RISK SHARING, FINANCE AND INSTITUTIONS IN INTERNATIONAL PORTFOLIOS

by Marcel Fratzscher
and Jean Imbs

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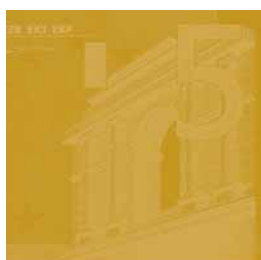
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Abstract

We show that international consumption risk sharing is significantly improved by capital flows, especially portfolio investment. Concomitantly, we show that poor institutions hamper risk sharing, but to an extent that decreases with openness. In particular, risk sharing is prevalent even among economies with poor institutions, provided they are open to international markets. This is consistent with the view that the prospect of retaliation may deter expropriation of foreign capital, even in institutional environments where it is possible. This deterrent is anticipated by investors, who act to diversify risk. By contrast, capital flows headed for closed economies with poor institutions are designed and constrained so as to limit the cost incurred in case of expropriation, and thus achieve little risk sharing. Finally, we show this non-linearity continues to be present in the determinants of international capital flows themselves. Institutions are crucial in attracting capital for closed economies, but are barely relevant in open ones.

Non-technical summary

Where do individuals choose to hold capital? Using what class of assets? What does their strategy achieve? Typical answers almost unanimously show that the international allocation of capital depends on the institutional and regulatory context, and observed investment does not seem to achieve much by way of diversification. The extent of international risk sharing appears to remain minimal, and, according to Karen Lewis (1999), largely driven by de jure restrictions to international capital flows. In this paper we argue that these conclusions, while true, obscure empirical regularities implying *conditional* relations between the regulatory environment, institutions, effectively observed international investment and the extent of risk sharing.

We stress three results. First, the extent of consumption risk sharing is directly related to the intensity and composition of international capital flows. More cross-holdings of capital - especially portfolio investment - tend to be associated with more insurance. Second, international risk sharing is present even in countries that are categorized as having poor institutions, a priori deterrent of international capital, such as poor property rights or limited contract enforceability. A substantial amount of income insurance can be achieved provided these countries are open to international markets. Closed economies tend to experience less risk sharing, but it is only when this is complemented by poor institutions that measured income insurance drops significantly. Third, the response of capital flows themselves to the institutional environment displays similar non-linearities. Institutions affect international capital flows but in a manner that significantly depends on the extent of openness.

How does risk sharing continue to be possible within closed *or*, say, corrupt economies? We find empirically that it is only in closed *and* corrupt economies that no asset remains available to reliably contract international income insurance. Good institutions or liberalized markets are each sufficient for there to be (at least) one asset available to international investors seeking to diversify risk. We offer an explanation that accounts for the diversity in empirical conclusions, and rehabilitates all assets as potential vectors of risk sharing, on an equal footing with alternative asset classes - provided the right environment is present. We argue that alienability is endogenous to the possibility of retaliation: economies that are open to international markets expose themselves to dynamic retaliation if they choose to expropriate foreign capital. Closed economies, in contrast, benefit from relative impunity, though of course that does not come without other static costs. In open economies therefore, the expropriation risk that plagues foreign capital is muted, even if institutions are poor: international investment may become a vector for international diversification on par with other assets. In closed economies, on the other hand, the sensitivity of investment to the institutional environment (one way or the other) is

particularly prevalent and international investment patterns are governed by concerns that are orthogonal to international diversification motives.

The paper brings to bear an exhaustive dataset with information on bilateral asset holdings between up to 42 economies. We break total bilateral holdings down into three main components, portfolio investment, direct investment, and bank loans. These data open the door to three refinements relative to the existing literature on international finance and risk sharing. First, we are able to control for some of the push and pull effects known to affect international investment, as we include fixed source and random destination intercepts. Second, we are able to decompose bilateral holdings into their components, which may all respond differently to the institutional environment, and enable international risk sharing to a varying extent. Third, we extend the classical analysis of risk sharing due to Lewis (1996, 1997). Like her, we measure the extent of income insurance by the responsiveness of local consumption to idiosyncratic local output shocks. But unlike her we condition our estimations on de facto measures of capital intensity, as well as its composition, and thus pinpoint what type of capital appears to be responsible for risk sharing. Further, we extend her multi-lateral approach to a bilateral context.

1 Introduction

Where do individuals choose to hold capital? Using what class of assets? What does their strategy achieve? Typical answers almost unanimously show that the international allocation of capital depends on the institutional and regulatory context, and observed investment does not seem to achieve much by way of diversification. The extent of international risk sharing appears to remain minimal, and, according to Karen Lewis (1999), largely driven by de jure restrictions to international capital flows. In this paper we argue that these conclusions, while true, obscure empirical regularities implying *conditional* relations between the regulatory environment, institutions, effectively observed international investment and the extent of risk sharing.

We stress three results. First, the extent of consumption risk sharing is directly related to the intensity and composition of international capital flows. More cross-holdings of capital - especially portfolio investment - tend to be associated with more insurance. Second, international risk sharing is present even in countries that are categorized as having poor institutions, a priori deterrent of international capital, such as poor property rights or limited contract enforceability. A substantial amount of income insurance can be achieved provided these countries are open to international markets.[1] Closed economies tend to experience less risk sharing, but it is only when this is complemented by poor institutions that measured income insurance drops significantly. Third, the response of capital flows themselves to the institutional environment displays similar non-linearities. Institutions affect international capital flows but in a manner that significantly depends on the extent of openness.

In short, international investment patterns do correspond to a risk sharing motive, which obtains even in the presence of poor institutions provided the destination country is open. This is because the international allocation of capital features the same non-linearity: poor institutions deter capital flows, but the effect is muted if the borrowing economy is open. If it is not, the international allocation of investment (and especially foreign direct investment (FDI)) becomes dominated by other motives than simple diversification, e.g. preparing for or avoiding expropriation.

How does risk sharing continue to be possible within closed *or*, say, corrupt economies? We argue it is only in closed *and* corrupt economies that no asset remains available to reliably contract international income insurance. Good institutions or liberalized markets are each sufficient for there to be (at least)

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[1] This paper takes consumption risk sharing, income insurance and risk diversification as synonymous. We focus on short term risk, rather than long term differences in marginal returns to capital. Further, we discuss international opportunities to diversify uncertainty, rather than self insurance or the importance of potential credit constraints.

one asset available to international investors seeking to diversify risk. The intuition is straightforward. It is well known that economies with poor property rights, limited contract enforceability or more generally poor institutions receive on the whole less foreign capital. It is however intensely debated how (and whether) the composition of incoming capital across different asset classes is affected, if at all. The bone of contention rests on whether some classes of investment are more easily expropriable than others. Foreign Direct Investment (FDI) is particularly relevant to the question. At one end of the spectrum, FDI is construed to be more likely to be confiscated by rogue governments, because unlike equity or even bank loans, installed physical assets can readily be claimed by local authorities. FDI is then especially inappropriate as a vector of investment to countries with poor institutions. At the other end of the spectrum, the value of FDI is argued to actually reside in the know-how versed into it, but that will vanish in case of expropriation. In this case, FDI is especially attractive when considering investment to economies with poor institutions. Albuquerque (2003) and Daude and Fratzscher (forthcoming) offer supportive evidence of the latter, whereas Wei (2006, 2000) and Faria and Mauro (2004) present supportive evidence of the former.

In either case, FDI is a special kind of asset, one for which risk sharing motives may well be dominated by other concerns, e.g. hands-on control or expropriation. We offer an explanation that accounts for the diversity in empirical conclusions, and rehabilitates all assets as potential vectors of risk sharing, on an equal footing with alternative asset classes - provided the right environment is there. We argue that alienability is endogenous to the possibility of retaliation: economies that are open to international markets expose themselves to dynamic retaliation if they choose to expropriate foreign capital. Closed economies, in contrast, benefit from relative impunity, though of course that does not come without other static costs. In open economies therefore, the expropriation risk that plagues foreign capital is muted, even if institutions are poor: international investment may become a vector for international diversification on par with other assets. In closed economies, on the other hand, the sensitivity of investment to the institutional environment (one way or the other) is particularly prevalent and international investment patterns are governed by concerns that are orthogonal to international diversification motives.

In our empirical analysis, we find that limited enforceability of contracts, repudiation risk or corruption all act to lower capital inflows. This holds across all asset classes we observe, namely the stocks of portfolio investment, FDI, and bank loans. But these effects are significantly different depending on whether the borrowing economy is open or not: they are muted in open economies, indeed to the extent that institutions barely have any significant overall effect. This supports the hypothesis that poor institutions deter incoming investment in general, but to an extent that is mitigated in open economies, where presumably the confiscation of foreign capital is more costly.

The existence of these non-linearities suggests that expropriation, say, is particularly costly - and thus effectively seldom implemented - in open economies. This finding is consistent with Ju and Wei (2006), who propose a model in which agents circumvent poor institutions by triggering capital outflows through some form, such as portfolio investment, but capital inflows in other forms, such as FDI. The argument is also in line with the work of Gourinchas and Jeanne (2006), who show that openness can function as a disciplining device on a country's institutional quality. The finding also implies that sampling is crucial from an empirical standpoint. A dataset focused on open or closed economies is likely to yield estimates at opposite ends of the spectrum, because the putative alienability of direct investment is endogenous to and conditioned by openness to international markets.[2]

The paper brings to bear an exhaustive dataset with information on bilateral asset holdings between up to 42 economies, listed in the Appendix. We break total bilateral holdings down into three main components, portfolio, direct investment, and bank loans. These data open the door to three refinements relative to the existing literature on international finance and risk sharing. First, we are able to control for some of the push and pull effects known to affect international investment, as we include fixed source and random destination intercepts.[3] Second, we are able to decompose bilateral holdings into their components, which may all respond differently to the institutional environment, and enable international risk sharing to a varying extent.

Third, we extend the classical analysis of risk sharing due to Lewis (1996, 1997). Like her, we measure the extent of income insurance by the responsiveness of local consumption to idiosyncratic local output shocks. But unlike her we condition our estimations on de facto measures of capital intensity, as well as its composition, and thus pinpoint what type of capital appears to be responsible for risk sharing. Further, we extend her multi-lateral approach to a bilateral context. Under full risk sharing, pairwise international differences in consumption should be unrelated to pairwise international differences in output. But it is possible that consumption plans be identical between two countries even though no risk sharing occurs bilaterally, but rather via a third party. We introduce an estimation strategy that implies zero risk sharing in case there is no incentive to trade bilaterally, i.e. in case fluctuations in output are perfectly synchronized. The estimation entails that bilateral risk sharing is characterized by perfectly correlated consumption plans but imperfectly correlated fluctuations in output.[4] We use the approach to verify

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[2] And indeed, Albuquerque (2003) focuses on countries where credit ratings are available, which may not be irrelevant to the link between FDI and corruption he seeks to evaluate. Our purpose here is not to settle the question of the end effects of, say, corruption on FDI, a question tackled upfront in Daude and Fratzscher (forthcoming). Rather, we seek to establish the endogeneity of foreign capital alienability to openness, via appropriately specified non-linearities.

[3] See Lane and Milesi-Ferretti (2004) for a seminal description of push and pull effects in international capital flows.

[4] The approach was first used in Imbs (2005).

whether bilateral asset holdings affect the measured extent of risk sharing, and through which types of capital.

The paper is organized as follows. The next section introduces our data, and reviews the relevant literature. Section 3 presents our methodology to assess (bilateral and multilateral) consumption risk sharing, and discusses the results implied by our data. We investigate the link between risk sharing and international capital flows on the one hand, and between risk sharing and the institutional environment on the other hand. In section 4 , we focus on the remaining question of a link between capital flows and institutions. We show that, just as the extent of risk sharing, the allocation of international investment depends on both institutions and the degree of openness. Section 5 discusses some endogeneity issues and section 6 concludes.

2 Data and Related Literature

We now introduce our data and briefly discuss the related literature.

2.1 Data

We build a comprehensive database of bilateral capital stock holdings across a broad set of mature and emerging market economies. We inform all three categories of the capital account - FDI, portfolio investment, and bank loans. The data pertaining to FDI stem from information released by UNCTAD, and detail bilateral FDI flows and stocks between large sets of both industrialized and developing countries. The data are annual from 1980, in US dollars, and cover capital held by about 90 reporting countries in virtually the complete universe of destinations. We omit missing observations, and in particular exclude country pairs without observations over the past ten years.[5]

Data on global equity and bond holdings are taken from the IMF's Coordinated Portfolio Investment Survey (CPIS) for the years 2001, 2002 and 2003. CPIS provides information about foreign portfolio investment for around 70 reporting countries. Portfolio investment is broken down between equity and debt, with information on the residence of the issuer and the destination of the investment.

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[5] These data are not without problem. For instance, some of the FDI flows reported by UNCTAD are effectively the result of interpolation exercises combined with a fitted gravity model. We alleviate these concerns by focusing on a cross-section of OECD lending economies, and using stock rather than flow information. In addition, these are the data also used as a basis for the construction of Net Foreign Wealth by the seminal work by Lane and Milesi-Ferretti (2001, 2006).

CPIS data are not perfect. For instance, they do not provide a currency breakdown of bilateral investments, nor do they identify domestic security holdings. As with any unique data source, it is impossible to ascertain whether low values reflect reality or merely reporting omissions: there is nothing to compare these data with. This is particularly problematic for emerging markets or developing economies. But CPIS is simply the most comprehensive and indeed unique survey of bilateral portfolio investment holdings there is.

Information on bank loans are taken from the International Locational Banking Statistics (ILB) database constructed by the Bank of International Settlement (BIS). The data comprise an aggregate of the assets and liabilities of all banks in 32 reporting countries, vis-à-vis borrowing and lending institutions in more than 100 partner countries. Assets and liabilities capture mostly loans and deposits, but may also include other transactions that fall under portfolio or direct investment. To minimize this overlap, we focus on inter-bank claims only, that is on the assets and liabilities pertaining to investments between banks only. The number of reporting countries is smallest in these database. We make use of the availability of both assets and liabilities data to partly make up for this limitation, and use liability information in reporting countries to approximate (bank) assets held in non-reporting countries.

Data collection is generally based on the residence principle, which may imply that countries report asset holdings in their direct counterpart, but not in the country where the asset is ultimately invested. This will give enormous predominance to financial centers, but not reflect true bilateral holdings. Like most of the literature making use of these data, we therefore exclude financial hubs.[6]

Even though data definitions are the same across all sources, our combining data from such different origins raises the question of their compatibility. We note that most of the results in this paper in fact do not combine data sources; it is only when computing portfolio *shares* that merging becomes necessary. We focus on a cross-section of bilateral capital holdings, measured as an average over 1999-2003. This is likely to help smooth out yearly fluctuations in international capital holdings, and in particular high frequency fluctuations due to valuation changes. This is undoubtedly a limitation of our approach, but data availability prevents any alternative. We have complete information covering all bilateral holdings between 42 rich and emerging economies. They are listed in Appendix A.[7]

Consumption and output fluctuations are measured using the Baxter-King filter to extract the cycli-

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[6]See for instance Lane and Milesi-Ferretti (2004).

[7]We observe positive cross-border holdings for most country pairs, though a minority effectively appear to be zero. Given the small number of zero entries, we maintain a linear approach. Taking censoring into account does not change our conclusions

cal component of yearly series measured between 1961 and 2003. The data is taken from the World Development Report issued by the World Bank.

We use a broad set of indicators for the institutional quality of countries, focusing in particular on those measures proxying repudiation and corruption. We draw from the World Bank's Doing Business database, information put together by Transparency International and the International Country Risk Guide (ICRG), and the indexes constructed by La Porta et al. (1998). Appendix B lists our variables and their definitions. In Figure 1, we present a few scatterplots illustrating the relations between institution quality, effective capital stock holdings (as a proportion of GDP), and the extent of risk sharing which is discussed in details in Section 3. We seek to establish the existence of robust (unconditional) positive relations between institution quality and capital linkages on the one hand, and between institutions and income insurance on the other. Figure 1 suggests these hold unconditionally; most importantly, the relations are not driven by a few outliers.

2.2 Related Literature

This paper lies on the intersection between two strands of the literature on capital flows. First, we contribute to the discussion on the role of institutions in affecting international capital flows. Second, we take part in the research effort seeking to quantify the extent of international consumption risk sharing in the data, and whether it relates to financial asset trade.

There is a broad consensus that poor institutions reduce the size of capital flows.[8] But it remains hotly debated how institutions affect the composition of cross-border investment. On the one hand, several recent studies have linked poor institutions to FDI. Albuquerque (2003) reasons that direct investment is hardest to expropriate, because it contains more intangible assets whose value would vanish with confiscation. It should therefore be a privileged vector of investment in economies likely to expropriate foreign investment. He uses the argument to explain why FDI is directed in particular at developing economies, and presents some evidence that countries with low credit ratings tend to be recipients of larger FDI flows. In support of Albuquerque's argument, Hausmann and Fernandez-Arias (2000) confirm that a higher share of FDI seems to go to poorer countries and often ones with weaker institutions. Along

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[8]For instance, Kho, Stulz and Warnock (2006) show that poor institutions and governance in host countries increase the home bias vis-à-vis these countries. Related evidence is presented in Fidora, Fratzscher and Thimann (2007). Ju and Wei (2006) present a theory that can account for gross capital flows, and provide some evidence that outflows of financial capital are often paired with inflows of foreign direct investment, in ways that depend on the institutional and regulatory environments.

the same lines, Daude and Fratzscher (forthcoming) use information on FDI, portfolio investment and loans to find that countries with poor institutions are mostly recipient of FDI. The relevant institutions appear to be high expropriation risk, poor enforcement of contracts and rampant corruption.

On the other hand, FDI is sometimes argued to be most likely to be confiscated by local authorities because of its physical nature. As a result, FDI would become less attractive as a vehicle of investment in countries with poor institutions. Wei (2000, 2006), Faria and Mauro (2004), and Faria et al. (2006) provide empirical support for this argument. For instance, Wei (2000) finds that corruption affects FDI most, but more weakly once controls for government attitudes towards FDI are included. Faria and Mauro (2004) show that good institutions attract FDI, and may thereby reduce the likelihood of financial crises among developing countries. Kraay et al. (2005) argue that FDI is harder to repossess than loans in the event of a default and hence developing countries choose bank loans rather than FDI. According to this argument, it is sovereign risk that explains the prevalence of loans in developing economies' portfolios.

A closely related literature focuses on the link between the composition of capital flows, information asymmetries and transaction costs. Razin, Sadka and Yuen (1998) argue that FDI is the preferred form of financing in the presence of information frictions because it provides hands-on control on the investment, thus alleviating imperfect information. With the additional hypothesis that FDI entails a fixed cost, Goldstein and Razin (2005) show that countries with lower information asymmetries (and better institutions) receive more portfolio investment and relatively less FDI. Portes, Rey and Oh (2001) and Portes and rey (2005) find that information frictions matter less for standardized financial assets such as treasury bonds, than for information-intensive equity or corporate bonds. They relate their findings to the financial gravity model developed in Martin and Rey (2004) or Coeurdacier and Martin (2006).

There is overwhelming evidence against international consumption risk sharing. Backus, Kehoe and Kydland (1994) famously coined the low values of international consumption correlations a "quantity puzzle", spurring an enormous literature. Lewis (1999) proposed two main explanations for the lack of consumption risk sharing in the data, which she related to the home bias in asset holdings. She pointed to the importance of separability of preferences between traded and non-traded goods and barriers to free-flowing international capital. Once both were controlled, she found significant evidence supporting income insurance. A burgeoning literature, pioneered by Asdrubali et al (1996) has extended Lewis's approach to investigate the magnitude and determinants of consumption risk sharing, not unlike what is proposed in this paper. For instance, Kalemli-Ozcan et al (2001, 2003) have related consumption insurance and the specialization of production across U.S States and countries.[9]

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[9]See also Tesar (1993), Stockman and Tesar (1995), Ravn (2001) and more recently Artis and Hoffmann (2004).

In this paper, we bridge both literatures. We do not directly evaluate the effects of institutions on capital flows, nor indeed do we quantify precisely the extent of international risk sharing.[10] Rather, we analyze and show how both are related. Institutions affect capital flows, and they affect the extent of risk sharing. We do not seek to establish the absolute level of income insurance in the data. Rather, we pinpoint the determinants of its cross-section; and institutions are one of them.

3 Risk Sharing

What does cross-border investment achieve in terms of risk sharing? In this section, we discuss how we measure the extent of consumption insurance. Our approach finds inspiration from Karen Lewis's insight that income insurance unhinges consumption from output. We first introduce and motivate our estimations for the standard, multilateral definition of risk sharing, and then move towards discussing our bilateral approach and its implications.

3.1 Multilateral risk sharing

In a panel of countries i, Lewis (1996) estimates

$$c_{it} = \alpha_t + \beta \, y_{it} + \varepsilon_{it} \tag{1}$$

where c_{it} and y_{it} denote the cyclical components of consumption and output, respectively, in country i at time t. The time specific intercept α_t ensures the estimation focuses on the idiosyncratic component of output which, under perfect risk sharing, should be uncorrelated with consumption, so that $\beta = 0$. We call this a test for "multilateral" risk sharing because its findings say nothing about which partner a particular economy shares risk with. Lewis obtains significant and large estimates of β in her sample of 72 countries, and in each G7 economy taken in isolation, indicating a low degree of risk sharing. Once she controls for legal restrictions to capital flows (as well as consumption in non-traded goods), β becomes insignificant. Thus, an important reason why risk sharing is hardly apparent in the data appears to be the existence of de jure impediments to the international flow of capital.

Volosovych (2006) provides evidence that an index of investor protection is a leading determinant of the estimated amount of risk sharing.

[10] The interested reader may refer to the exhaustive analysis developed in Kose et al (2007), the evidence proposed in Bekaert et al (2006), or the survey by Kose et al (2006).

Estimates of equation (1) do not provide any information through what channels risk sharing obtains. Our first contribution is to extend Lewis's results in that direction. We perform estimations of equation (1) allowing for the possibility that β depends on financial integration. In particular, we estimate

$$c_{it} = \alpha_t + \beta_1 \, y_{it} + \beta_2 \, y_{it}.\phi_i + \varepsilon_{it}$$

where ϕ_i denotes a (de jure or de facto) measure of financial openness in country i. Estimates of β_2 capture the extent to which risk sharing is affected by financial integration. We first measure ϕ_i with the total value of capital held abroad relative to domestic GDP; second, we decompose them into the three types of financial assets we observe, portfolio investment, FDI, and bank loans. We also reproduce Lewis's approach using standard de jure measures of financial openness, focusing in particular on those compiled by Kaminsky and Schmukler (2003) for coverage reasons.

Table 1 shows our findings based on augmenting equation (1) with an interaction term in a sample of 42 source economies. The estimation does not make use of the bilateral dimension of our data, and aggregates up asset holdings across host countries. We focus on a panel of lending countries where we observe the sum of all gross foreign capital holdings, and how it decomposes in its various components.[11] We use two approaches to investigate the importance of portfolio composition. First, we normalize holdings of FDI, portfolio investment or bank loans by GDP in the source country, i.e.

$$\phi_i = \frac{k_i}{GDP_i}$$

where $k = \{fdi, pi, loans\}$ (the "holdings" measures). Second, we compute the shares of each asset into overall capital, i.e.

$$\%\phi_i = \frac{k_i}{fdi_i + pi_i + loans_i}$$

where $k = \{fdi, pi, loans\}$ (the "share" measures). Both capture the importance of a given asset type in countries' international investment; the former normalizes foreign holdings by the size of the investing economy, whereas the latter focuses directly on portfolio composition, and is thus scale independent. Observations on "holdings" are computed from one data source only, and thus do not conflate putative measurement errors arising from one dataset or the other.

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[11] All our measures of international investment are time-invariant, for reasons of data availability. We compute averages over 1999-2003, the longest period with consistent information, in the hope that a five-year average will help smooth short run fluctuations arising for instance from valuations issues, and extract instead the cross-section we are interested in. There is simply no way in which we could observe a similar cross-section as of the beginning of the period over which risk sharing is analyzed, so we simply rely on the extreme persistence in international investment patterns. See for instance Portes and Rey (2005) or Lane and Milesi-Ferretti (2004).

Table 1 suggests that income insurance is imperfect among the 42 countries forming our sample; estimates of β are positive and significant on the basis of the whole sample. But as in Lewis (1996), conditioning on the degree of financial openness has a direct impact on β, which is not different from zero in a panel of countries that are open. In contrast, consumption risk sharing is estimated to be virtually non existent in the sample of closed economies, with an estimate of β indistinguishable from unity.[12] These confirm Karen Lewis's conclusions in our sample, and they continue to hold once effective capital holdings are introduced to capture financial integration.[13] This vindicates the possibility that Lewis's findings indeed obtained because financially open economies invest more abroad, for the purpose of diversifying risk.

But it remains silent as to which class of asset achieves such diversification. The last six columns in Table 1 answer this question. Both "holdings" and "shares" measures imply the same striking conclusion as regards the special status of portfolio investment. The table indicates that risk sharing is higher (β_2 is negative) when there are larger holdings of any of the three types of capital. However, the results for the share variables underlines that it is in particular in countries that are integrated via portfolio investment that risk sharing is high. By contrast, large FDI shares - at a given level of cross-border holdings - are associated with lower income insurance. The estimates of β are large and significant when $\%Fdi$ are larger than their median value across countries. They are barely significant for small FDI holdings, as if it were there that income insurance were most prevalent.

When measured as a share of GDP, bank loans also seem to deliver significant risk sharing. However, similar to FDI, portfolios heavy in bank loans seem to deliver little risk sharing, as per the last panel of Table 1. This might be an artefact of the way the dependent variable is computed. $\%\phi_i$ sum to one by definition. For instance, portfolios with a large share of loans may mechanically be ones with little equity investment, and thus ones with little risk sharing as a result. The fact that countries have less risk sharing when they are financially integrated primarily via FDI or bank loans does not only stress the importance of portfolio investment as a channel for risk sharing, but also that those countries may be different with regard to other relevant factors, such as the quality of institutions. We turn to this issue in detail in the next section.

Overall, Table 1 stresses that the extent of consumption insurance is heterogeneous across countries,

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[12] These are implied by the point estimates of β_2 in the sample of countries with above-median (de jure) financial openness.

[13] To be precise, Lewis (1996) also controls for non-tradability so as to find evidence supportive of perfect income insurance. Our country coverage makes that decomposition empirically impossible. What is more, we cannot reject perfect risk sharing amongst the open economies in our sample; controlling for consumption in non-tradable goods would presumably only reinforce this conclusion.

in a way that correlates with financial openness. We reproduce Karen Lewis's seminal result, and show it is not only because of legal restrictions to capital flows that risk sharing is limited in the data. In fact, the countries that are most invested abroad are also those that achieve high - or even perfect - income insurance in some sub-samples. On the basis of a cross-section of investing economies, we find that Foreign Direct Investment has a special status amongst the classes of assets we observe. While portfolio investment is unambiguously associated with risk diversification, the opposite tends to be true of FDI. We next use the full bilateral dimension of our data to verify how our results depend on recipient countries' characteristics, which is of course impossible in a multilateral setting. Given our data sources, the cross-section of borrowing economies is by construction substantially broader than lender heterogeneity, and thus potentially more interesting.

3.2   Bilateral risk sharing

Risk sharing does not lend itself easily to pairwise analysis. Two countries engaging in bilateral risk sharing should have perfectly synchronized fluctuations in consumption. The residual uncertainty in consumption corresponds to the component of the fluctuations in local production that is common to both countries, and thus not insurable via bilateral capital flows. But perfect pairwise correlation in consumption does not necessarily mean a high degree of bilateral risk sharing. It may well happen via third countries. As a result, a direct application of equation (1) to pairwise variables is unsatisfactory.

However risk sharing is presumably motivated by those idiosyncratic fluctuations in local output that can be insured away in the partner economy. In other words, a metric for the desirability of risk sharing between two regions should decrease in the extent of co-fluctuations of output between them. Two regions with perfectly correlated consumption plans do presumably engage in risk sharing, but there will be no reason to do so with each other if output fluctuations are also perfectly correlated. Following this insight, we introduce a measure of bilateral risk sharing given by estimates of γ in

$$(y_{it} - y_{jt}) - (c_{it} - c_{jt}) = \alpha_{ij} + \gamma \ (y_{it} - y_{jt}) + \varepsilon_{ijt} \tag{2}$$

where α_{ij} denotes an intercept specific to each country pair, and y_{st} (c_{st}) denotes the cyclical components of output (consumption) in country s.

The intuition is as follows. If countries i and j choose to share risk, not with each other but solely with the rest of the world, and if they do so perfectly, then $\gamma = 0$. Indeed, then, the differential in consumption $c_{it} - c_{jt}$ is zero, but so is presumably $y_{it} - y_{jt}$ since otherwise direct bilateral risk sharing

would be desirable. But if it is bilaterally that i and j share risk, $\gamma = 1$ since then equation (2) regresses (non-zero) output growth differentials on themselves. Finally, if neither multilateral nor bilateral risk sharing occurs, the dependent variable in equation (2) is akin to noise, as consumption tracks output fluctuations in both economies. Then, $\gamma = 0$. Estimates for γ capture the extent of bilateral risk sharing, at least under the hypothesis that income insurance is motivated by the intensity of the bilateral synchronization in business cycles.

Equation (2) reflects the well known result that diversification motives imply a portfolio share that increases in the hedging possibilities conferred by a given asset. Ceteris paribus, negatively correlated fundamentals ($y_{it} - y_{jt}$ away from zero) should imply high capital cross-holdings, and consumption paths that are insured against output shocks in either economy (i.e. $c_{it} - c_{jt}$ close to zero).[14] In other words, this approach assumes the variance-covariance matrix of fundamentals is exogenous, i.e. that output co-fluctuations are not affected by investment patterns. In section 5, we invoke the results of a large literature on the determinants of business cycles synchronization to isolate the component of $y_{it} - y_{jt}$ that is arguably exogenous to financial integration.

Measurement error is a potentially damaging issue in estimating equation (2), where a bilateral dimension is of the essence.[15] Suppose data in country i is mismeasured: the corresponding error will affect all country pairs where i is involved, and thus create heteroskedasticity of a kind that standard techniques are unable to address.[16] We follow two avenues. First, we allow for clustered standard errors, along the i dimension. Second, we include country-pair fixed effects, i.e. unobserved country-specific factors. This will soak up precisely the kind of heteroskedasticity measurement error may create in equation (2).[17] Note further that no common trend needs to be included in equation (2), since the component of the fluctuations in consumption or in output that is common across countries cancels in international differences.

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[14]See for instance Lewis (2000) or Obstfeld (1992).

[15]The econometric issues raised in this paragraph are relevant more generally to any literature making use of a bilateral dimension, for instance the analysis of the determinants of business cycles correlations, or of income differences. See Spolaore and Wacziarg (2006) for details.

[16]Under specific assumptions on the nature of uncertainty, it is possible to use GMM to tackle the issue of heteroscedasticity. See Clark and van Wincoop (2001). Their approach is however not applicable to the present context.

[17]Alternatively, we included intercepts specific to each source (or host) country, and clustered the standard errors accordingly, with no changes on the end results. See Spolaore and Wacziarg (2006) for a detailed exposition of the argument. These authors also show how fixed effects will account for the presence of repeated variables in the cross-section formed by equation (2).

3.2.1 Risk Sharing and International Investment

We augment equation (2) with interaction terms akin to those discussed in the previous section, and estimate

$$(y_{it} - y_{jt}) - (c_{it} - c_{jt}) = \alpha_{ij} + \gamma_1 \ (y_{it} - y_{jt}) + \gamma_2 \ (y_{it} - y_{jt}) . \phi_{ij} + \gamma_3 \ (y_{it} - y_{jt}) . T_{ij} + \varepsilon_{ijt}$$

where ϕ_{ij} denotes a measure of bilateral capital cross-holdings. We include a control for bilateral trade T_{ij} since it is important to account for the possibility that some risk sharing be achieved via bilateral trade in goods, as implied most prominently by Cole and Obstfeld (1991). In addition, bilateral trade in goods an in assets are highly correlated, so it is important to ensure the effects we document indeed work via assets trade.[18]

To take advantage of the bilateral dimension characterizing this sample, we compute ϕ_{ij} in three ways, which all focus on the cross-section of borrowing economies. We reduce the sample of source lenders to the OECD only. Thus the bilateral approach brings the focus on the most heterogeneous dimension of data on international capital flows, i.e. the borrowing side.

First, we compute K/Y, the total stock of assets held between source country i and host country j, as a proportion of source GDP. Second, we introduce a measure of the effective allocation of capital across available destinations, and compute

$$\phi_{ij} = \frac{k_{ij}}{\sum_j k_{ij}}$$

where $k = \{fdi, pi, loans\}$. This "allocation" measure highlights the cross-section of destinations where a given type of asset is invested. We normalize bilateral holdings of a given asset class by the total investment using that same asset held in the source country. The measure underlines how heterogeneity in the characteristics of recipient economies within a given asset class affects its international allocation.

But it ignores composition issues across asset types, which is the focus of our third measure. We compute

$$\%\phi_{ij} = \frac{k_{ij}}{fdi_{ij} + pi_{ij} + loans_{ij}}$$

where $k = \{fdi, pi, loans\}$. This simply extends our "share" measure to a bilateral context. $\%\phi_{ij}$ now sheds light on how portfolio composition is affected by the characteristics of the borrowing economy. As before, $\%\phi_{ij}$ is scale independent, but might conflate measurement error present in different datasets.

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[18] Goods trade is also potentially endogenous to business cycle synchronization. We follow an enormous literature and instrument bilateral trade with standard gravity variables. See for instance Frankel and Rose (1998).

Table 2 presents the estimates of equation (2) for a variety of interaction terms. Note that γ_1 is now a direct index of risk sharing, i.e. $\gamma_1 = 1$ corresponds to full income insurance. The upper panel of Table 2 suggests that income insurance, albeit not perfect, is present between our sampled 21 investing and 53 borrowing countries. In the whole sample, the estimate of γ_1 is significantly positive, though also significantly different from one. Interestingly, risk sharing is significantly more prevalent when the total stock of asset cross-holdings is high, albeit still below unity.

The next six columns in Table 2A interact the extent of risk sharing with values of ϕ_{ij} and $\%\phi_{ij}$, for all values of k. Similar to Table 1, the conclusions depend on the specification. The "share" based interaction terms continue to confer a special status to FDI, as it appears that it is mostly amongst countries with portfolio *low* on FDI that risk sharing obtains. Portfolio investment continues to be associated with large estimates for γ. But the sample splits based on ϕ_{ij} paint a different picture. There, the countries that are the bigger recipients of OECD investment unanimously appear to achieve significant risk sharing, no matter the type of asset used. In particular, estimates of γ are always significantly larger for high values of fdi, pi and $loans$. None of these results depend on the inclusion of a measure of bilateral trade, and the possibility that insurance be achieved via goods trade rather than financial assets.

Taken together, these results suggest that the extent of risk sharing increases with the magnitude of effective investment, as can be expected. Borrowing capital in the form of FDI does not seem to hamper diversification motives any more than borrowing on equity markets or from banks. The countries that are high recipients of OECD foreign direct investment, equity investment or bank loans achieve significant risk sharing, of comparable amounts. Of course, the identities of these countries might be similar across asset classes. After all, portfolio investment, FDI and bank loans may all be headed to overlapping sets of borrowing countries.

By definition, the "share" measures $\%\phi_{ij}$ isolates different sets of borrowing countries, and thus lends itself to investigating putative differences between types of assets.[19] In both Tables 1 and 2, FDI and bank loans seem to have a special status, in that portfolios heavy in foreign direct investment achieve overall less diversification, whether from the lender or the borrower's standpoint. In particular, portfolios that are biased in FDI achieve significantly less consumption risk sharing than those with low values of $\%fdi$. We later argue this stems from the institutional and regulatory characteristics of the economies that borrow in FDI.

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[19]A country cannot borrow mostly both in FDI and in equity. This is the flip side of the issue that the $\%\phi_{ij}$ measures sum to unity.

3.2.2 Risk Sharing and Institutions

The paper's main contention is that the diversification potential of different classes of assets is endogenous. For instance, in specific regulatory or institutional environments, the patterns of FDI become dominated by issues of expropriation rather than simple diversification strategies. We argue these are the circumstances when estimates of γ get close to zero (and those of β get close to one) even though the share of FDI in investment is high. The rest of this section establishes the importance of the legal environment for risk sharing.

In Table 3, we investigate whether consumption risk sharing is affected by the measures of institutional quality we deem relevant to issues of expropriation of foreign investment.[20] The Table paints a clear picture: low institutional quality significantly hampers consumption insurance. In all cases, γ is significantly larger in samples with good institutions, regardless of bilateral trade intensity. Interestingly however, our estimates imply that risk sharing continues to be possible even with borrowers with less than median institutions, as γ continues to be significantly non zero in samples with low but positive values of indexes of institutional quality. How is this possible?

We argue it is the conjunction of poor institutions and closedness to international markets that makes risk sharing truly impossible. Poor institutions in open markets barely prevent diversification, because expropriation, though possible in principle, is rarely exacted in practice lest retaliation on international markets occurs. Table 4 shows this to be the case in our data. We now introduce a double interaction term testing the joint effects of institutional quality and openness to trade on the extent of risk sharing.[21] Our hypothesis of a substitutability between the two margins implies a negative coefficient on this additional interaction term. This corresponds to the notion that the effects of institutions are muted in open economies. And indeed, the coefficient is estimated to be negative in four out of five cases in Table 4, and significantly so in three of them.

Table 4 illustrates how, in our sample, the only countries where consumption risk is barely diversified at all are ones where institutions are poor *and* goods markets are closed. Elsewhere, and in particular where institutions are below median *but* trade is high, our point estimates imply consumption risk sharing is present and significant. They are even higher within closed economies (below median trade) endowed with good institutions (above median indexes), where, in fact γ is not significantly different from its value

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[20] This is similar to Volosovych (2006), except that his approach involves a two-step estimation procedure, with possible efficiency consequences.

[21] Trade openness continues to be captured by the exogenous component of bilateral trade intensity.

in samples regrouping open economies with good institutions. Unsurprisingly, the quality of institutions does affect estimates of γ, and, holding openness constant, they are higher for good institutions.

Table 5 clarifies these channels, splitting our sample four ways according to both financial openness and institutional quality. This has the advantage that separate estimates of γ are directly available for different sub-samples, and clarifies where some insurance continues to be possible. We also use a measure of financial openness in the Table - taken from Kaminsky and Schmukler (2003) - reasoning that the dynamic retaliation mechanism we underline may equally well be at work via asset markets. The Table illustrates how the only countries where consumption risk is barely diversified at all are ones where institutions are poor *and* financial markets are closed. Elsewhere, and in particular where institutions are poor *but* financial markets are open, consumption risk sharing is present, significant, and estimates of γ are all higher than 0.5. They are even higher within closed economies endowed with good institutions, where, in fact γ is not significantly different from its value in samples regrouping open economies with good institutions. Unsurprisingly, the quality of institutions does affect estimates of γ, and, holding openness constant, they are higher for good institutions.[22]

Tables 4 and 5 provide support for the conjecture that the quality of institutions and openness are substitutes in enabling risk diversification. Financial assets continue to be available to investors willing to diversify risk in (say) corrupt economies that are open; it is only when they are closed that diversification effectively plummets in the data. We now turn to the question whether this happens because of the specific response of capital flows to the legal environment.

4 Openness, Institutions and International Investment

This paper's argument links risk diversification, the intensity and characteristics of international investment and institutional quality in borrowing economies. The previous section established a significant relation between diversification and international portfolio on the one hand, and between diversification and institutions on the other. In this section, we discuss the remaining link, between international investment patterns and institutions. This is an increasingly well-charted area, and we do not propose to have

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[22] We have verified that a sample split along the openness dimension does not separate our data into samples with fundamentally distinct institutions. In other words, we check that openness incorporates information that is different from mere institutional quality. In fact, there are no significant differences in institutions across closed and open economies - across the four indexes we use in Table 5. In other words, isolating closed (or open) economies is different from focusing on countries with poor (or good) institutions.

the definite word on how institutional quality affects the magnitude and composition of international capital flows.[23] Our purpose is more focused: we seek to establish whether the intensity and composition of capital flows depends non-linearly on the quality of institutions. In particular, do institutions affect investment patterns identically irrespective of openness to world markets?

The question is especially relevant for FDI, which may be particularly sensitive to the risk of expropriation because of its physical nature. But more generally corruption or poor property rights might also affect capital flows that use other classes of assets, such as bank loans for instance. However, expropriation, repudiation or corruption entail dynamic costs, in that international markets can decide to sanction and ostracize a guilty party, by excluding it from world trade or global capital markets. A large literature is dedicated to evaluating the costs of such an exclusion.[24] But one thing is for sure. A closed economy cannot be further ostracized, and thus might hesitate less when choosing to renege on previous commitments, holding the quality of institutions constant. In other words, for a given value of an index of institutional quality, the likelihood of actions detrimental to foreign investors is endogenous to openness.

If this mechanism is indeed present in our data, it stands to reason that capital invested in economies that are both closed and have poor institutions reflects motives different from mere diversification strategies. If finance towards such parties does not disappear altogether, whatever remains must be determined at least in part by the prospect of repudiation. How much capital flows to closed, corrupt economies must differ substantially from what they would be if risk diversification was the only motive for investment. In contrast, if repudiation effectively ceases to be a credible threat for investment in open (yet corrupt) economies, diversification motives may once again take center stage.

The mechanism can account for the fact that risk sharing continues to be possible in corrupt yet open economies, and implies that capital should continue to flow there. In other words, the same non-linear effect of institutions should characterize international investment, which should flow to corrupt yet open economies. We now formally verify this to be the case. In doing so, we refer to the empirical approaches that have been tried and tested in the literature on the determinants of international capital flows. In particular, we follow Wei (2000, 2006) and Lane and Milesi-Ferretti (2004), and estimate in pure cross-section

$$\phi_{ij} = \alpha_i + \tilde{\alpha}_j + \delta_1 \ [Op_j \ . \ I_j] + \delta_2 \ Op_j + \delta_3 \ I_j + \delta' X_{ij} + \varepsilon_{ij} \tag{4}$$

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[23] We refer the interested reader to contributions by Lane and Milesi-Ferretti (2004), Faria and Mauro (2004), Alfaro et al (forthcoming) or Daude and Fratzscher (forthcoming).

[24] See among many others chapter 6 in Obstfeld and Rogoff (1996).

where X_{ij} denotes a vector of controls for bilateral investment patterns between lending country i and borrowing country j. Op_j denotes the index of current account openness compiled by the International Monetary Fund (which takes value one in open borrowing economies) and I_j is an index of institutional quality. We control for source specific intercepts, and destination specific random effects.[25] A large literature has taken interest in the signs of δ_2 and δ_3; we are here mostly interested in the sign of δ_1.

Table 6 presents the results pertaining to all measures of k_{ij}, where I_j corresponds to the corruption index proposed by the World Development Report, whose value increases with corruption. Several results deserve mention. First, it is always significantly true that δ_1 is negative, whereas δ_2 and δ_3 are positive or zero. The direct effect of corruption on capital is muted in open economies. As discussed for instance in Wei (2000), a crucial conditioning variable in Table 6 is per capita GDP in the borrowing economy, which might capture the marginal return to capital. We stress our main conclusion regarding the sign and significance of δ_1 holds irrespective of the conditioning set - and indeed whether per capita GDP is included or not. As discussed in Wei (2000) or Daude and Fratzscher (forthcoming), this is not necessarily true of the estimates of δ_3.

What is more, the significance of δ_1 suggests sampling is of the essence when it comes to assessing the effects of corruption on international investment. A sample biased towards open economies (for instance ones where credit ratings are available) is more likely to deliver positive estimates of δ_3, especially if the specification is linear. The end effect of institutions on capital has to do with the relative magnitudes of the estimates for δ_1 and δ_3, along with average realizations of I_j and Op_j.[26] We leave a precise answer to this question to the literature concerned more directly with it, but stress the non-linearity we document does not contradict existing estimates.

Table 6 shows that corrupt and closed economies have difficulties borrowing relative to open ones. Given a level of corruption, capital goes first to open economies, and in general appears to shun closed and corrupt borrowers. That is consistent with the conjecture that international investment is particularly sensitive to repudiation risk, so that investors avoid at all costs countries where institutional quality can not be mitigated by putative market sanctions. It is also consistent with the conjecture that whatever investment remains headed towards corrupt and closed economies, it may be governed by other motives than portfolio diversification.

This section provides evidence of a significant relation linking international investment patterns to the

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[25] Given that we focus on the cross-section formed by borrowing economies, this is the most we can control for. See Daude and Fratzscher (2006) for a more general setting.

[26] The same is true of the end effects of openness on the international allocation of capital.

interaction of institutional quality and trade openness. Institutions matter when attracting capital, but poor institutions lose most of their deterrent in open economies, where a market sanction becomes possible. We conclude standard diversification strategies may continue to motivate international investment towards countries with poor institutions, provided they are also open. If they are closed, expropriation concerns take over, and prevent consumption risk sharing.

5   Endogeneity

Our measure of bilateral risk sharing is novel. It is important to ensure our results are robust to alternatives. Here we address the possibility that cycle synchronization and financial integration themselves be endogenous in equation (2).

Two crucial variables are likely to be endogenous on the right-hand side of equation (2), not least possibly to each other. Output co-fluctuations may be driven by the extent of bilateral financial integration, which may drive a spurious correlation between $y_{it} - y_{jt}$ and k_{ij} in Table 2 and thus explain away some of the results there. In addition, financial integration itself may be endogenous to the nature of business cycles, for instance if risk insurance is particularly desirable given highly volatile consumption.[27] This correlation would however act against our results. Suppose output fluctuations become internationally more synchronized between economies where bilateral investment is high. We would then conclude that estimates of γ are low between countries with high realizations of ϕ_{ij}, since their output fluctuations would be more synchronized bilaterally. Endogeneity will only explain our results away if different types of capital have different effects on the international synchronization of output fluctuations. This seems unlikely.

Nevertheless, we augment equation (2) with two equations meant to capture the putative autonomous determinants of $y_{it} - y_{jt}$ and k_{ij}, and estimate the resulting system using three-stage least squares (3SLS). Luckily an enormous literature is available for choosing instruments.[28] We include the most robust and

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[27] Note that both of these sources of endogeneity pertain to Table 2, where the nature of business cycles and financial integration may be endogenous and inter-related. In the rest of our analysis, our independent variables such as institutions or gravity-implied trade intensity may reasonably be assumed exogenous.

[28] A lengthy discussion is out of order here. For a detailed discussion, including of the relevance of 3SLS in this context, see Imbs (2004). La Porta et al (1998) have famously argued that financial development is well predicted by the legal environment, and we take advantage of their results when instrumenting ϕ_{ij}.

uncontroversial of them all, namely a measure of bilateral trade, and estimate jointly

$$
\begin{aligned}
(y_{it} - y_{jt}) - (c_{it} - c_{jt}) &= \gamma_1 \ (y_{it} - y_{jt}) + \gamma_2 \ \phi_{ij} + \gamma_3 \ (y_{it} - y_{jt}) . \phi_{ij} + \varepsilon_{ijt} \\
y_{it} - y_{jt} &= \lambda_1 \ \phi_{ij} + \lambda_2 \ t_{ij} + \lambda_3 \ I_{ij}^1 + \eta_{ijt} \\
\phi_{ij} &= \delta_1 \ t_{ij} + \delta_2 \ I_{ij}^2 + \nu_{ijt}
\end{aligned}
\tag{6}
$$

for all values of ϕ_{ij}. Table 7 lists the instruments in I_{ij}^1 and I_{ij}^2, which include a measure of the exchange rate regime, the index of legal origins proposed by La Porta et al (1998), and other measures that pertain to the extent of investment in different asset classes. Note that the system (6) also accounts for the simultaneity between output fluctuations, trade linkages and bilateral capital flows. Reassuringly, none of the results of the paper is affected by these endogeneity issues, as testified by Table 7.[29]

6   Conclusion

International risk sharing is far from perfect in the data. But this fact averages away important differences. Lewis (1996) taught us that diversification was hampered by de jure restrictions to international capital flows. We show this extends to effectively measured investment: countries that trade financial assets are also diversified, in that they manage to unhinge domestic consumption from domestic production, in some cases perfectly. Surprisingly, economies with low institutional quality still achieve a high degree of risk diversification, though we show that they must also be open to international markets. It is only in closed economies with poor institutions that risk sharing is virtually absent.

Thus, openness and institutions are to an extent substitutes when it comes to attracting capital for the purpose of risk diversification. We conjecture this corresponds to the credible threat of retaliation that open countries have to internalize when deciding to confiscate foreign capital. Closed countries cannot be excluded from anything, and engage in expropriation more readily. Investors anticipate this. Whatever capital still goes to closed, corrupt economies achieves little diversification, for these investments are now constrained to avoid or prepare for the event of confiscation.

If the mechanism were indeed prevalent, international investment should respond to institutional quality in a non-linear manner, that depends on the borrowing country's openness to world markets. In

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[29]We also verified that our results are robust across samples. In particular, we show the results in Table 4 continue to hold in samples focused on the post Bretton Woods period, and when the universe of host countries is reduced to OECD economies, albeit somewhat less significantly. These results are not reported for the sake of brevity, but they suggest our conclusions are not driven by outliers in the time or the country dimensions.

particular, the deterrent impact of poor institutions should be muted in open economies. That should be particularly true of the type of asset that is easiest to confiscate, FDI, and it should be particularly true of institutions that pertain to expropriation risk or contract enforceability. We show these predictions are all borne out in a dataset detailing bilateral investment patterns between a broad set of economies, that comprises information on cross-holdings of foreign direct investment, portfolio investment, and bank loans.

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Appendix A: Country sample

Emerging Market Economies		Mature Economies	
Argentina	Malta	Australia	Japan
Chile	Mauritius	Austria	Netherlands
Colombia	Mexico	Canada	New Zealand
Costa Rica	Pakistan	Denmark	Norway
Cyprus	Philippines	Finland	Portugal
Egypt	Poland	France	Spain
Hong Kong	Singapore	Germany	Sweden
Hungary	South Africa	Greece	Switzerland
Indonesia	Uruguay	Iceland	United Kingdom
Israel	Venezuela	Ireland	United States
Korea		Italy	

Appendix B: Variable definitions and sources

Variable definition:	Source:
Bilateral FDI stocks – FDI asset holdings of source country i in host country j in million US dollar	UNCTAD
Bilateral portfolio equity and portfolio debt stocks – average 2001-2003 holdings of source country i in host country j in million US dollar	Coordinated Portfolio Investment Survey (CPIS), IMF
Bilateral loans – aggregate assets and liabilities of banks in reporting countries vis-à-vis banking and non-banking institutions in host countries	International Locational Banking Statistics (ILB), BIS
Distance – log bilateral great circle distance in miles between economic centers of source country and host country	Andy Rose's website
Common language – dummy equal to one if both countries speak the same language and zero otherwise	Andy Rose's website; CIA World Factbook
Property rights – index that goes from 0 to 5, with higher values representing bad protection of property rights	Heritage Foundation
Expropriation risk – index goes from 0 to 10, with high values = low risk	ICRG – PRS
Repudiation risk – index goes from 0 to 10, with high values = low risk	ICRG – PRS
Days of enforcement –the time of dispute resolution—in calendar days—counted from the moment the plaintiff files the lawsuit in court until settlement or payment.	World Bank – Doing Business Database
WDR corruption – index goes from 1 to 8, with higher values indicating higher levels of corruption	World Bank (Wei, 2000)
TI corruption – value of index goes from 0 to 10, with higher values indicating higher levels of corruption	Transparency International (Wei, 2000)

Table 1: Risk Sharing - Multilateral Approach

Output	0.4535*** (3.01)	0.8755*** (13.88)	0.5735*** (4.80)	0.5905*** (5.04)	0.5737*** (4.94)	0.4894*** (3.43)	0.2624 (1.18)	1.5909*** (13.11)	0.1283 (0.75)
Interactions									
De jure		−0.4954*** (−3.51)							
K/Y			−0.0018*** (−3.08)				−0.0015*** (−2.79)	−0.0006 (−1.50)	−0.0010*** (−2.54)
FDI				−0.0073*** (−3.07)					
Portfolio					−0.0028*** (−3.01)				
Loans						−0.0019** (−2.31)			
%FDI							1.5054*** (2.59)		
%Portfolio								−1.9100*** (−5.92)	
%Loans									1.7082*** (5.14)
R^2	0.53	0.53	0.57	0.57	0.57	0.54	0.59	0.72	0.74
Obs.	1,385	1,145	1,385	1,385	1,385	1,385	1,385	1,385	1,385

Notes: The dependent variable is the cyclical component of consumption, and "Output" denotes the cyclical component of output. All regressions include Source and Year effects. K/Y, FDI, Portfolio and Loans are measured in proportion of Source country GDP, % are measured as a proportion of total holdings. Numbers in parantheses are t-statistics from robust standard errors. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table 2: Risk Sharing - Bilateral Approach: De Facto Measures

Panel A

Output	0.6127***(4.28)	0.5596***(4.01)	0.5097***(3.01)	0.5570***(4.16)	0.5087***(3.09)	0.5492***(3.78)	0.4907***(3.00)	0.5818***(4.11)	0.5111***(3.05)
Interactions									
K/Y		12.275***(3.54)	8.962***(3.85)						
FDI				0.9773***(3.02)	0.7427**(2.76)				
Portfolio						1.0191**(2.56)	0.8793***(3.06)		
Loans								0.5465**(2.73)	0.4686***(3.33)
Trade			19.494*(1.89)		19.153*(1.79)		20.713***(2.88)		23.049**(2.61)
R²	0.56	0.59	0.61	0.59	0.61	0.59	0.62	0.58	0.61
Obs.	11,516	11,410	11,043	11,516	11,043	11,516	11,043	11,516	11,043

Panel B

Output	0.7138***(6.15)	0.6066***(4.00)	0.2176(1.07)	0.0905(0.49)	0.8008***(6.59)	0.7060***(4.78)
Interactions						
%FDI	−0.3875(−1.55)	−0.3788(−1.53)				
%Portfolio			0.7610***(3.70)	0.787***(4.93)		
%Loans					−0.8549***(−6.57)	−0.9290***(−6.93)
K/Y		8.393***(3.31)		10.986***(5.12)		12.750***(3.73)
Trade		20.522**(2.42)		19.318**(2.71)		16.765**(2.46)
R²	0.58	0.63	0.66	0.72	0.64	0.69
Obs.	11,516	11,043	11,516	11,043	11,516	11,043

Notes: The dependent variable is dY-dC, the difference between the international discrepancies in output and consumption. "Output" denotes the international discrepancies in GDP. The sample is reduced to OECD Source countries. All regressions include country-pair effects, and standard errors are clustered by source country. K/Y denotes the ratio of all asset holdings relative to source country GDP. All effective asset holdings are measured as "allocations", i.e. in proportion of total Source country holdings in the same asset class. % Variables are measured as a proportion of total holdings. "Trade" denotes bilateral trade intensity, as predicted by bilateral distance, geographic area and the presence of a common border. A significant coefficient indicates risk sharing, the coefficient is one under perfect risk sharing. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table 3: Risk Sharing - Bilateral Approach: Institutions

Panel A

Output	1.1104^{***} (23.87)	1.0180^{***} (15.16)	-0.1128 (-0.68)	-0.0989 (-0.57)	0.2526 (0.97)	0.1527 (0.63)
Interactions						
Property Rights	-0.2193^{***} (-3.32)	-0.1993^{***} (-3.36)				
Enforcement			0.1219^{***} (6.82)	0.1080^{***} (6.97)		
Regulation					0.0007^{**} (2.57)	0.0007^{***} (3.28)
Trade		14.469 (1.42)		18.224 (1.27)		26.482^{***} (5.38)
R^2	0.65	0.63	0.63	0.65	0.64	0.67
Obs.	10,332	10,026	9,754	9,597	10,987	10,681

Panel B

Output	-1.3938^{***} (-3.66)	-1.3670^{***} (-3.67)	0.0777 (0.37)	0.0846 (0.38)
Interactions				
Repudiation	0.2356^{***} (7.02)	0.2290^{***} (7.70)		
Corruption			0.1390^{***} (5.05)	0.1229^{***} (5.80)
Trade		9.1340 (1.02)		17.476 (1.36)
R^2	0.71	0.72	0.61	0.63
Obs.	11,481	11,008	11,481	11,008

Notes: The dependent variable is dY-dC, the difference between the international discrepancies in output and consumption. "Output" denotes the international discrepancies in GDP. The sample is reduced to OECD Source countries. All regressions include country-pair effects, and standard errors are clustered by source country. "Property Rights" denotes the index of property rights compiled by the Heritage Foundation (a high value means poor rights), "Enforcement" denotes the index of contract enforcement computed by La Porta et al (1998) (a high value means good enforcement). "Regulation" denotes the quality of the regulatory environment from the same source (a high value means high quality). All indexes of institutions in Panel B come from International Country Risk Guide, and their value all increase in the quality of the institutional environment. "Trade" bilateral trade intensity, as predicted by bilateral distance, geographic area and the presence of a common border. A significant coefficient indicates risk sharing, the coefficient is one under perfect risk sharing. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table 4: Risk Sharing: Non-Linearities

Output Non-Linearity	1.0366*** (16.31)	−0.3150 (−1.54)	0.0977 (0.37)	−1.472*** (−3.43)	−0.0147 (−0.06)
Institution x Trade Interactions	4.887 (0.51)	−8.137*** (−5.64)	−0.0391*** (−3.24)	−5.781 (−0.51)	−7.309** (−2.11)
Property Rights	−0.2103** (−2.81)				
Enforcement		0.1435*** (6.81)			
Regulation			0.0008*** (3.29)		
Repudiation				0.2402*** (6.70)	
Corruption					0.1465*** (4.62)
Trade	6.926 (0.71)	73.282*** (5.41)	44.437*** (3.30)	64.024 (0.58)	51.008** (2.20)
R^2	0.66	0.66	0.68	0.72	0.63
Obs.	10,026	9,597	10,681	11,008	11,008

Notes: The dependent variable is dY-dC, the difference between the international discrepancies in output and consumption. "Output" denotes the international discrepancies in GDP. The sample is reduced to OECD Source countries. All regressions include country-pair effects, and standard errors are clustered by source country. "Property Rights" denotes the index of property rights compiled by the Heritage Foundation (a high value means poor rights), "Enforcement" denotes the index of contract enforcement computed by La Porta et al (1998) (a high value means good enforcement). "Regulation" denotes the quality of the regulatory environment from the same source (a high value means high quality). Repudiation, Expropriation and Corruption all come from International Country Risk Guide, and their value all increase in the quality of the institutional environment. "Trade" denotes bilateral trade intensity, as predicted by bilateral distance, geographic area and the presence of a common border. A significant coefficient indicates risk sharing, the coefficient is one under perfect risk sharing. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table 5: Risk Sharing: Sample Splits - Financial Openness

	Closed		Open	
	Low	High	Low	High
Enforcement	0.0869*** (6.89)	0.9112*** (14.34)	0.5311*** (5.65)	0.8970*** (17.21)
Obs	1,149	941	4,329	2,901
	High Risk	Low Risk	High Risk	Low Risk
Repudiation	0.0694*** (4.76)	0.8937*** (14.98)	0.2335* (1.93)	0.9148*** (34.51)
Obs	871	1,779	1,894	5,336
	High Risk	Low Risk	High Risk	Low Risk
Expropriation	0.0898*** (7.63)	0.9207*** (19.94)	0.5108*** (5.07)	0.8504*** (13.58)
Obs	1,271	1,379	2,381	4,849
	Poor	High	Poor	High
Property Rights	0.0612*** (4.33)	0.9107*** (17.86)	0.5568*** (5.40)	0.7735*** (6.95)
Obs	787	1,443	3,414	3,497

Notes: The Table reports estimates of γ in equation (2). All regressions include include country-pair effects, and standard errors are clustered by source country. The sample is reduced to OECD Source countries, and sample splits pertain to Host economies. "Closed" and "Open" samples refer to financial openness as measured by the index compiled by Kaminsky and Schmukler (2003). Enforcement captures enforceability of contracts as implied by the index introduced by La Porta et al. (1998); low enforcement means a value below 8. Repudiation risk is measured by the index computed by ICRG; high repudiation risk means a value below 9. Expropriation risk is measured using the index computed by ICRG; high expropriation risk corresponds to a value below 10. Property Rights are measured using the index proposed by the Heritage Foundation; poor rights correspond to a value above 1.

Table 6: Capital Flows - Non-linearities

|	FDI	FDI	Portfolio	Portfolio	Loans	Loans
Interaction	−0.0131** (−2.47)	−0.0162*** (−2.61)	−0.0128*** (−2.57)	−0.0109** (−2.37)	−0.0155** (−2.50)	−0.0232*** (−2.68)
Openness	0.0560** (2.34)	0.0711** (2.46)	0.0623*** (2.78)	0.0568*** (2.71)	0.0704*** (2.65)	0.1067*** (2.78)
Corruption	0.0001 (0.08)	0.0088** (2.33)	0.0006 (1.28)	0.0065* (1.84)	−0.0001 (−0.08)	0.0096** (2.06)
Per Capita GDP		−0.8889 (−1.24)		−0.5563 (−1.15)		−1.5699** (−2.53)
GDP		0.0223*** (6.46)		0.0269*** (11.35)		0.0194*** (10.92)
Distance		−0.0223*** (−4.23)		−0.0168*** (−3.80)		−0.0311*** (−4.00)
Language		0.0343*** (4.23)		0.0212* (1.91)		0.0149 (1.37)
Source Effects	Yes	Yes	Yes	Yes	Yes	Yes
(Random) Host Effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	658	639	658	639	658	639

Notes: The dependent variable is the share of one particular type of asset between Source and Host countries, relative to the total held by the Source economy in the same asset category. Corruption is measured by the World Development Report index. "Openness" is the index of Current Account openness as collected by AREAR. "Interaction" denotes the interaction between institutional and openness variables. "Language" takes value one when both source and host countries share the same language. The sample is focused on OECD Source countries. Standard errors are clustered by Host country.

Table 7: Three-Stage Least Squares

Output	-0.0098 (-0.24)	-0.0392 (-1.00)	-0.0120 (-0.32)	0.0488 (1.29)	0.2551^{***} (4.80)	-0.0664^{*} (-1.73)	0.3479^{***} (7.61)
Interactions							
K/Y	54.304^{***} (13.52)						
FDI		1.9291^{***} (14.75)					
Portfolio			1.7596^{***} (16.70)				
Loans				2.1331^{***} (11.63)			
%FDI					-0.0281 (-0.23)		
%Portfolio						1.0953^{***} (20.05)	
%Loans							-0.3609^{***} (-3.76)

Notes: The dependent variable is dY-dC, the difference between the international discrepancies in output and consumption. "Output" denotes the international discrepancies in GDP, which are instrumented with a measure of bilateral trade intensity following Frankel and Rose (1999) and a binary variable capturing the nature of the exchange rate regime. In turn, "Output" is allowed to depend on the measure of bilateral financial integration. In addition, effective capital holdings are instrumented with the index of legal origins, the index of anti-director rights, a measure of the soundness of banks, and the index of disclosure all introduced by La Porta et al (1998). In addition, each measure is allowed to depend on bilateral trade intensity. The sample is reduced to OECD Source countries. K/Y denotes the ratio of all asset holdings relative to source country GDP. All effective asset holdings are measured as "allocations", i.e. in proportion of total Source country holdings in the same asset class. % Variables are measured as a proportion of total holdings. A significant coefficient indicates risk sharing, the coefficient is one under perfect risk sharing. * (**, ***) corresponds to 10% (5%, 1%) significance level. The table only report the first equation of the system, of interest to measuring bilateral risk sharing.

Figure 1: De facto openness, risk sharing and institutions – some examples
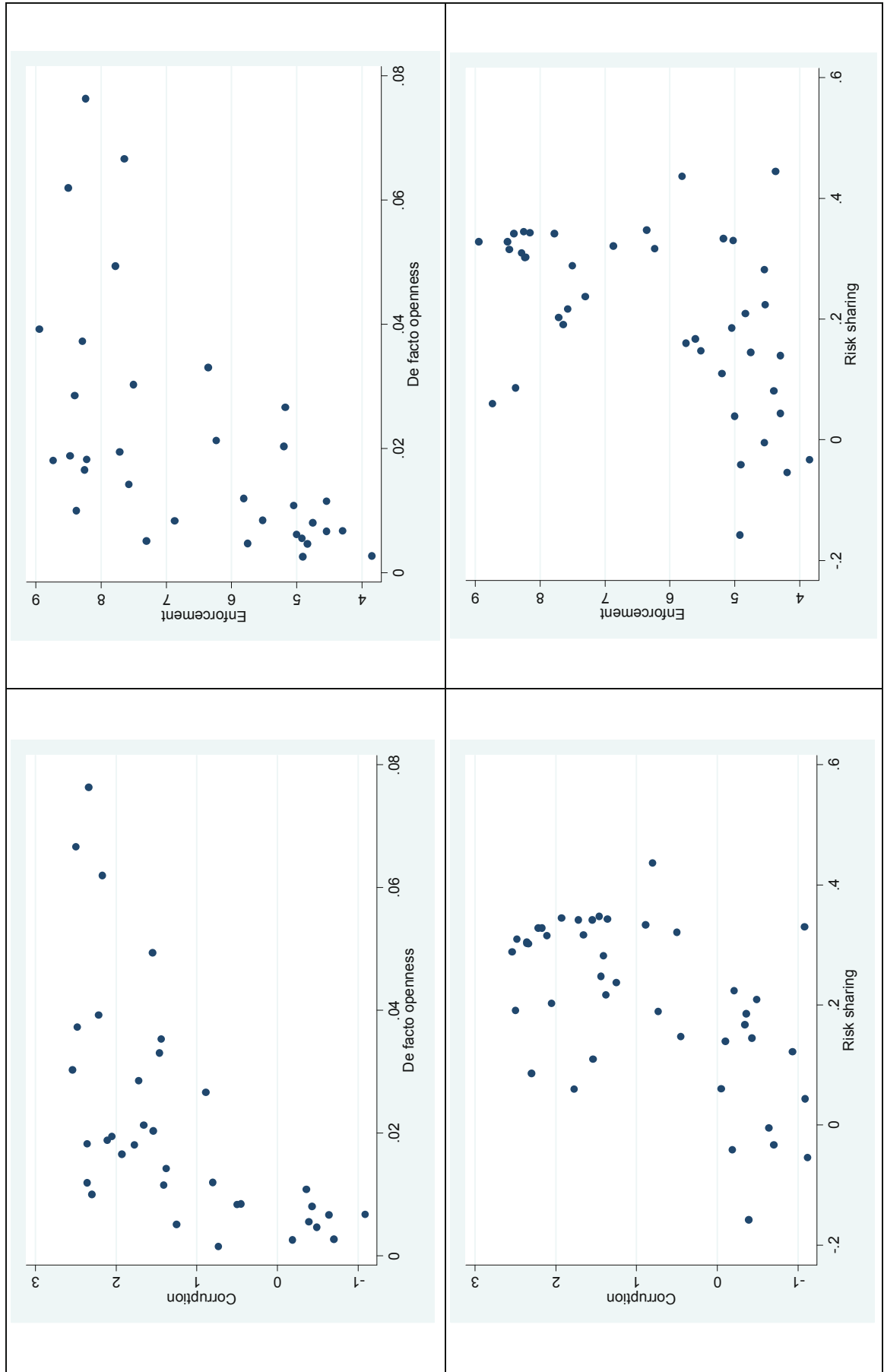
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