample period. In this sense, the UK is an outlier in this sample. Leaving out the UK should hence be a good test of the robustness of the empirical results presented so far.

**[about here: Table 6]**

As in the previous subsection, table 6 concentrates on the interconnectedness vis-à-vis the banking sector and reports the results from the final baseline regression, taking into account interaction of idiosyncratic GDP growth with a time trend and industrial production gaps. Apparently, leaving the UK out of the sample leaves the main results largely unaffected. Irrespective of the variety of the interconnectedness measure the main conclusion prevails. The interaction coefficient of banks' international interconnectedness with idiosyncratic GDP growth remains statistically significant indicating that the ability of countries to share their consumption risk internationally is weakened if banks' located in that countries are highly interconnected with banks in the rest-of-the-world.

# 6 Conclusions

In general, cross-border assets and liabilities have contributed to international consumption risk sharing over the past two decades. However, this paper shows that banks' international ties with other banks are negatively related to the ability of their host countries to diversify risk internationally. Countries that host banks with relatively high interbank links happen to achieve less risk sharing than countries with relatively little interbank connections. This finding is consistent with theoretical models and empirical evidence showing that international interbank links contribute to disseminating and amplifying asset price shocks that have the potential to negatively affect the real economy. Banks' international interbank interconnectedness seems to be associated with macroeconomic costs in the form of less consumption risk sharing of their host countries.

This finding could be interpreted as providing an additional macroeconomic rationale for recent regulatory attempts to curb interbank links as e.g. in the Basel III proposals for a new liquidity regulation framework (Basel Committee on Banking Supervision, 2010) or in the calibration of capital surcharges for global systemically important banks (Group of Governors and Heads of Supervision, 2011). So far, such proposals rest on the notion that banks' interconnectedness is associated with importance for the international financial system as highlighted in a recent study of the Bank for International Settlements (Bank for International Settlements, 2009). Since the quantification of systemic risk is difficult (see e.g. Adrian and Brunnermeier, 2009; Drehmann and Tarashev, 2011), the evidence presented in this paper could be interpreted as reinforcing the point that certain characteristics of banking sectors might bear macroeconomic costs that could justify regulatory actions.

## References


Adrian, T. and M. Brunnermeier (2009), "CoVaR", working paper FRB New York and Princeton University.

Adrian, T., Moench, E. and H.S. Shin (2010), "Financial Intermediation, Asset Prices and Macroeconomic Dynamics", FRB staff report No. 422 revised version September 2010.

Artis, M. and M. Hoffmann (2008), "Financial Globalization, International Business Cycles and Consumption Risk Sharing", *Scandinavian Journal of Economics* 110, 447-471.

Artis, M. and M. Hoffmann (2011), "The Home Bias, Capital Income Flows and improved Long-Term Consumption Risk Sharing between Industrialized Countries", forthcoming *International Finance*.

Asdrubali, P., Sørensen, B. and O. Yosha (1996), "Channels of interstate risk sharing: United States 1963-1990", *Quarterly Journal of Economics* 111, 1081-1110.

Bank for International Settlements (2009), "Guidance to Assess the Systemic Importance of Financial Institutions, Markets, and Instruments: Initial Considerations – Background Paper". Report to the G20 Finance Ministers and Central Bank Governors

Basel Committee for Banking Supervision (2010), "Basel III: International framework for liquidity risk measurement, standards and monitoring", Bank for International Settlements.

Brunnermeier, M. (2009), "Deciphering the Liquidity and Credit Crunch 2007-2008", *Journal of Economic Perspectives* 23, 77-100.

Cetorelli, N. and L.S. Goldberg (2010), "Global Banks and International Shock Transmission: Evidence from the Crisis", NBER working paper 15974.

Cetorelli, N. and L.S. Goldberg (2011), "Banking Globalization and Monetary Transmission", forthcoming *Journal of Finance*.

Cooper,I. and R. Priestley (2009), "Time-varying risk premiums and the output gap", *Review of Financial Studies* 22, 2801-2833.

Drehmann, M. and N. Tarashev (2011), "Measuring the systemic importance of interconnected banks", BIS working paper No 342.

Fratzscher, M. and J. Imbs (2009), "Risk sharing, finance and institutions in international portfolios", *Journal of Financial Economics* 94, 428-447.

Fuhrer, C.J. and G.D. Rudebusch (2004), "Estimating the Euler Equation for Output", *Journal of Monetary Economics* 51, 1133-1153.

Group of Governors and Heads of Supervision (2011), "Measures for global systemically important banks agreed by Group of Governors and Heads of Supervision", press release 25 June 2011, Bank for International Settlements.

Hoffmann, M. and I. Shcherbakova-Stewen (2011), "Consumption Risk Sharing over the Business Cycle: The Role of Small Firms' Access to Credit Markets", *Review of Economics and Statistics* 93, 1403-1416.

Hoffmann, M. and T. Nitschka (2012), "Securitization of Mortgage Debt, Domestic Lending and International Risk Sharing", forthcoming *Canadian Journal of Economics* 45(2).

Kollmann, R., Enders, Z. and G.J. Müller (2011), "Global banking and international business cycles", *European Economic Review* 55, 407-426.

Lane, P.R. and G.M. Milesi-Ferretti (2001), "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Nations", *Journal of International Economics* 55, 263-294.

Lane, P.R. and G.M. Milesi-Ferretti (2003), "International Investment Patterns", *IMF staff papers* 50, 82-113.

Lane, P.R. and G.M. 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, 223-250.

Leibrecht, M. and J. Scharler (2012), "Banks, Financial Markets and International Consumption Risk Sharing", forthcoming *German Economic Review*.

Mendoza, E.G. and V. Quadrini (2010), "Financial globalization, financial crises and contagion", *Journal of Monetary Economics* 57, 24-39.

Ozer-Balli, H. and B.E. Sørensen (2011), "Interaction Effects in Econometrics", mimeo Massey University and University of Houston and CEPR.

Petersen, M.A. (2009), "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches", *Review of Financial Studies* 22, 435-480.

Schnabl, P. (2012), "The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market", forthcoming *Journal of Finance*.

Sørensen, B.E.,Yosha, O., Wu, Y.-T. and Zu, Y. (2007), "Home Bias and International Risk Sharing: Twin Puzzles Separated at Birth", *Journal of International Money and Finance*, 26, 587-625.

Sørensen, B.E. and O. Yosha (1998), "International Risk Sharing and European Monetary Unification", *Journal of International Economics* 45, 211-238.

## Tables

**Table 1: Descriptive statistics of banking sectors' international interconnectedness**

| | *All sectors* | | | *Non-bank sector* | | | *Bank sector* | | |
|---|---|---|---|---|---|---|---|---|---|
| | mean | min | max | mean | min | max | mean | min | max |
| 1980Q1 | 1.91 | 0.46 | 5.19 | 0.39 | 0.02 | 1.37 | 1.52 | 0.44 | 3.82 |
| 2009Q4 | 8.74 | 2.66 | 19.99 | 2.68 | 0.39 | 7.16 | 6.06 | 2.27 | 12.83 |

Notes: Table 1 presents the mean, minimum and maximum of $ic_t^{k,X}$, the measure of international interconnectedness of banks located in country k at time t vis-à-vis sector X (all sectors, non-banks, banks) in the rest-of-the-world, in the first quarter of 1980 (beginning of sample period) and the fourth quarter of 2009 (end of sample period).

**Table 2**: **Banks' interconnectedness (assets and liabilities) and international risk sharing**

| $\beta_0$: | $\beta_1$: | $\beta_2$: | $\beta_3$: |
|---|---|---|---|
| 1 | $ic_t^k$ | *trend* | $gap_t^k$ |
| Panel A: Interconnectedness vis-à-vis all sectors | | | |
| 0.86 ** (8.96) | 0.09 ** (2.03) | | |
| 0.85 ** (8.78) | 0.07 (1.53) | − 0.00 (−1.25) | |
| 0.85 ** (8.77) | 0.07 (1.57) | − 0.00 (−1.26) | − 0.05 (−0.12) |
| Panel B: Interconnectedness vis-à-vis non-bank sector | | | |
| 0.86 ** (8.17) | 0.04 (0.89) | | |
| 0.85 ** (8.52) | 0.01 (0.27) | − 0.00 * (−1.89) | |
| 0.85 ** (8.51) | 0.01 (0.25) | − 0.00 * (−1.89) | − 0.20 (−0.44) |
| Panel C: Interconnectedness vis-à-vis bank sector | | | |
| 0.86 ** (9.49) | 0.15 ** (2.26) | | |
| 0.85 ** (9.14) | 0.12 * (1.85) | − 0.00 (−1.15) | |
| 0.85 ** (9.13) | 0.12 * (1.94) | − 0.00 (−1.18) | 0.01 (0.02) |

Notes: Table 2 provides estimates from the regression

$$\Delta\tilde{c}_t^k = \beta_U(t) \times \Delta\tilde{y}_t^k + \mu + \delta^k + \tau_t + \varepsilon_t^k$$

with the parameterization

$$\beta_U(t) = \beta_0 + \beta_1 i\tilde{c}_t^{k,X} + \beta_2 gap_t^k + \beta_3 trend$$

where $ic_t^{k,X}$ represents country k banks' international interconnectedness, measured as the sum of gross cross-border assets and liabilities relative to GDP, vis-à-vis sector X (all sectors, non-banks, banks) in the rest-of-the-world. Deviations of an industrial production index from a linear and a quadratic trend, $gap_t^k$, are included in the estimation as a proxy for asset price swings. Finally, *trend* denotes a time trend. T-statistics from standard errors clustered by country appear below the estimates in parenthesis. Significant values at the 95 and 90 percent confidence level are marked with ** and * respectively. The sample period runs from the first quarter of 1980 to the fourth quarter of 2009. The countries included in the sample are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom.

**Table 3: Banks' interconnectedness (assets) and international risk sharing**

| $\beta_0$: | $\beta_1$: | $\beta_2$: | $\beta_3$: |
|---|---|---|---|
| 1 | $ic_t^k$ | *trend* | $gap_t^k$ |
| Panel A: Interconnectedness vis-à-vis all sectors | | | |
| 0.86 ** (8.51) | 0.13 * (1.82) | | |
| 0.85 ** (8.56) | 0.09 (1.43) | − 0.00 (−1.57) | |
| 0.85 ** (8.56) | 0.08 (1.48) | − 0.00 (−1.57) | − 0.08 (−0.18) |
| Panel B: Interconnectedness vis-à-vis non-bank sector | | | |
| 0.86 ** (8.14) | 0.08 (1.07) | | |
| 0.85 ** (8.54) | 0.01 (0.07) | − 0.00 * (−1.83) | |
| 0.85 ** (8.53) | 0.03 (0.04) | − 0.00 * (−1.83) | − 0.20 (−0.44) |
| Panel C: Interconnectedness vis-à-vis bank sector | | | |
| 0.86 ** (9.20) | 0.26 ** (2.13) | | |
| 0.85 ** (8.89) | 0.20 (1.59) | − 0.00 (−1.21) | |
| 0.85 ** (8.90) | 0.21 * (1.78) | − 0.00 (−1.24) | 0.08 (0.20) |

Notes: Table 3 provides estimates from the regression

$$\Delta\tilde{c}_t^k = \beta_U(t) \times \Delta\tilde{y}_t^k + \mu + \delta^k + \tau_t + \varepsilon_t^k$$

with the parameterization

$$\beta_U(t) = \beta_0 + \beta_1 i\tilde{c}_t^{k,X} + \beta_2 gap_t^k + \beta_3 trend$$

where $ic_t^{k,X}$ represents country k banks' international interconnectedness, measured as gross cross-border assets relative to GDP, vis-à-vis sector X (all sectors, non-banks, banks) in the rest-of-the-world. Deviations of an industrial production index from a linear and a quadratic trend, $gap_t^k$, are included in the estimation as a proxy for asset price swings. Finally, *trend* denotes a time trend. T-statistics from standard errors clustered by country appear below the estimates in parenthesis. Significant values at the 95 and 90 percent confidence level are marked with ** and * respectively. The sample period runs from the first quarter of 1980 to the fourth quarter of 2009. The countries included in the sample are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom.

**Table 4: Banks' interconnectedness (liabilities) and international risk sharing**

| $\beta_0$: | $\beta_1$: | $\beta_2$: | $\beta_3$: |
|---|---|---|---|
| 1 | $ic_t^k$ | *trend* | $gap_t^k$ |
| Panel A: Interconnectedness vis-à-vis all sectors | | | |
| 0.85 ** (9.18) | 0.16 * (1.90) | | |
| 0.85 ** (8.98) | 0.13 (1.56) | − 0.00 (−1.42) | |
| 0.85 ** (8.97) | 0.13 (1.58) | − 0.00 (−1.43) | − 0.11 (−0.25) |
| Panel B: Interconnectedness vis-à-vis non-bank sector | | | |
| 0.86 ** (8.19) | 0.07 (0.69) | | |
| 0.85 ** (8.53) | 0.05 (0.50) | − 0.00 * (−1.94) | |
| 0.85 ** (8.52) | 0.05 (0.50) | − 0.00 * (−1.94) | − 0.20 (−0.44) |
| Panel C: Interconnectedness vis-à-vis bank sector | | | |
| 0.86 ** (9.12) | 0.16 * (1.70) | | |
| 0.85 ** (8.98) | 0.13 (1.48) | − 0.00 (−1.57) | |
| 0.85 ** (8.96) | 0.13 (1.52) | − 0.00 (−1.56) | − 0.13 (−0.28) |

Notes: Table 4 provides estimates from the regression

$$\Delta\tilde{c}_t^k = \beta_U(t) \times \Delta\tilde{y}_t^k + \mu + \delta^k + \tau_t + \varepsilon_t^k$$

with the parameterization

$$\beta_U(t) = \beta_0 + \beta_1 i\tilde{c}_t^{k,X} + \beta_2 gap_t^k + \beta_3 trend$$

where $ic_t^{k,X}$ represents country k banks' international interconnectedness, measured as the sum of gross cross-border liabilities relative to GDP, vis-à-vis sector X (all sectors, non-banks, banks) in the rest-of-the-world. Deviations of an industrial production index from a linear and a quadratic trend, $gap_t^k$, are included in the estimation as a proxy for asset price swings. Finally, *trend* denotes a time trend. T-statistics from standard errors clustered by country appear below the estimates in parenthesis. Significant values at the 95 and 90 percent confidence level are marked with ** and * respectively. The sample period runs from the first quarter of 1980 to the fourth quarter of 2009. The countries included in the sample are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom.

**Table 5: Banks' interconnectedness vis-à-vis banking sector and international risk sharing (1980Q1 – 2006Q4)**

| | $\beta_0$: 1 | $\beta_1$: $ic_t^k$ | $\beta_2$: *trend* | $\beta_3$: $gap_t^k$ |
|---|---|---|---|---|
| FA+FL | 0.87 ** (9.26) | 0.19 ** (2.70) | 0.00 (0.07) | – 0.12 (–0.23) |
| FA | 0.88 ** (9.41) | 0.37 ** (2.07) | 0.00 (0.30) | 0.23 (0.40) |
| FL | 0.88 ** (8.56) | 0.19 * (1.90) | – 0.00 (–0.41) | – 0.29 (–0.48) |

Notes: Table 5 provides estimates from the regression

$$\Delta\tilde{c}_t^k = \beta_U(t) \times \Delta\tilde{y}_t^k + \mu + \delta^k + \tau_t + \varepsilon_t^k$$

with the parameterization

$$\beta_U(t) = \beta_0 + \beta_1 i\tilde{c}_t^{k,X} + \beta_2 gap_t^k + \beta_3 trend$$

where $ic_t^{k,X}$ represents country k banks' international interconnectedness, measured as the sum of gross cross-border assets and liabilities relative to GDP as well as assets and liabilities only, vis-à-vis sector X (all sectors, non-banks, banks) in the rest-of-the-world. Deviations of an industrial production index from a linear and a quadratic trend, $gap_t^k$, are included in the estimation as a proxy for asset price swings. Finally, *trend* denotes a time trend. T-statistics from standard errors clustered by country appear below the estimates in parenthesis. Significant values at the 95 and 90 percent confidence level are marked with ** and * respectively. The sample period runs from the first quarter of 1980 to the fourth quarter of 2006. The countries included in the sample are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom.

**Table 6: Banks' interconnectedness vis-à-vis banking sector and international risk sharing (leaving out UK)**

| | $\beta_0$: 1 | $\beta_1$: $ic_t^k$ | $\beta_2$: *trend* | $\beta_3$: $gap_t^k$ |
|---|---|---|---|---|
| FA+FL | 0.83 ** (8.77) | 0.15 ** (2.46) | – 0.00 * (–1.90) | 0.22 (0.42) |
| FA | 0.83 ** (8.55) | 0.31 ** (2.68) | – 0.00 (–1.68) | 0.34 (0.69) |
| FL | 0.83 ** (8.57) | 0.16 * (1.87) | – 0.00 ** (–2.12) | 0.06 (0.11) |

Notes: Table 6 provides estimates from the regression

$$\Delta\tilde{c}_t^k = \beta_U(t) \times \Delta\tilde{y}_t^k + \mu + \delta^k + \tau_t + \varepsilon_t^k$$

with the parameterization

$$\beta_U(t) = \beta_0 + \beta_1 i\tilde{c}_t^{k,X} + \beta_2 gap_t^k + \beta_3 trend$$

where $ic_t^{k,X}$ represents country k banks' international interconnectedness, measured as the sum of gross cross-border assets and liabilities relative to GDP as well as assets and liabilities only, vis-à-vis sector X (all sectors, non-banks, banks) in the rest-of-the-world. Deviations of an industrial production index from a linear and a quadratic trend, $gap_t^k$, are included in the estimation as a proxy for asset price swings. Finally, *trend* denotes a time trend. T-statistics from standard errors clustered by country appear below the estimates in parenthesis. Significant values at the 95 and 90 percent confidence level are marked with ** and * respectively. The sample period runs from the first quarter of 1980 to the fourth quarter of 2009. The countries included in the sample are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands and Sweden.

## Figures

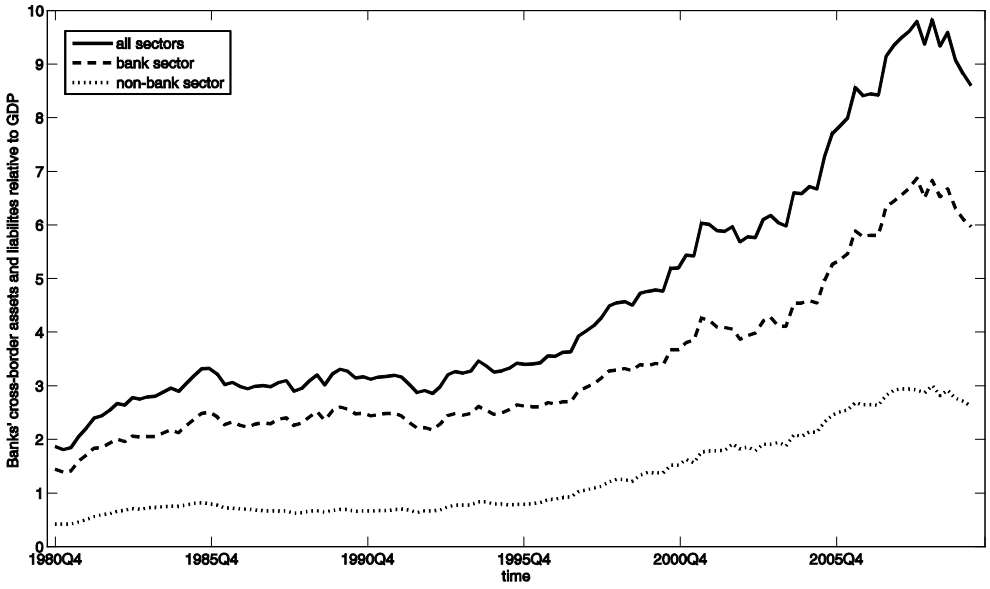


**Figure 1**: This figure gives an optical impression of the changes in average interconnectedness of banking sectors vis-à-vis counterparties of different sectors across the sample countries Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom over the period from 1980 to 2009. The interconnectedness of banks located in country k is defined as $ic_t^{k,X} = \left( \frac{FA + FL}{GDP} \right)_t^{k,X}$ where FA asset holdings vis-à-vis the rest-of-the-world of banks located in country k, L is the respective liability counterpart and X represents the sectoral distinction, i.e. all sectors (solid line), bank sector (dashed line) or non-bank sector (dotted line)

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