DEPARTMENT OF ECONOMICS
JOHANNES KEPLER UNIVERSITY OF LINZ

Banks, Financial Markets and International Consumption Risk Sharing

by

Markus LEIBRECHT

Johann SCHARLER

Working Paper No. 1015
December 7, 2010

Johannes Kepler University of Linz
Department of Economics
Altenberger Strasse 69
A-4040 Linz - Auhof, Austria
www.econ.jku.at

johann.scharler@jku.at
phone +43 (0)70 2468 -8360, -9679 (fax)

Banks, Financial Markets and International Consumption Risk Sharing

Markus Leibrecht* Johann Scharler†

December 7, 2010

Abstract

In this paper we empirically explore how characteristics of the domestic financial system influence the international allocation of consumption risk using a sample of OECD countries. Our results show that the extent of risk sharing achieved does not depend on the overall development of the domestic financial system *per se*. Rather, it depends on how the financial system is organized. Specifically, we find that countries characterized by developed financial markets are less exposed to idiosyncratic risk, whereas the development of the banking sector contributes little to the international diversification of consumption risk.

Keywords: International Risk Sharing, Financial Development, Financial System

JEL codes: F36, F41

*Corresponding author; Vienna University of Economics and Business, Department of Economics, Augasse 2 - 6, A-1090 Vienna, Austria, Phone (+43-1) 313 36-4264, Fax (+43-1) 313 36-9203, e-mail: markus.leibrecht@wu-wien.ac.at.

†University of Linz, Department of Economics, Altenbergerstrasse 69, A-4040 Linz, Austria, Phone (+43-0) 732-2468-8360, Fax (+43-0) 732-2468-9679, e-mail: Johann.Scharler@jku.at.

1 Introduction

How do countries deal with macroeconomic risk? In principle, countries should be able to pool and diversify idiosyncratic, that is, country-specific, risk internationally and thereby smooth consumption despite the occurrence of shocks. Although an extensive literature shows that the extent of consumption risk sharing between countries is relatively low (see e.g. Obstfeld and Rogoff, 2000; Lewis, 1999; Obstfeld, 1994; Backus et al., 1992), the precise channels through which risk is shared are less clear.

In this paper we study the role of domestic financial systems, by which we mean financial markets and banks, for the international sharing of consumption risk. The domestic financial system may be relevant for the international allocation of risk since it should provide instruments to share risk across countries. However, the provision of appropriate instruments may depend on how developed the financial system is and on its organization.

In general, countries with more developed financial systems are more likely to provide the appropriate instruments to share risk across borders. Thus, the overall development of the domestic financial system may determine the extent to which idiosyncratic risk can be diversified across countries. However, financial systems may be rather heterogeneous in terms of the development of the individual sectors. In other words, an overall highly developed financial system may be the result of a developed banking sector or sophisticated financial markets or both. If banks and financial markets are distinct channels for risk sharing then the degree of risk sharing achieved may in fact depend on the development of financial markets and banks, respectively, and not on the overall development of the domestic financial system *per se*. In this case, it also follows that the extent of risk sharing may depend on which element of the financial system is dominant. In market-based systems, financial markets are relatively more important than the banking sector, whereas the opposite is true in countries which are better described as bank-based financial systems.[1] Thus, risk sharing may vary across these types of financial system.

Against this background we explore empirically how characteristics of the domestic financial system influence the extent to which countries are able to share country-specific

[1]See Allen and Gale (2000) for a classification and a more detailed discussion of financial systems.

risk internationally. Our results indicate that it is primarily the development of financial markets which helps to share risk across countries. This result is in line with the idea that financial markets provide the necessary instruments to trade and diversify risk. Moreover, we find that banks play only a limited role for international risk sharing, which may be due to a home bias in bank assets (see e.g. Vazquez and Garcia-Herrero, 2007). Thus, financial markets and banks do not appear to be close substitutes for the international sharing of consumption risk.

Our analysis is closely related to Demyanyk et al. (2007) and Hoffmann and Shcherbakova-Stewen (2010) who argue that banks play an important role for the sharing of risk across US states. Thus, although the banking sector in the US contributes to risk sharing across states, banks do not appear to improve risk sharing across countries. The paper is also closely related to Hoffmann and Nitschka (2008). They show that the securitization of mortgage debt contributes significantly to risk sharing by making risk associated with residential real estate tradable. Yet, our analysis takes a broader view by analyzing the role of financial markets in general. Nevertheless, our results confirm that the tradability of risk helps to reduce the exposure to country-specific shocks.

The paper is structured as follows: Section 2 discusses why characteristics of the domestic financial system may determine the degree of risk sharing and it summarizes the four issues that we explore in the paper. Section 3 describes the empirical methodology and the data set. Section 4 presents the estimation results. Section 5 summarizes and concludes the paper.

2 The Domestic Financial System and Risk Sharing

In this section, we discuss how characteristics of the domestic financial system may influence the extent to which country-specific risk is shared internationally. Basically, consumption risk can be diversified across countries via financial transactions. Consequently risk sharing should be closely related to cross-border financial flows. Nevertheless, at a somewhat deeper level, characteristics of the domestic financial system may ultimately determine how well countries can insure against idiosyncratic risk.

In general, it appears plausible that the instruments which are necessary to share risk

efficiently are more readily available in financial systems which are characterized by a relatively high level of development. Thus, countries with developed financial systems - in a broad sense - should be less exposed to idiosyncratic risk. Yet, the overall level of development does not take into account how the financial system is organized. In principle, agents can insure against country-specific risk by holding diversified portfolios consisting of assets which represent claims on a country's GDP. If such assets are traded on financial markets, risk essentially becomes tradable. Consequently, one would expect that countries with more developed financial markets are able to share risk to a greater extent, simply because risk is more tradable.

However, even if risk is not sufficiently tradable due to a lack of the appropriate instruments or if direct financial market participation is limited, international risk sharing may still occur indirectly through financial intermediaries. Consider for instance the case where a country is hit by macroeconomic shocks which lead to fluctuations in income. Although a substantial fraction of agents in the economy may not be able to smooth these shocks via cross-border financial transactions, they may be able to smooth consumption by either depositing funds at a bank or by borrowing from a bank. In other words, agents share risk intranationally with banks.[2] These, in turn, diversify risk across countries and thereby reallocate risk internationally. A similar point is emphasized by Demyanyk et al. (2007) and Hoffmann and Shcherbakova-Stewen (2010) who find that banks play an important role for risk sharing between federal states in the US.

More generally, the international sharing of consumption risk may involve two stages. At the first stage, risk is pooled within countries and then, at the second stage, risk is diversified across countries. If risk is shifted from agents with limited access to international financial markets, e.g. households, to agents who can more easily participate on international financial markets, as for instance banks, then the overall exposure to country-specific risk may decline. In this sense, financial intermediaries may act as a substitute for the tradability of risk.[3]

[2]Boot (2000) argues that banks increasingly provide risk sharing in a general sense, since the traditional banking business has been declining over time.

[3]Note that in addition to financial intermediaries who diversify risk internationally on behalf of retail customers, financial markets may provide a similar type of intermediation via investments in multinational companies. Multinational companies typically acquire claims on the GDPs of foreign countries. Thus, an agent who invests in a multinational company essentially purchases a diversified portfolio of claims

In short, risk is either shared directly via asset trade, or indirectly via intermediaries such as banks. As long as banks and markets give rise to the same net foreign asset position, that is, if intermediaries just replicate the net foreign asset position that results from the direct trade of assets, the organization of the domestic financial system is largely irrelevant. In this case banks and markets are essentially close substitutes for the international allocation of risk and therefore risk sharing depends only on the overall level of development of the domestic financial system. However, this need not be the case and therefore financial markets and banks may represent distinct channels of risk sharing.

So far, we have focused either on financial development in a broad sense, or on the development of individual sectors of the financial system. The extent of risk sharing may also depend on which element of the financial system is the most dominant, that is, whether a country is better characterized as a market-based or as bank-based financial system. Consider, for instance, two countries where financial markets are developed to a similar extent. Suppose that in one of the countries banks are relatively more important than markets in the sense that financial transactions are primarily conducted through banks, whereas in the other country, markets are relatively more important than banks. Clearly, if banks and financial markets represent distinct channels for risk sharing, then the countries may achieve different levels of risk sharing despite the fact that they both have financial markets with similar degrees of development. In short, the overall extent of risk sharing may vary across countries characterized by different types of financial system. Thus, whether banks and financial markets are indeed distinct channels for risk sharing and which type of financial system leads to a lower exposure to risk, are both empirical questions.

To sum up, the first issue we explore in the paper is whether countries with more developed domestic financial systems are less exposed to idiosyncratic risk. Second, we analyze if countries characterized by more developed financial markets manage to diversify a larger fraction of their idiosyncratic risk. If macroeconomic risk cannot be traded to a sufficient extent, financial intermediaries can still facilitate international risk sharing. Therefore, the third issue we study is the role of banks for international risk sharing.

on foreign productive assets. Hence, in addition to ensuring that macroeconomic risk become tradable, financial markets also allow to shift risk to agents with a readier access to international financial markets.

And finally, we directly test which type of financial system, market-based or bank-based, provides more risk sharing.

3 Empirical Strategy and Data

3.1 Empirical Strategy

To empirically evaluate the role of the domest ic financial system for risk sharing we adopt the framework advocated in Asdrubali et al. (1996) which has become the workhorse approach to measure risk sharing. The standard risk sharing regression is based on the benchmark of complete markets. Intuitively, under complete markets any idiosyncratic influences are diversified away and therefore consumption should only react to global factors, which affect all countries. More specifically, if markets are complete and if preferences of the representative agent are described by a constant relative risk aversion utility function, then we should observe that: $\Delta \log c_{it} = \Delta \log c_{jt}$, where c_{it} and c_{jt} denote real per capita consumption in countries $i = 1, ..., N$ and $j = 1, ..., N$ at time t. Thus, consumption growth rates are equalized across countries (see e.g. Obstfeld and Rogoff, 1996, chapter 5, for a detailed derivation).

Since this condition for an optimal allocation has to hold for any two countries i and j, it also has to hold between country i and the world average: $\Delta \log c_{it} = \Delta \log c_t$, where c_t is a population weighted average of real per capita consumption growth rates. That is, under complete markets, consumption growth in each country should be equal to average growth.

If full risk sharing is not feasible due to incomplete markets, then consumption growth may depend on idiosyncratic variables, such as idiosyncratic income growth, $\Delta \log y_{it} - \Delta \log y_t$, where $\Delta \log y_{it}$ is the growth rate of per capita output in country i and $\Delta \log y_t$ is the average per capita output growth rate across countries:

$$\Delta \log c_{it} - \Delta \log c_t = \beta(\Delta \log y_{it} - \Delta \log y_t), \tag{1}$$

The left-hand-side of the equation is essentially the deviation from the benchmark of perfect risk sharing, which is linked to idiosyncratic output growth on the right-hand-side. If $\beta = 0$, then we have perfect risk sharing. In contrast, $\beta = 1$ corresponds to a complete

lack of risk sharing, that is, the autarky allocation. More generally, Asdrubali et al. (1996) show that β can be interpreted as the exposure to idiosyncratic risk. Put differently, β measures the fraction of idiosyncratic shocks which are not shared internationally. Similarly, $1-\beta$ provides a measure of the extent of risk sharing. To empirically quantify the extent of risk sharing, Asdrubali et al. (1996) run a panel regression of idiosyncratic consumption growth on idiosyncratic output growth:

$$\Delta\tilde{c}_{it} = \zeta_i + \beta\Delta\tilde{y}_{it} + \epsilon_{it}, \tag{2}$$

where $\Delta\tilde{c}_{it} = \Delta\log c_{it} - \Delta\log c_t$ and $\Delta\tilde{y}_{it} = \Delta\log y_{it} - \Delta\log y_t$, ζ_i denote country-fixed effects and ϵ_{it} is the remainder error term.

To explore how the domestic financial system influences the exposure to idiosyncratic shocks we follow Sørensen et al. (2007) and allow β in (2) to depend on variables which proxy aspects of the financial system. More specifically, we parameterize β as

$$\beta = \beta_0 + \beta_F F_{it} + \gamma Trend, \tag{3}$$

where F_{it} denotes a proxy either for the overall development of the financial system, for the development of financial markets and banks or for the type of the financial system. $Trend$ is a time trend. Several studies find that risk sharing has increased over the last decades due to deeper financial integration (see e.g. Artis and Hoffmann, 2008b; Sørensen et al., 2007). We include $Trend$ to control for this increase in risk sharing in a general way.

Using the parameterization for β and (2) we obtain our estimating equation:

$$\Delta\tilde{c}_{it} = \zeta_i + \alpha Trend + (\beta_0 + \beta_F F_{it} + \gamma Trend)\Delta\tilde{y}_{it} + \delta F_{it} + \epsilon_{it}. \tag{4}$$

So essentially we are adding interaction terms to capture the influence of the domestic financial system for the dependence of country-specific consumption growth on country-specific output growth. Thereby β_0 is the average exposure to idiosyncratic risk and β_F measures the effect of F_{it} on the exposure.

To specifically analyze the implications of financial integration we also estimate specifications where we add a dummy for membership in the European Monetary Union (EMU)

to (3) or replace $Trend$ in (3) by a proxy variable for international asset trade.

Note, that in addition to the interaction terms, we include the variables contained in F_{it} and $Trend$ directly in (4), that is not interacted with $\Delta\tilde{y}_{it}$. Although the coefficients on these variables are not of direct interest for the analysis, their inclusion helps to avoid potential mis-specification. Throughout the paper, we use a Newey-West-HAC-robust Variance-Covariance matrix of the remainder error term ϵ_{it}. Here, we choose a lag of 3 which roughly corresponds to $T^{1/3}$.

3.2 Data

Our analysis is based on annual data from 23 OECD countries and covers the period 1988 - 2004, since some the financial system variable we use for our analysis are not available for longer periods.[4] The precise sample varies somewhat depending on the availability of data for the individual countries. Real per capita consumption and real per capita GDP are taken from the Penn World Tables, described in Heston et al. (2006), and are measured in constant international prices. World aggregates are calculated as weighted averages: $y_t = \sum_{i=1\neq j}^{23} w_{it} y_{it}$ and $c_t = \sum_{i=1\neq j}^{23} w_{it} c_{it}$. The weights w_{it} are calculated as $w_{it} = pop_{it} / \sum_{i=1\neq j}^{23} pop_{it}$, where pop_{it} is the population of country i at time t.

To obtain proxy variables for the characteristics of the domestic financial system we draw on the large literature studying finance and growth. Data on financial system indicators are provided by Demirguc-Kunt and Levine (2001).[5] Specifically, we follow Demirguc-Kunt and Maksimovic (1998) and use bank assets as a percentage of GDP as an indicator for the development of the banking sector ($bank_{it}$) and the ratio of stock market capitalization to GDP to proxy the development of financial markets ($market_{it}$) in general. Based on these two variables we construct two further indicators for the domestic financial system: The first is a proxy for the overall level of the financial system's development, denoted by dev_{it}, which we calculate as $dev_{it} = bank_{it} + market_{it}$. The second variable we construct, $syst_{it}$, indicates the type of financial system which characterizes an economy. This variable is calculated as the size of financial markets relative to the size of the banking

[4] Our sample includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

[5] The data are available at: $http://www.econ.brown.edu/fac/Ross\_Levine/Publications.htm$

sector: $syst_{it} = market_{it}/bank_{it}$. We interpret countries characterized by high values of $syst_{it}$ as being relatively more market-based economies.

The set of financial variables, F_{it}, thus consists of dev_{it}, $market_{it}$, $bank_{it}$ and $syst_{it}$. These four variables are directly related to the four issues we explore in this paper: If the overall level of development has a favorable impact on the degree of international risk sharing, dev_{it} should enter significantly with a negative sign in (4) (i.e. $\beta_{dev} < 0$); If $\beta_{market} < 0$, then larger financial markets lead to a lower exposure to country-specific risk; Similarly, $\beta_{bank} < 0$ indicates that countries with a larger banking sector are less exposed to idiosyncratic income shocks. This result would be consistent with the interpretation that banks diversify risk internationally on behalf of agents who do not participate on financial markets directly; Finally if $\beta_{syst} < 0$, then we may conclude that market-based economies are able to share a larger fraction of risk than bank-based economies.

To capture the effect of international financial transactions, we construct a measure for total asset trade, FA_{it}, as the sum of a country's foreign assets and liabilities to GDP (see Obstfeld, 2004). We interpret FA_{it} as a proxy for international financial integration. Data on foreign assets and liabilities are obtained from Lane and Milesi-Ferretti (2006) and consist of foreign direct investment, equity and debt portfolio investment and financial derivatives.

All variables, except $Trend$ and dummy variables, are logged to cope with potential outliers in the data. Moreover, we subtract the means from the variables included in F_{it}, from FA_{it} and also from $Trend$. Using de-meaned variables allows for a ready interpretation of the coefficients on the interaction terms. Tables 1 and 2 show descriptive statistics for the variables used in the estimations.

4 Estimation Results

Column (I) in Table 3 shows the results for the standard risk sharing equation augmented with a time trend, but without the financial system variables. We see that the average exposure to idiosyncratic risk is about 65 percent. Thus, countries are able to insure against approximately 35 percent of idiosyncratic fluctuations in output. Moreover, the trend variable enters significantly with a negative sign, indicating a general increase in

the degree of risk sharing over time. This result is in line with the existing literature (see e.g. Artis and Hoffmann, 2008b).

The remaining columns of Table 3 show how dev_{it}, $market_{it}$, $bank_{it}$, and $syst_{it}$ influence the exposure to idiosyncratic fluctuations in output. We see from column (II) that the interaction term involving dev_{it} enters with a negative sign. That is, high values of dev_{it} tend to reduce the impact of idiosyncratic output growth on consumption growth. However, the coefficient is not significant at conventional levels. Thus, column (II) provides only weak evidence in favor of the hypothesis that developed domestic financial systems result in higher risk sharing.

Columns (III) and (IV) show how the development of financial markets and of banks influence risk sharing. In contrast to the overall financial development, we see from column (III) that countries with large financial markets are less exposed to idiosyncratic risk. This result confirms our expectation that the higher tradability of risk associated with large and developed financial markets improves the ability to share risk across countries. The effect of $market_{it}$ is not only statistically significant, but also economically meaningful. From a substantive point of view our results suggest that an increase in $market_{it}$ by one standard deviation (i.e, by 0.782; cf. Table 1) increases the degree of risk sharing by about 10 percentage points to 55 percent.[6]

Concerning the role of banks, column (IV) shows that $bank_{it}$ does not significantly impact upon the exposure to idiosyncratic risk. Thus, although large financial markets foster risk sharing, banks do not appear to provide international diversification of consumption risk. This conclusion is reinforced when we compare risk sharing across types of financial systems. Column (V) shows that higher values of $syst_{it}$ significantly reduce the exposure to country-specific fluctuations in output growth.[7] That is, relatively more market-based systems are less exposed to risk, which is consistent with the interpretation that the tradability of risk in market-based systems is essential for risk sharing.

[6]Calculated as 0.651-0.124*0.782, based on column (III) in Table 3.

[7]Note, that in the specification in Column (V), we do not control for the overall level of development. Since $syst_{it}$ ignores the overall level of development, countries where the relative importance of banks and markets is similar are treated similarly in this specification, although these countries may still differ substantially with respect to their overall level of financial development. However, since our sample consists only of OECD countries with relatively developed, albeit heterogeneous, financial systems, this issue does not appear to be problematic. This interpretation is also supported by the insignificance of dev_{it} in Column (I).

Thus, what matters for risk sharing is not financial development *per se*, but the development of financial markets. Banks do not appear to be a substitute for the tradability of risk. The result that it is primarily the tradability of risk which helps to share risk across countries is in line with Hoffmann and Nitschka (2008) who show that the increased tradability of risk due to securitization has improved international risk sharing. The limited influence of the banking sector on the extent to which countries are exposed to shocks contrasts somewhat with the important role of banks for risk sharing among US states documented by Demyanyk et al. (2007). Thus, although banks foster intranational risk sharing, they do not appear to improve the sharing of risk across borders. Interestingly, this interpretation is in line with the empirically documented home bias in bank assets (see Vazquez and Garcia-Herrero, 2007) and also with the finding in Buch and DeLong (2004) that cross-border bank mergers can only be partly explained by diversification motives.

Yet, one might question our results with the argument that the proxies for the domestic financial system pick up too much short-run volatility to allow for a structural interpretation. For instance, stock market capitalization may be driven by price changes. That is, a relatively large stock market capitalization may not only be an indication for the development of financial markets, but may simply show that stock prices have strongly increased. And since risk sharing may be higher in times of rising stock prices, we may simply pick up the effect of stock prices instead of structural aspects of the financial system.

To meet this concern, we re-estimate (4) with categorical indicators for the various proxies of the domestic financial system.[8] That is, we group countries according to the characteristics of their financial systems. More specifically, we create a set of dummy variables, D_i^F, where F is either *dev*, *market*, *bank*, or *syst*, which are equal to unity if the mean value of the respective financial indicator variable for country i is above the cross-country average. For example, D_i^{dev} is defined as $D_i^{dev} = 1$ if $1/(T)\sum_{t=1}^{T} dev_{it} > 1/(NT)\sum_{i=1}^{N}\sum_{t=1}^{T} dev_{it}$, and $D_i^{dev} = 0$ otherwise. The dummies D_i^{bank}, D_i^{market} and D_i^{syst}

[8] We also explore the cross-sectional stability of our estimates by conducting a country-jackknife analysis. Our conclusions are robust to dropping individual countries from the sample. Detailed results are available upon request.

are defined analogously.

Note that since the grouping of countries depends on averages taken over the entire sample period, we are much less likely to pick up any short run variation such as large movements in stock prices. However, the period over which we take the averages is clearly somewhat arbitrary. It appears conceivable that the relative importance of banks and markets changes as financial systems evolve over time. To meet this concern, we allow countries to switch between bank-based and market-based systems by grouping countries based on a comparison of F_{it} with the cross section average in every year. However, we find that the relative positions remain remarkable stable over time.[9] The only exceptions are Finland and Japan. Using yearly, cross-section, averages indicates that these two countries switch their relative positions in 1997. In particular, Finland moves from the group of bank-based economies to the group of market-based countries and Japan vice versa.[10] To cope with this issue we explicitly allow these two countries to switch their positions in the year 1997. Specifically, $D_{it}^{syst} = 0$ for $t < 1997$ and $D_{it}^{syst} = 1$ for $t \geq 1997$ for Finland and for Japan vice versa.

In addition, we also consider an alternative grouping of the countries based on characteristics of their legal systems. La Porta et al. (1997) argue that the origin of the legal system, and in particular the distinction between common and civil law traditions, determines to a large extent the structure and development of the financial system. The reason is that common law countries offer systematically better investor protection which fosters the development of financial markets. We define the dummy $D_i^{com} = 1$ if country has common law tradition and $D_i^{com} = 0$ otherwise.[11] Basically, the groupings we obtain based on D_i^{market} and D_i^{com} are similar: four of the six common law countries are market-based. The exceptions are Ireland and New Zealand which we classify as bank-based despite their common law legal tradition.

Again to account for a general increase in risk sharing over time, we allow β to depend

[9]Using the whole sample to group the countries, the market-based countries are Australia, Canada, Denmark, Finland, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States.

[10]The classification of Japan is generally not unambiguous since the Japanese financial system consists of large financial markets as well as an important banking sector (see also Allen et al., 2007).

[11]Common law countries are Australia, Canada, Ireland, New Zealand, the United Kingdom and the United States. Data on the origin of the legal system is available at *http://www.economics.harvard.edu/faculty/ shleifer/dataset.*

on a time trend which may now exert a different effect on risk sharing across the groups of countries.:

$$\beta = \beta_0 + \beta_{1F} D_i^F + \beta_{2F}(1 - D_i^F) + \gamma_{1F} D_i^F Trend + \gamma_{2F}(1 - D_i^F) Trend. \tag{5}$$

From Table 4 we see that our main conclusions remain unaltered. According to column (I), countries with a more developed financial system are slightly less exposed to idiosyncratic risk, although the null hypothesis that the coefficients are equal (i.e. $H_0 : \beta_{1F} = \beta_{2F}$) cannot be rejected. Nevertheless, Column (II) shows that countries with an above average stock market capitalization are exposed to about 56 percent of the idiosyncratic variation in their outputs, whereas the exposure is about 74 percent for countries with below average stock market capitalizations. In addition to this economically meaningful difference, the null of equal exposures in both groups of countries is rejected. From Column (III) we see that the exposure to idiosyncratic risk appears to be slightly lower in countries with large banking sectors. However, the null of equal coefficients is not rejected. Column (IV) shows that countries characterized by a market-based financial system are significantly less exposed to idiosyncratic risk. Column (V) displays the corresponding results when Finland and Japan are allowed to switch their positions; Finland moves from bank- to market-based and Japan vice versa. Clearly, also in this case market-based economies achieve a significantly higher level of risk sharing.[12] Finally, Column (VI) shows that countries with a common law tradition are significantly less exposed to idiosyncratic shocks. Since the majority of common law countries also are market-based countries Column (VI) reinforces our results.

As a final step of our analysis, we now explore the impact of financial globalization on risk sharing in somewhat greater detail. In the estimations reported so far, we have included a time trend to take the impact of financial globalization into account. Although this approach allows for a substantial amount of flexibility, it captures variations in risk sharing over time in a general sense.

In Table 5 we take into account that the process of European monetary integration may

[12]We also explore how our results change if these two countries are classified as bank-based instead of market-based. The estimation results are not affected by this re-classification. Detailed results are available upon request.

have had an effect on the ability of countries to diversify risks (see Artis and Hoffmann, 2008a). To capture this potential effect, we include a dummy variable, D_{it}^{EMU}, which is defined as $D_{it}^{EMU} = 1$ if country i is a member of EMU at time t, and $D_{it}^{EMU} = 0$ otherwise. Table 5 shows that while our main conclusions remain unchanged, EMU membership does not appear to play a special role for risk sharing. Although EMU membership reduces the exposure to idiosyncratic output shocks, as expected, the effect is not significant at standard levels. Note that the effect of EMU membership remains insignificant once $Trend$ is dropped from (3). Thus, it appears that the general trend towards more risk sharing is similar in EMU and non-EMU countries.

Next, we replace $Trend$ with our proxy for foreign asset trade, FA_{it}, in (4), which allows us to analyze the impact of financial globalization and integration more specifically. Since the domestic financial system and foreign asset trade are likely to be closely interrelated, this extension provides a more detailed picture of how the domestic financial system and international asset trade influence international consumption risk sharing.

According to Table 6 the coefficient on the interaction term $\Delta\widetilde{y}_{it} * FA_{it}$ is negatively signed and significant at standard levels in Column (I). As expected, the degree of risk sharing achieved rises with an increase in total asset trade. However, substituting $Trend$ by FA_{it} impacts on the significance of the interaction terms involving $market_{it}$ and $syst_{it}$. Although columns (III) and (V) again indicate that an increase in $market_{it}$ and $syst_{it}$ reduces the exposure to shocks, these variables are significant only at the 15 percent significance level. This reduced significance is not entirely unexpected. It may simply mirror the fact that domestic and foreign asset trade are closely interrelated in financially integrated economies. Hence, the insignificance of the interaction terms may just indicate that the information contained in the data is insufficient to distinguish the effects of the domestic financial system on the one hand, from those of FA_{it}, on the other hand.

A way to cope with this issue is to orthogonalize FA_{it} and the financial system variables by running the following regression:[13]

$$FA_{it} = \alpha_0 + \alpha_F F_{it} + u_{it}^F, \tag{6}$$

[13]See Benassy-Quere et al. (2007) for a similar approach.

where F_{it} is either dev_{it}, $market_{it}$, $bank_{it}$ or $syst_{it}$. The estimated residual of this regression, $\hat{u}_{it}^F$, is by construction orthogonal to F_{it} and can therefore be interpreted as the extent of foreign asset trade which is not related to the financial system variable under consideration. We now substitute $\hat{u}_{it}^F$ for $Trend$ in (4). Note that although this approach helps to distinguish between the influence of the domestic financial system and the role of trade in foreign assets we assign the common variation in FA_{it} and F_{it} to F_{it}. It may therefore overstate the importance of F_{it} relative to FA_{it}. Thus, if FA_{it} still enters significantly, we may conclude that foreign asset trade is an important channel for international risk sharing which operates independently from F_{it}.

The results are displayed in Table 7. We see that dev_{it}, $market_{it}$ and $syst_{it}$ significantly reduce the exposure to idiosyncratic output growth. Equally important, the interaction with $bank_{it}$ remains insignificant (see column (III)). Thus, even after assigning the common information contained in FA_{it} and $bank_{it}$ to the latter variable, we still find that a large banking sector does not exert a significant effect on the degree of risk sharing. Rather, it appears that the banking sector and foreign asset trade represent unrelated channels for risk sharing. That is, countries with a large banking sector are still able to share risk via trade in foreign assets, but according to our results without the banking sector as an intermediary. Again, this result suggests that the banking sector plays only a limited role for the international sharing of consumption risk.

5 Summary and Concluding Remarks

In this paper we explore how characteristics of the domestic financial system determine the degree to which countries can diversify risk internationally. Although risk is shared via foreign asset trade it is ultimately the domestic financial system which drives the extent of risk sharing as the domestic financial system provides the means to trade risk across borders. In this sense, our analysis complements the literature which focuses on the role of international capital flows for international consumption risk sharing (see e.g. Imbs, 2006; Sørensen et al., 2007; Imbs and Fratscher, 2007).

We find that the overall development of the financial system does not necessarily lead to a low exposure to shocks. Only countries with developed financial markets are

able to share a larger fraction of their idiosyncratic output risk internationally. Market-based financial systems tend to be less exposed to idiosyncratic shocks, whereas countries characterized by bank-based financial systems are more exposed.

We also find that risk sharing via foreign asset holdings is largely independent of the banking sector. This result suggests that once countries open up and participate to a larger extent on international financial markets, market-based economies are likely to diversify a larger fraction of their idiosyncratic consumption risk internationally.

It has to be pointed out, however, that although developed financial markets lead to relatively high risk sharing, the overall extent of risk sharing still remains limited. Thus, even market-based countries with developed financial markets are still exposed to a substantial amount of idiosyncratic risk.

Analyzing the relationship between the domestic financial system and international risk sharing using a more detailed characterization of financial systems appears to be an interesting direction for future research. Our classification of bank-based systems based on aggregate data is frequently used in the literature, but nevertheless somewhat coarse. Using micro data may allow to compare banking sectors across countries in terms of e.g. fragmentation and competition.

Finally, we would like to point out that although the focus of this paper is on the domestic financial system, the idea that structural or institutional aspects which are primarily related to domestic issues may also matter for the international allocation of consumption risk, may apply more generally. Analyzing such issues in the context of international risk sharing appears to be another interesting avenue for future research.

References

Allen, F., Bartiloro, L., Kowalewski, O., 2007. The finanical system of the EU 25. In: Liebscher, K., Christl, J., Mooslechner, P., Ritzberger-Grunwald, D. (Eds.), Financial Development, Integration And Stability: Evidence from Central, Eastern And South-Eastern Europe. Edward Elgar.

Allen, F., Gale, D., 2000. Comparing Financial Systems. MIT Press, Cambridge, MA.

Artis, M., Hoffmann, M., 2008a. Declining home bias and the increase in international risk sharing: Lessons from european integration. In: Jonung, L., Christop, W., Watson, M. (Eds.), Building the Financial Foundations of the Euro, Experiences and challenges. Routledge, London.

Artis, M., Hoffmann, M., 2008b. Financial globalization, international business cycles and consumption risk sharing. Scandinavian Journal of Economics 110 (3), 447–471.

Asdrubali, P., Sørensen, B. E., Yosha, O., 1996. Channels of interstate risk sharing: The United States 1963-1990. Quarterly Journal of Economics 111 (4), 1081–1110.

Backus, D. K., Kehoe, P. J., Kydland, F. E., 1992. International real business cycles. Journal of Political Economy 100 (4), 745–775.

Benassy-Quere, A., Coupet, M., Mayer, T., 2007. Institutional determinants of foreign direct investment. The World Economy 30 (5), 764–782.

Boot, A. W. A., 2000. Relationship banking: What do we know? Journal of Financial Intermediation 9 (1), 7–25.

Buch, C. M., DeLong, G., 2004. Cross-border bank mergers: What lures the rare animal? Journal of Banking & Finance 28 (9), 2077–2102.

Demirguc-Kunt, A., Levine, R., 2001. Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development. MIT Press, Cambridge, MA.

Demirguc-Kunt, A., Maksimovic, V., 1998. Law, finance, and firm growth. Journal of Finance 53 (6), 2107–2137.

Demyanyk, Y., Ostergaard, C., Sørensen, B. E., 2007. U.S. banking deregulation, small businesses, and interstate insurance of personal income. Journal of Finance 62 (6), 2763–2801.

Heston, A., Summers, R., Aten, B., 2006. Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Hoffmann, M., Nitschka, T., 2008. Securitization of mortgage debt, asset prices and international risk sharing. IEW - Working Paper 376, Institute for Empirical Research in Economics - IEW.

Hoffmann, M., Shcherbakova-Stewen, I., 2010. Consumption risk sharing over the business cycle: the role of small firms' access to credit markets. Review of Economics and Statistics, forthcoming.

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

Imbs, J., Fratscher, M., 2007. Risk sharing, finance and institutions in international portfolios. Discussion Paper 6496, CEPR.

La Porta, R., de Silanes, F. L., Shleifer, A., Vishny, R. W., 1997. Legal determinants of external finance. Journal of Finance 52 (3), 1131–50.

Lane, P. R., Milesi-Ferretti, G. M., 2006. The external wealth of nations mark ii: Revised and extended estimates of foreign assets and liabilities, 1970 - 2004. IMF Working Paper 06/69, IMF.

Lewis, K., 1999. Trying to explain home bias in equities and consumption. Journal of Economic Literature XXXVII, 571–608.

Obstfeld, M., 1994. Are industrial-country consumption risks globally diversified? In: Leiderman, L., Razin, A. (Eds.), Capital mobility: the impact on consumption, investment and growth. Cambridge University Press, Cambridge.

Obstfeld, M., 2004. External adjustment. Review of World Economics 140 (6), 541–568.

Obstfeld, M., Rogoff, K., 1996. Foundations of International Macroeconomics. MIT Press.

Obstfeld, M., Rogoff, K., 2000. The six major puzzles in international macroeconomics. In: Bernanke, B. S., Rogoff, K. (Eds.), NBER Macroeconomic Annual 2000. MIT Press, Cambridge, Massachusetts.

Sørensen, B. E., Wu, Y.-T., Yosha, O., Zhu, Y., 2007. Home bias and international risk sharing: Twin puzzles separated at birth. Journal of International Money and Finance 26 (4), 587–605.

Vazquez, F. F., Garcia-Herrero, A., 2007. International diversification gains and home bias in banking. IMF Working Papers 07/281, International Monetary Fund.

Table 1: Descriptive Statistics

		Mean	Std. Dev.	Min	Max	Obs
$\Delta\widetilde{c}_{it}$	overall	-0.002	0.019	-0.080	0.056	368
	between		0.007	-0.012	0.018	
	within		0.018	-0.074	0.061	
$\Delta\widetilde{y}_{it}$	overall	0.002	0.020	-0.091	0.072	368
	between		0.010	-0.011	0.038	
	within		0.018	-0.086	0.055	
$market_{it}$	overall	0.000	0.782	-2.202	1.833	357
	between		0.608	-1.334	1.034	
	within		0.496	-1.484	1.695	
$bank_{it}$	overall	0.000	0.389	-0.890	0.698	375
	between		0.326	-0.731	0.654	
	within		0.220	-0.558	0.919	
$syst_{it}$	overall	0.000	0.808	-2.449	2.118	342
	between		0.660	-1.631	1.416	
	within		0.480	-1.781	1.799	
dev_{it}	overall	0.000	0.389	-0.987	1.139	342
	between		0.294	-0.408	0.756	
	within		0.258	-0.739	0.836	
FA_{it}	overall	0.000	0.854	-1.339	4.557	379
	between		1.074	-0.729	4.408	
	within		0.431	-1.158	1.252	

Table 2: Correlation Matrix of the Explanatory Variables

	$\Delta\widetilde{y}_{it}$	$market_{it}$	$bank_{it}$	$syst_{it}$	dev_{it}	FA_{it}
$\Delta\widetilde{y}_{it}$	1.000					
$market_{it}$	0.175	1.000				
$bank_{it}$	-0.092	0.157	1.000			
$syst_{it}$	0.214	0.887	-0.318	1.000		
dev_{it}	0.071	0.807	0.663	0.465	1.000	
FA_{it}	0.166	0.540	0.419	0.321	0.614	1.000

Table 3: Domestic Financial System and Risk Sharing

	(I)	(II)	(III)	(IV)	(V)
$\Delta\widetilde{y}_{it}$	0.653***	0.649***	0.651***	0.653***	0.649***
	(0.049)	(0.050)	(0.050)	(0.050)	(0.048)
$\Delta\widetilde{y}_{it} * dev_{it}$		-0.190			
		(0.134)			
$\Delta\widetilde{y}_{it} * market_{it}$			-0.124**		
			(0.061)		
$\Delta\widetilde{y}_{it} * bank_{it}$				0.014	
				(0.175)	
$\Delta\widetilde{y}_{it} * syst_{it}$					-0.126**
					(0.057)
$\Delta\widetilde{y}_{it} * Trend$	-0.021**	-0.016	-0.015	-0.019*	-0.016*
	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)
N	368	340	355	353	340

Notes: The endogenous variable is $\Delta\widetilde{c}_{it}$; All specifications include country-fixed effects and $Trend$ as well as either dev_{it}, $market_{it}$, $bank_{it}$ or $syst_{it}$ as additional (not interacted) regressors; Newey-West-HAC-robust standard errors in parenthesis; *** / ** / * = significant at 1 / 5 / 10 percent significance level.

Table 4: Risk Sharing with Grouped Countries

	(I)	(II)	(III)	(IV)	(V)	(VI)
$\Delta\widetilde{y}_{it} * D_i^{dev}$	0.649***					
	(0.111)					
$\Delta\widetilde{y}_{it} * (1 - D_i^{dev})$	0.655***					
	(0.055)					
$\Delta\widetilde{y}_{it} * D_i^{market}$		0.559***				
		(0.072)				
$\Delta\widetilde{y}_{it} * (1 - D_i^{market})$		0.743***				
		(0.071)				
$\Delta\widetilde{y}_{it} * D_i^{bank}$			0.631***			
			(0.068)			
$\Delta\widetilde{y}_{it} * (1 - D_i^{bank})$			0.670***			
			(0.076)			
$\Delta\widetilde{y}_{it} * D_i^{syst}$				0.567***	0.495***	
				(0.078)	(0.072)	
$\Delta\widetilde{y}_{it} * (1 - D_i^{syst})$				0.740***	0.740**	
				(0.070)	(0.056)	
$\Delta\widetilde{y}_{it} * D_i^{com}$						0.521***
						(0.062)
$\Delta\widetilde{y}_{it} * (1 - D_i^{com})$						0.698***
						(0.064)
$\Delta\widetilde{y}_{it} * Trend_1^F$	-0.021	-0.026*	-0.014	-0.029**	-0.038***	-0.012
			(0.013)	(0.013)	(0.013)	(0.014)
$\Delta\widetilde{y}_{it} * Trend_2^F$	-0.021*	-0.022	-0.030*	-0.021	-0.014	-0.025*
	(0.013)	(0.015)	(0.018)	(0.015)	(0.012)	(0.014)
N	368	368	368	368	368	368
$p(\beta_{1F} = \beta_{2F})$	0.96	0.068	0.714	0.089	0.014	0.049

Notes: The endogenous variable is $\Delta\widetilde{c}_{it}$; All specifications include country-fixed effects as well as $Trend$ as additional (not interacted) regressors; $Trend_1^F$ is a group-specific trend for countries with an above cross-country average value of the financial variable or a common law tradition; $Trend_2^F$ is a group-specific trend for countries with a below cross-country average value of the financial variable or a civil law tradition; Newey-West-HAC-robust standard errors in parenthesis; *** / ** / * = significant at 1 / 5 / 10 percent significance level; 1 = country with an above cross-country average value of the financial system variable ; 2 = country with a below cross-country average value of the financial system variable; The last line shows the p-value for the null hypothesis that the coefficients are equal in the two groups of countries.

Table 5: Domestic Financial System and Risk Sharing; Controlling for EMU Membership

	(I)	(II)	(III)	(IV)	(V)
$\Delta\widetilde{y}_{it}$	0.660***	0.650***	0.655***	0.652***	0.648***
	(0.056)	(0.058)	(0.056)	(0.058)	(0.055)
$\Delta\widetilde{y}_{it} * dev_{it}$		-0.188			
		(0.133)			
$\Delta\widetilde{y}_{it} * market_{it}$			-0.129**		
			(0.060)		
$\Delta\widetilde{y}_{it} * bank_{it}$				0.046	
				(0.179)	
$\Delta\widetilde{y}_{it} * syst_{it}$					-0.135**
					(0.057)
$\Delta\widetilde{y}_{it} * EMU_{it}$	-0.032	-0.008	-0.070	0.046	-0.047
	(0.148)	(0.121)	(0.130)	(0.179)	(0.114)
$\Delta\widetilde{y}_{it} * Trend$	-0.017	-0.014	-0.010	-0.017	-0.012
	(0.013)	(0.013)	(0.012)	(0.013)	(0.012)
N	368	340	355	353	340

Notes: The endogenous variable is $\Delta\widetilde{c}_{it}$; All specifications include country-fixed effects, an EMU-dummy, $Trend$ as well as either dev_{it}, $market_{it}$, $bank_{it}$ or $syst_{it}$ as additional (not interacted) regressors; Newey-West-HAC-robust standard errors in parenthesis; *** / ** / * = significant at 1 / 5 / 10 percent significance level; if $Trend$ is dropped from (3), interaction term with D_{it}^{EMU} remains insignificant.

Table 6: Risk Sharing with Foreign Asset Position

	(I)	(II)	(III)	(IV)	(V)
$\Delta\widetilde{y}_{it}$	0.667***	0.650***	0.660***	0.658***	0.646***
	(0.044)	(0.046)	(0.045)	(0.047)	(0.045)
$\Delta\widetilde{y}_{it} * dev_{it}$		-0.163			
		(0.151)			
$\Delta\widetilde{y}_{it} * market_{it}$			-0.106		
			(0.069)		
$\Delta\widetilde{y}_{it} * bank_{it}$				0.049	
				(0.164)	
$\Delta\widetilde{y}_{it} * syst_{it}$					-0.096
					(0.062)
$\Delta\widetilde{y}_{it} * FA_{it}$	-0.135***	-0.082	-0.068	-0.143***	-0.088*
	(0.046)	(0.059)	(0.058)	(0.044)	(0.049)
N	357	333	344	346	333

Notes: The endogenous variable is $\Delta\widetilde{c}_{it}$; All specifications include country-fixed effects, FA_{it} and either dev_{it}, $market_{it}$, $bank_{it}$ or $syst_{it}$ as additional (not interacted) regressors; Newey-West-HAC-robust standard errors in parenthesis; *** / ** / * = significant at 1 / 5 / 10 percent significance level.

Table 7: Orthogonalization of F_{it} and FA_{it}

	(I)	(II)	(III)	(IV)
$\Delta\widetilde{y}_{it}$	0.645***	0.660***	0.653***	0.641***
	(0.050)	(0.047)	(0.047)	(0.050)
$\Delta\widetilde{y}_{it} * dev_{it}$	-0.276**			
	(0.123)			
$\Delta\widetilde{y}_{it} * market_{it}$		-0.147**		
		(0.065)		
$\Delta\widetilde{y}_{it} * bank_{it}$			-0.083	
			(0.156)	
$\Delta\widetilde{y}_{it} * syst_{it}$				-0.127**
				(0.063)
$\Delta\widetilde{y}_{it} * \hat{u}^F_{it}$	-0.082	-0.068	-0.143**	-0.088
	(0.067)	(0.062)	(0.057)	(0.054)
N	333	344	346	333

Notes: The endogenous variable is $\Delta\widetilde{c}_{it}$; All specifications include country-fixed effects, $\hat{u}^F_{it}$ and either dev_{it}, $market_{it}$, $bank_{it}$ or $syst_{it}$ as additional (not interacted) regressors; *** / ** / * = significant at 1 / 5 / 10 percent significance level. As $\hat{u}^F_{it}$ is a generated regressor, bootstrapped standard errors are shown (a non-parametric bootstrap over countries with 1000 replications is performed).