Risk Sharing, Finance and Institutions in International Portfolios*

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Abstract

We develop a standard model to show how transaction costs in international investment affect conventional tests of consumption risk sharing, both in a multilateral and a bilateral setting. We implement the tests in a novel international dataset on bilateral holdings of equity, bonds, foreign direct investment and bank loans. International consumption risk sharing increases with foreign capital holdings; this is especially true of investment in equity or bonds, but not of foreign direct investment or bank loans. In our model, this implies transaction costs are higher for FDI and international loans. The discrepancy may reflect technological differences across asset classes, but also the prospect of expropriation, perhaps most stringent for FDI or loans. We argue that expropriation risk is endogenous to both the borrower's institutions *and* its openness to international markets. The detrimental impact of poor institutions is muted in open economies, where the possibility of subsequent exclusion from world markets deters expropriation of foreign capital. We show the implied non-linear effects of institutions prevail in both the cross-section of consumption risk sharing, and in observed international investment patterns.

Keywords: Risk sharing, Diversification, Portfolio Choice, Financial Integration, Cross-Border Investment. JEL Classification: F21, F30, G15

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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 limited, and, according to Lewis (1996), largely driven by *de jure* restrictions to international capital flows. We argue that these conclusions, while true, obscure empirical regularities implying *conditional* relations between the regulatory environment, institutions, the composition of international investment portfolio, and the extent of risk sharing.

Our purpose is to improve in two dimensions the conventional test of international consumption risk sharing introduced by Lewis (1996).[1] First, do diversification gains depend on the magnitude and the composition of international investment across various asset classes? If differences exist, why do they arise? Second, can one use information on *bilateral* capital flows to investigate the extent of risk insurance between pairs of countries? This provides an attractive alternative to considering the multilateral problem faced by a small open economy, especially when data on bilateral financial linkages are becoming readily available.

We frame the paper around a simple model of international investment with incomplete markets, inspired from Lewis (1996). The model purports to motivate the consumption risk sharing conditions we test, both multilaterally and bilaterally. It also provides an illustration of the reason why risk diversification may differ across asset classes. We assume domestic purchases of foreign assets entail payment of a transaction cost, that potentially differs across asset classes. But this is the only source of heterogeneity. In particular, equity, bonds, foreign direct investment (FDI) or bank loans are all assumed to confer identical control on the invested project, or to encapsulate identical information on the lender.

Obviously this is a strong assumption. But our aim is not to develop a general equilibrium theory of dynamic portfolio choice. Rather, we need tractable theoretical guidance to introduce asset-specific investment in conventional tests of international risk sharing. The model shows that foreign assets with high transaction costs deliver little consumption risk sharing. As a result, domestic consumption will not decouple from domestic resources, as it would under complete markets and perfect risk sharing. We show this to be true both in the conventional multilateral setup, and extend it to a bilateral framework.

[1] The 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.

We then turn to the empirics, and bring to bear a novel dataset with information on bilateral asset holdings between up to 42 source and 90 host countries. Total bilateral holdings break down into three main components: portfolio investment (i.e. equity and bonds), direct investment, and bank loans. We find that the overall magnitude of international investment does improve risk diversification. Interestingly, this is exclusively delivered by portfolio investment - not by FDI nor bank loans. The result is true both multilaterally and bilaterally.

In the model, the implication is that transactions costs are higher for FDI or international loans. There may well be exogenous, technological reasons for this. Here we pursue the (non-competing) argument that expropriation risk -or more generally poor institutions- generate costly frictions in international investment. In particular, institutional quality conditions the extent of consumption risk sharing, but in a way that depends on the borrowing economy's openness to world markets. This is because investment 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 costs.

In open economies therefore, the institutional risk that plagues foreign capital is muted, even if institutions are poor. In closed economies, on the other hand, the sensitivity of investment to the institutional environment is particularly prevalent and international investment patterns may be governed by concerns that are orthogonal to international diversification motives. Empirically, a non-linearity should prevail between the extent of consumption risk sharing and the quality of institutions: The relation should depend on the level of openness at the borrowing end. Closed economies should experience less risk sharing overall, but it is only when this is complemented by poor institutions that measured income insurance should drop significantly.

Presumably the same non-linearity should also prevail in the relation between institutional quality and effectively observed international investment patterns. Closed economies with poor institutions pose serious risks, and it is highly costly to invest there. We observe little capital flows. On the other hand, open economies benefit from international investment, even those with relatively poor institutions. Investors anticipate that detrimental actions are less likely, thanks to the possibility of dynamic retaliation. This acts to diminish effective transaction costs, and capital flows to these countries with end effects on diversification gains.

We show both non-linearities are present and significant in our dataset. The finding suggests that expropriation (say) is particularly costly -and thus effectively seldom implemented- in open economies.

The argument is consistent with Ju and Wei (2006), who propose a model in which agents circumvent poor institutions by triggering capital outflows in portfolio investment, but capital inflows in other forms, such as FDI. It is also in line with Gourinchas and Jeanne (2006), who show that openness can function as a disciplining device on a country's institutional quality.

FDI is particularly relevant to the question. At one end of the spectrum, FDI is often construed to be more likely to be confiscated by rogue governments, because unlike equity installed physical assets can readily be claimed by local authorities. Direct investment 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, 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 (2008) offer supportive evidence of the latter, whereas Wei (2006, 2000) and Faria and Mauro (2004) present supportive evidence of the former.

The non-linearity we document offers an explanation that accounts for the diversity in empirical conclusions, since it implies that sampling is crucial. A dataset focused on open or closed economies is likely to yield estimates about the extent of risk sharing at opposite ends of the spectrum, because the putative alienability of direct investment is endogenous to and conditioned by openness to international markets. 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.

The paper is organized as follows. Section 2 presents the model used to motivate our (multilateral and bilateral) tests for risk sharing. Section 3 describes the data, implements our tests and discusses the results. Section 4 documents the non linear impact of institutions on consumption risk sharing and international investment patterns. Section 5 concludes.

2 Testing Risk Sharing

We describe how we adapt the conventional test for consumption risk sharing introduced by Lewis (1996) to our purposes. In particular, we show how transaction costs on the asset market (or borrowing constraints) act to increase the dependence of domestic consumption on domestic income, and how this extends to a bilateral approach.

2.1 Multilateral Test

We consider a two-country world formed by the domestic economy H, and the rest of the world F. A representative consumer in each country maximizes utility of consumption $U\left[C\left(s_t\right)\right]$, where s_t denotes the state of the economy at time t. A social planner maximizes

$$\sum_t \rho^t \sum_{s_t} \pi\left(s_t\right) \left\{\omega\ u\left[C^H\left(s_t\right)\right] + \left(1-\omega\right)\ u\left[C^F(s_t)\right]\right\}$$

where ρ denotes the subjective discount rate, ω is the welfare weight associated to the domestic economy and $\pi\left(s_t\right)$ is the probability that state s_t occurs. The resource constraint writes

$$C^H\left(s_t\right) + C^F(s_t) = Y^H(s_t) + Y^F(s_t)$$

This is an endowment economy, with home and foreign endowments given by $Y^H(s_t)$ and $Y^F(s_t)$, respectively. The setup is consistent with our focus on international risk sharing assuming away intertemporal self-insurance. As argued in Lewis (1996), a social planner in a production economy would choose an efficient stream of output over time and maximize the very same objective function. As is well known, optimality conditions require that

$$\begin{aligned} \omega\ \rho^t\ u'\left[C^H\left(s_t\right)\right] &= \lambda\left(s_t\right) \\ \left(1-\omega\right)\ \rho^t\ u'\left[C^F\left(s_t\right)\right] &= \lambda\left(s_t\right) \end{aligned} \tag{1}$$

where $\lambda\left(s_t\right)$ is the Lagrangian multiplier on the budget constraint. This equates marginal utilities across countries, with predictions on the international correlation in consumption. These are largely invalidated in the data, an anomaly famously coined a "quantity puzzle" by Backus, Kehoe and Kydland (1992). But equation (1) also implies that marginal utilities in both economies do not depend on any domestic variables, but only on the uninsurable component of uncertainty, i.e. one that depends on world factors.[2].

Equation (1) immediately implies that consumption growth rates in both economies should only depend on a world factor, and in particular not on country-specific income. With standard CRRA utility, straightforward log-linearization of a first-differenced version of equation (1) implies

$$\ln\left[\frac{C^H\left(s_t\right)}{C^H\left(s_{t-1}\right)}\right] = \ln\left[\frac{C^F\left(s_t\right)}{C^F\left(s_{t-1}\right)}\right] = -\frac{1}{\sigma}\ln\left[\frac{1}{\rho}\frac{\lambda\left(s_t\right)}{\lambda\left(s_{t-1}\right)}\right]$$

[2]To be precise, Lewis (1996) also allows for non-separability between tradable and non-tradable consumption, so that domestic marginal utility depends on the domestic consumption of non-tradables. Our country coverage makes that decomposition empirically impossible. But 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.

where σ denotes risk aversion, common across both economies. The expression implies consumption growth rates are perfectly correlated internationally. A corollary, explored in a vast literature, is that consumption growth in each country varies with world factors only. Lewis (1996) proposes to test the claim in a panel of countries $i = H, F$, estimating β in

$$gc_t^i = \alpha_t + \beta \; gy_t^i + \varepsilon_t^i \tag{2}$$

where $gx_t^i = gx^i(s_t)$ denotes the log growth rate of x in state s_t. α_t captures the world factors embedded in the Lagrangian multiplier and the discount rate, and ε_{it} denotes measurement error or preference shocks. Perfect risk sharing implies $\beta = 0$ with consumption growth independent on domestic income. We call this a test for "multilateral" risk sharing because its findings say nothing about which partner a particular economy shares risk with. Lewis (1996) 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.

It is easy to see how the introduction of borrowing constraints, or -potentially asset specific- transaction costs must result in estimates of β further away from zero. The intuition is straightforward: incomplete markets render risk sharing more difficult, and thus idiosyncratic consumption growth becomes more dependent on idiosyncratic income changes. Formally, consider the decentralized problem of consumers in each economy faced with a cost $0 < \tau(a) < 1$ levied on international transactions in asset a. Transaction costs in international investment can simply reflect different tax treatments, intermediation fees or liquidity premia across countries and asset classes. They may also arise from information frictions. For instance, Portes, Rey and Oh (2001) and Portes and Rey (2005) find that information asymmetries matter less for standardized financial assets such as treasury bonds, than for information-sensitive equity or corporate bonds. Thus they validate at least partly the possibility that τ shoud indeed depend on a. In fact, financial transaction costs offer a parsimonious and frequent means of introducing market incompleteness in general equilibrium models of dynamic portfolio choice. Coeurdacier (2008) for instance, shows financial transaction costs help rationalize the equity home bias.

In the domestic economy, consumers maximize

$$E\left\{\sum_t \rho^t \; u\left(C_t^H\right)\right\}$$

subject to

$$C_t^H + r_t b_t^H + \sum_a \chi_{Ht}(a) \; q_t^H(a) + \sum_a \chi_{Ht}^F(a) \; q_t^F(a) = b_{t-1}^H + \sum_a \chi_{Ht-1}(a) \left[q_t^H(a) + Y_t^H\right] + \sum_a \left[1 - \tau(a)\right] \chi_{Ht-1}^F(a) \left[q_t^F(a) + Y_t^F\right]$$

where we have omitted s_t for ease of exposition. Following Lewis (1996), b_t^H denotes the domestic holdings of a riskless bond and r_t is its price. We let $\chi_{Ht}(a)$ and $\chi_{Ht}^F(a)$ denote the time t domestic holdings of domestic and foreign asset a, respectively. a indexes different types of assets (portfolio, FDI, or bank loans), which we assume all pay the output stream of their economy of origin, Y_t^H or Y_t^F. The three classes of assets are therefore assumed to differ only in terms of $\tau(a)$ and their prices $q_t^H(a)$ or $q_t^F(a)$.

This is obviously a simplifying assumption, that assumes away the vast differences between the three assets we consider, not least in terms of information content or the control afforded by asset ownership. For instance, 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 and helps alleviating imperfect information. With the additional hypothesis that FDI entails a fixed cost, Goldstein and Razin (2005) show that countries with lower information asymmetries receive more portfolio investment and relatively less FDI.

Ours is however not a full-fledged theory of endogenous portfolio choice, and our contribution is mostly empirical. We merely seek to establish how estimates of β in equation (2) respond to impediments to international capital flows -or indeed borrowing constraints- that may potentially be asset specific. Optimal investment in the foreign asset a implies

$$\frac{1}{1-\tau(a)} = \rho E \left\{ \frac{u'\left(C_t^H\right)}{u'\left(C_{t-1}^H\right)} \frac{q_t^F(a) + Y_t^F}{q_{t-1}^F(a)} \right\}$$

The ratio of marginal utilities is pinned down by the riskless rate, by virtue of the optimal choice of b_t^H. An asset with relatively large $\tau(a)$ must therefore either deliver relatively high returns, or provide relatively attractive hedging opportunities, with returns that covary positively with the ratio of marginal utilities $\frac{u'\left(C_t^H\right)}{u'\left(C_{t-1}^H\right)}$.

How do high values of $cov\left(\frac{u'\left(C_t^H\right)}{u'\left(C_{t-1}^H\right)}; \frac{q_t^F(a)+Y_t^F}{q_{t-1}^F(a)}\right)$ translate into estimates of β in equation (2)? We follow the appendix in Lewis (1996) and consider the definition of the OLS estimate of β in the domestic version of equation (2):

$$\hat{\beta} = \frac{cov(gc_t^H; gy_t^H)}{var(gy_t^H)}$$

Ceteris paribus, high values of $\hat{\beta}$ obtain when the growth rates in local consumption and output are positively related. Fast consumption growth means low values for the growth in marginal utility $\frac{u'\left(C_t^H\right)}{u'\left(C_{t-1}^H\right)}$. Therefore, large positive estimates of β obtain for negative correlations between $\frac{u'\left(C_t^H\right)}{u'\left(C_{t-1}^H\right)}$ and the value of domestic output growth *relative to the world average,* since equation (2) controls for world output fluctuations. In a two-country world, gy_t^H will be *relatively* high when output growth takes relatively low

values in the foreign economy. Since all assets pay the income stream from their country of origin, this implies foreign returns in general are relatively low. In other words, β will be estimated to take large positive values in states of the world where foreign returns and the ratio of marginal utilities co-move positively. Ceteris paribus, this tends to be true precisely for assets with high transaction costs.[3]

In short, international portfolios that are long in assets with high transaction costs are associated with high estimates of β in equation (2). We do not observe directly the transaction costs associated with the international holdings of various assets. But we do observe their quantities and we can investigate how the magnitude and composition of international portfolios affects estimates of β. In particular, we estimate

$$gc_t^i = \alpha_t + \beta_1 \; gy_t^i + \beta_2 \; \phi_i(a) \cdot gy_t^i + \varepsilon_{it} \tag{3}$$

where $\phi_i(a)$ denotes a measure of financial openness in country i, potentially specific to asset a. Equation (3) is estimated on a panel of country-specific growth rates in both consumption and output. The estimation is a conventional test for multilateral risk sharing, augmented to account for the possibility that consumption insurance should vary across countries i, in particular because of financial openness and effectively observed foreign investment. This possibility is summarized by $\phi_i(a)$, which is assumed to be time-invariant.

Estimates of β_2 capture the extent to which risk sharing is affected by financial integration; positive estimates may stem from a variety of sources. First, they can reflect the fact that country i faces borrowing constraints across all asset classes, with $\phi_i(a) = \phi_i$ a measure of *de jure* capital controls on all asset types. Lewis (1996) found significant evidence in support of income insurance with controls for both consumption in local non-tradable goods and current account restrictions. A burgeoning literature, pioneered by Asdrubali et al. (1996) has extended her approach to investigate the magnitude and determinants of consumption risk sharing. For instance, Kalemli-Ozcan et al. (2001, 2003), Demyanyk et al (2007) or Corcoran (2008) have related consumption insurance to the specialization of production across U.S States and countries, or to measures of financial openness.

Estimates of β_2 can also reflect the fact that country i engages in little international investment because of market incompleteness of another type than simple capital controls, and potentially specific to one class of assets. This calls for measures of $\phi_i(a)$ that capture the scale of foreign asset holdings (of one type or another) relative to country i's economic size. These will quantify *de facto* international financial

[3] This follows exactly from the appendix in Lewis (1996). Borrowing constraints will have the same implication. In states of the world where the consumer faces constraints in raising credit, her expected intertemporal marginal rate of substitution in consumption will be lower than under complete markets. Since $cov\left(\frac{u'(C_t^H)}{u'(C_{t-1}^H)}; \frac{q_t^F(a)+Y_t^F}{q_{t-1}^F(a)}\right) = \frac{1}{\rho}\frac{1}{1-\tau(a)} - E\left(\frac{u'(C_t^H)}{u'(C_{t-1}^H)}\right) E\left(\frac{q_t^F(a)+Y_t^F}{q_{t-1}^F(a)}\right)$, the covariance term is also higher under borrowing constraints.

linkages as opposed to Lewis's *de jure* controls. Estimates of β_2 could also finally reflect the composition of international portfolios, long in one class of assets or another with potentially different values of $\tau(a)$. This calls for measures of $\phi_i(a)$ that reflect the allocation of foreign assets in country i across a assets. We discuss these three approaches in detail when we turn to our empirical analysis.

2.2 Bilateral Test

We now assume the world consists of three economies, indexed by $i = H, F, R$. As our purpose is to focus on a bilateral dimension, we want to differentiate situations where country H shares risk with F or with R.

Consider first the case where countries H and F choose to share risk *bilaterally*, and ignore the opportunities afforded by the rest of the world. By analogy with a two-country world, we have

$$gc_t^i = \alpha_t + \beta \; gy_t^i + \varepsilon_t^i \tag{4}$$

for $i = H, F$. By definition, the bilateral contract cannot insure away income fluctuations that are common to both economies, i.e. the aggregate formed by both economies output, denoted as before by α_t. Perfect bilateral risk sharing between H and F implies $\beta = 0$ in

$$gc_t^H - gc_t^F = \beta \; \left(gy_t^H - gy_t^F\right) + \eta_{HFt} \tag{5}$$

with $\eta_{HFt} = \varepsilon_t^H - \varepsilon_t^F$.

The presence of (potentially asset specific) transaction costs or borrowing constraints continues to bias estimates of β away from zero. To see this, it is important to notice that β in equation (4) depends on the correlation between consumption growth in country $i = H, F$ and the value of output growth there *relative to growth in the aggregate formed by economies H and F*. So as in the multilateral case, estimates of β take high values whenever the growth rate in consumption marginal utility in country H correlates negatively with *relative* output growth there. Since reference output is by construction $Y_t^H + Y_t^F$, this corresponds to a positive correlation with relative output growth in country F, and thus with relatively high returns there. Now, optimal portfolio choice in country H continues to require

$$cov\left(\frac{u'\left(C_t^H\right)}{u'\left(C_{t-1}^H\right)}; \frac{q_t^F(a) + Y_t^F}{q_{t-1}^F(a)}\right) = \frac{1}{\rho\left[1 - \tau(a)\right]} - E\left(\frac{u'\left(C_t^H\right)}{u'\left(C_{t-1}^H\right)}\right) E\left(\frac{q_t^F(a) + Y_t^F}{q_{t-1}^F(a)}\right)$$

Ceteris paribus, this implies that estimates of β still increase in $\tau(a)$.[4]

[4] The expected intertemporal marginal rate of substitution in consumption is again pinned down by the riskfree rate. As before, foreign expected returns may also adjust to compensate for the presence of transaction costs.

In a three-country world however, equation (5) is not a necessary and sufficient condition for bilateral risk sharing. It describes a test of bilateral consumption insurance as against no risk sharing at all. In reality of course diversification may well happen in partnership with the rest of the world R, rather than bilaterally. In fact, estimates of β would still be zero if both economies H and F chose to share risk with R, since both economies' consumption plans would be decoupled from the realizations of their idiosyncratic income. We need to introduce controls for the incentive to diversify risk bilaterally as opposed to multilaterally.

The diversification motive is directly related to the synchronization of output fluctuations in countries H and F. In particular, bilateral insurance gains are non-existent if $gy_t^H = gy_t^F$, and they increase in the discrepancy between the two. This suggests a parsimonious addition to equation (5), that consists in controlling for the desirability of diversification between each country pair:

$$\Delta gy_t^{HF} - \Delta gc_t^{HF} = \alpha_{HF} + \gamma \ \Delta gy_t^{HF} + \eta_{HFt} \tag{6}$$

where Δgx_t^{HF} denotes the international difference in gx_t computed bilaterally between countries H and F. The dependent variable now captures the magnitude of risk sharing between H and F given the desirability of consumption insurance there. This is parsimonious because it continues to focus the estimation on the country pair (H, F), without introducing explicitly third party effects.[5] What is more, estimates of γ continue to depend simply on the presence of transaction costs or borrowing constraints. We rearranged equation (6) so as to have estimates of consumption risk sharing increasing in the extent of insurance, and bounded above by 1. This means high values of $\tau(a)$ now correspond to *low* estimates of γ.

The intuition is straightforward. If countries H and F 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 Δgc_t^{HF} is zero, but so presumably is Δgy_t^{HF} since otherwise direct bilateral risk sharing would be desirable. But if it is bilaterally that H and F share risk, $\gamma = 1$ since then equation (6) regresses (non-zero) output growth differentials on themselves. Finally, if neither multilateral nor bilateral risk sharing occurs, the dependent variable in equation (6) 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. This follows from Imbs (2005).

Equation (6) reflects the well known result that diversification motives imply investment whose magnitude increases in hedging opportunities. Ceteris paribus, negatively correlated fundamentals (Δgy_t^{HF}

[5] In fact, equation (6) includes country-pair specific intercepts to account for measurement error, but also for third party effects, as explained precisely in Section 3. These fixed effects are the reason why equation (6) is more than a transformed version of equation (5).

away from zero) should imply high capital cross-holdings, and consumption paths that are insured against output shocks in either economy (Δgc_t^{HF} close to zero). In other words, the approach assumes the variance-covariance matrix of fundamentals is exogenous, i.e. that output co-fluctuations are not affected by international investment patterns. In the working version of this paper, we invoke the results of a large literature on the determinants of business cycles synchronization to isolate the component of Δgy_t^{HF} that is arguably exogenous to financial integration.[6]

As in the multilateral case, equation (6) can be augmented in a manner that identifies the channels of bilateral risk sharing. We estimate

$$\begin{aligned} \Delta gy_t^{HF} - \Delta gc_t^{HF} &= \alpha_{HF} + \gamma_1\ \Delta gy_t^{HF} + \gamma_2\ \phi_{HF}(a) \cdot \Delta gy_t^{HF} \\ &\quad + \gamma_3\ X_{HF} \cdot \Delta gy_t^{HF} + \eta_{HFt} \end{aligned} \tag{7}$$

where $\phi_{HF}(a)$ denotes measures of financial openness between countries H and F, and X_{HF} captures alternative channels whereby two countries may achieve bilateral consumption insurance. Most prominent is the intensity in goods trade between the two countries. Cole and Obstfeld (1991) showed that, under specific parametric conditions, movements in the terms of trade could perfectly insure away idiosyncratic fluctuations, and effectively render asset trade redundant. Bilateral trade in goods and in assets are also highly correlated, so it is important to ensure the effects we document indeed work via assets trade.[7]

As in equation (3), the extent of bilateral risk sharing is identified via a panel dimension. Now however, each individual observation corresponds to a country pair HF, and the panel traces the time variation in output and consumption growth differentials for each country pair. As in the multilateral case, we continue to allow for some variation in the extent of bilateral risk sharing that depends on bilateral financial linkages and openness to goods trade. The two possibilities are summarized by $\phi_{HF}(a)$ and X_{HF}, which are assumed to be time-invariant.

Estimates of γ_2 capture how bilateral risk sharing is affected by the nature, magnitude or composition of bilateral financial linkages. Negative values for γ_2 reflect less than perfect risk sharing, which in equation

[6] In particular, we use Three-Stage Least Squares to estimate equation (6) in a system that also controls for the putative endogeneity of both Δgy_t^{HF} and $\phi_{HF}(a)$, the intensity of financial linkages between the two countries. The system also lets output correlations Δgy_t^{HF} depend on financial integration. We instrument Δgy_t^{HF} with the intensity of bilateral goods trade and the nature of the exchange rate regime between H and F, and $\phi_{HF}(u)$ with an index of legal origins, and the index of anti-director rights, the measure of the soundness of banks and the index of disclosure all introduced by La Porta et al (1998). None of our results are affected.

[7] Goods trade is also potentially endogenous to business cycles synchronization. We follow a large literature and instrument trade with standard gravity variables.

(6) happens for $\gamma = 1$. They may correspond to market incompleteness at the aggregate level, or in a way that depends on which asset is purchased abroad. In particular, $\phi_{HF}(a) = \phi_{HF}$ captures the overall magnitude of capital flows between H and F, as a proportion of the investing country's size. At a more disaggregated level, $\phi_{HF}(a)$ may reflect the importance of a given type of asset, either again as a proportion of the investing economy's size, or as a proportion of total investment.

3 Documenting Risk Sharing

What does cross-border investment achieve in terms of risk sharing? In this section, we implement both our multilateral and bilateral tests, and detail how the estimations of equations (3) and (7) are performed in practice. We start with a description of our dataset.

3.1 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 (the United Nations Conference on Trade and Development), 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. 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. In their seminal work on the Net Foreign Wealth of nations, Lane and Milesi-Ferretti (2001, 2006) proposed to alleviate these concerns using stock rather than flow information. We follow the same route.

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.

CPIS data are not perfect. For instance, they do not provide a currency breakdown of bilateral investments, nor do they identify domestic security holdings by domestic residents. 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 the limitation. In particular, (bank) assets held in non-reporting countries are approximated by (bank) liability information in 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, and not necessarily reflect true bilateral holdings. Like most of the literature making use of these data, we therefore exclude financial hubs.[8]

Even though data definitions and units 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. In constructing our measures of international financial linkages, we focus on a cross-section of bilateral capital holdings, measured as an average over 1999-2003. The averaging is meant 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. That is also the reason for imposing time-invariant $\phi_i(a)$ and $\phi_{HF}(a)$ in our theoretical section.

We observe positive cross-border holdings for most country pairs, though a minority are effectively equal to zero. Given the small number of zero entries, we maintain a linear approach. Taking censoring into account does not change our conclusions. At the receiving end, we ultimately have reliable information on the magnitude and composition of capital across 54 borrowing economies. At the lending end, bilateral data are less reliable. For instance, while CPIS, UNCTAD and ILB all report the stock of foreign capital held in, say, Iran, how much Iranian capital is invested in the rest of the world is harder to infer, and patchy. As a

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

result, we focus the bilateral sample on 23 OECD lending countries. This is prudent, given our estimation cannot control for all the heterogeneity in economies that are borrowing from the developing world. (In particular, we can only have host specific random effects). And there is much more heterogeneity, especially in terms of institutional quality, at the borrowing end since most developing countries are borrowers.

Things are different in the multilateral approach, where heterogeneity across borrowers is simply averaged away. Identification here rests exclusively on the cross section of lenders, which we would like to maximize. Combining the three data sources, we have reliable information on the stock of capital held abroad for 42 lending economies. The sample is broader than just OECD members. Why not use all 42 lending economies in the bilateral approach? Because some of the measurement error embedded in bilateral holdings is averaged away in the multilateral approach, but will potentially obscure our bilateral results.[9] Appendix A lists the countries in both samples.

Annual total private consumption and Gross Domestic Product are taken from the World Development Report issued by the World Bank. Growth rates are measured in real, per capita terms and converted in 2000 US dollars at market exchange rates. We have information between 1961 and 2003, although some countries have shorter samples. Coverage includes all 42 source countries included in our multilateral sample on international investment. Therefore, we estimate equation (3) on a panel of 42 countries by 41 years, or a maximum of $1,722$ observations. The bilateral sample, in turn, contains data for 23 lending economies and 54 borrowing economies, or a maximum of 966 independent country pairs. We therefore estimate equation (7) on a maximum of $39,606$ observations. What with missing or zero observations on international capital cross-holdings, and incomplete time coverage on consumption or output, we typically end up with about a third of that sample size.

Obstfeld (1995) argued that insurable income should be computed net of investment and government consumption, since both are absent from the model, and consumption be that of private households. In Appendix C, we investigate the robustness of our results in an alternative dataset, released by the United Nations' UNSTATS, where these alternative measures can be computed.[10] The data cover 1971-2004,

[9] To be precise, we construct the sample of 42 lenders using data on 23 OECD economies, whose foreign holdings are observed directly. For the remaining 19 developing economies, we infer foreign holdings on the basis of the observed liabilities observed there for source, reporting economies. In theory, we should have the relevant data on $54-23=31$ countries; we only retain the 19 for which no bilateral linkage with a large, developed, G7 economy was missing.

[10] We are grateful to Aidan Corcoran for making these data available to us. Nominal consumption, investment, government consumption and output come from UNSTATS. Growth rates are computed in real, per capita terms, using national Consumers Price Indices from the International Monetary Fund and population measures from the Penn World Tables. 2000 PPP exchange rates also come from the Penn World Tables. See Corcoran (2008) for details.

are focused on OECD economies, and are converted into USD using 2000 PPP exchange rates. This is potentially important, for our bilateral approach rests directly on international comparisons, as opposed to country-specific only measures in the conventional multilateral framework. PPP exchange rates are also used in several recent contributions, e.g. Sorensen et al (2007), Kose et al (2007) or Hoffman and Shcherbakova (2008).[11]

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. We ultimately seek to establish the existence of robust 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. The figure plots the corruption and enforcement variables against overall financial openness (upper two charts) and against our measure of multilateral risk sharing. The scatterplots suggest the positive relations are not driven by a few outliers.

3.2 Multilateral Evidence

This section discusses how we estimate equation (3). We present results pertaining to three definitions of $\phi_i(a)$. We first reproduce Lewis's approach using standard *de jure* measures of financial openness, focusing in particular on those compiled by Kaminsky and Schmukler (2003) for reasons of coverage. We then introduce proxies for the magnitude of international investment normalized by the economic size of source country i. At the aggregate level, we compute $\phi_i(a) = \phi_i^{Hold}$ as the total value of capital held abroad by country i relative to its Gross Domestic Product (GDP). We then decompose aggregate holdings into different assets, and compute

$$\phi_i^{Hold}(a) = \frac{k_i(a)}{GDP_i}$$

where $a = \{FDI, Portfolio, Loans\}$, and $k_i(a)$ denotes foreign assets a held in economy i. These controls, which we label "holdings", assess whether the *scale* of international investment in asset a affect consumption risk sharing.

[11] Equation (3) is estimated on a panel of 20 countries over 34 years, for a maximum of 680 observations. Equation (7) introduces a bilateral dimension, for a maximum of 35,670 observations. Once again however, limits on the availability of bilateral data on cross-holdings mean our end sample is substantially smaller.

In contrast, our third measures focus on the *composition* of international investment. We compute the shares of each asset into overall capital, i.e.

$$\phi_i^{Share}(a) = \frac{k_i(a)}{\sum_a k_i(a)}$$

We label these controls "shares", and note they are scale independent. Unlike "holdings", they are not computed from one data source only, and may therefore conflate putative measurement error arising from one dataset or the other. On the other hand, they provide direct evidence on the role of portfolio composition: clearly, while $\phi_i^{Hold}(a)$ may take perfectly correlated values across a, by definition $\phi_i^{Share}(a)$ cannot.

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 rely on the extreme persistence in international investment patterns. See for instance Portes and Rey (2005) or Lane and Milesi-Ferretti (2004).

Panel A in Table 1 reports some brief summary statistics. On the basis of the *de jure* index constructed by Kaminsky and Schmukler (2003), our sample of 42 lending economies is relatively open, with an average value of 0.66 when full openness corresponds to one. We do however cover the whole spectrum of possible values, so that our cross-section is informative. In proportion of GDP, it is portfolio investment that dominates foreign holdings in this sample, followed closely by bank loans. This is confirmed by our measures of portfolio shares, which suggest the average portfolio we observe is composed of 44 percent of equity and debt contracts, as against 30 percent for bank loans and 26 percent for FDI.

Table 2 shows our results. The estimation does not make use of the bilateral dimension of our data, as asset holdings are aggregated up across host countries. We focus on a panel of lending countries where we observe gross foreign capital holdings, and their various components. The results in column (i) suggest 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, while perfect risk sharing should imply $\beta = 0$. But as in Lewis (1996), conditioning in column (ii) on the degree of (de jure) financial openness has a direct impact on β. On the basis of the point estimates of β_2, consumption risk sharing is more likely in the sample of countries with above-mean (de jure) financial openness. In contrast, estimates of β are indistinguishable from unity in the complementary sample of relatively closed economies.

These results confirm Karen Lewis's conclusions in our sample, and they continue to hold once effective capital holdings are introduced to capture financial integration, in column (iii). The rows labelled "Risk-sharing" in Table 2 show the P-values corresponding to the hypothesis of perfect risk sharing, $H_0 : \beta_1 + \beta_2 \ \phi_i(a) = 0$. The two rows evaluate $\phi_i(a)$ at its mean or 90th percentile values, respectively. The Table suggests perfect risk sharing cannot be rejected at average or top levels of financial openness in the considered sample.

To be precise, Lewis (1996) also needs to control for consumption in local non-tradable goods to find evidence supportive of perfect income insurance, a conclusion also reached in Tesar (1993). Our country coverage makes that decomposition empirically impossible. But we cannot reject perfect risk sharing amongst the most open economies in our sample. Controlling for consumption in non-tradable goods would presumably only reinforce this conclusion. In fact, the first three columns in Table 2 vindicate the possibility that Lewis's findings indeed obtained because financially open economies invest more abroad, for the purpose of diversifying risk.

But they remain silent as to which class of asset achieves such diversification. The rest of the Table answers this question. Specifications (iv)-(vi) in Panel A indicate that risk sharing is higher (β_2 is negative) with large holdings of any of the three types of capital. Interestingly, we fail to reject the null of perfect risk sharing for above-average values of all three values of $\phi_i^{Hold}(a)$. Panel B makes this clearer. The negative and significant coefficient on ϕ_i^{Share}(Portfolio) suggests that it is in countries integrated via portfolio investment that risk sharing is high: Investment patterns heavy in equity or bonds tend to achieve consumption insurance. The result actually obtains irrespective of the overall amount of capital cross-holdings $\phi_i^{Hold} = \frac{\sum_a k_i(a)}{GDP_i}$, which is weakly significant in this instance. By contrast, large FDI shares -holding constant the overall level of cross border investment- are associated with low income insurance. The estimates of β are large and significant when ϕ_i^{Share}(FDI) is larger than its median value across countries. They are barely significant for small FDI holdings, as if it were there that income insurance were most prevalent. The predominant importance of portfolio investment is confirmed for top decile values of $\phi_i^{Share}(a)$; we only fail to reject perfect risk sharing for high values of ϕ_i^{Share}(Portfolio).

When measured as a share of GDP, bank loans also seem to deliver significant risk sharing. However, just as for FDI, portfolios heavy in bank loans seem to deliver little risk sharing. This might be an artefact of the way the dependent variable is computed. $\sum_a \phi_i^{Share}(a)$ equals one by definition, and 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.

Overall, Table 2 stresses that the extent of consumption insurance is heterogeneous across countries, 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 and bank loans have 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 or loans. Table C1 in Appendix C largely confirm these results in the alternative data constructed from the United Nations' UNSTATS. There, the special status of portfolio investment is apparent on the basis of both measures of cross-holdings, $\phi_i^{Hold}(a)$ and $\phi_i^{Share}(a)$.

According to the theory we developed in Section 2, these results suggest international investment in the form of FDI or loans entails transaction costs whose magnitude translates into poor risk diversification performance. In contrast, international trade in equities or bonds appears to be less costly, and thus readily delivers consumption insurance. This is intuitive, as equities or bonds are presumably traded on liquid markets, and transactions are relatively standardized. Such is not the case for FDI or bank loans. There, high transaction costs are a possibility, for instance in case of expropriation, which would effectively translate into $\tau(a)$ reaching its maximal value of 1. The possibility of expropriation of FDI or bank loans is in fact the object of a voluminous empirical literature. For instance, Wei (2000, 2006) finds that corruption is especially prone to deter FDI capital flows. 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. We come back to this literature in Section 4.

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 informative.

3.3 Bilateral Evidence

Equation (7) introduces a bilateral dimension in tests of consumption risk sharing, which we now discuss empirically. In practice, the symmetry between borrowing and lending economies featured in the model of Section 2 is far from supported in the data. The overwhelming majority of lending economies are developed, homogeneous, OECD countries, while developing countries form the majority of borrowers with vastly more diverse characteristics. Equation (7) is identified in a panel of country pairs, which given this asymmetry finds most of its variation at the receiving, borrowing end. Therefore, to minimize noise we

now restrict the cross-section of investing economies onto 23 OECD countries. It is unlikely much reliable information be contained in the remaining lenders in our data, as capital flows originating from developing economies are harder to measure. In addition, the multilateral approach just described focused precisely on a broader cross section of lenders - but limited the impact of measurement error by averaging investment across destination markets.

We use our data to capture $\phi_{HF}(a)$ in three broad categories. We first introduce a measure of the scale of bilateral investment. Following the multilateral approach, we compute $\phi_{HF}(a) = \phi_{HF}^{Hold}$, the total stock of assets held between countries H and F as a proportion of source GDP. Second, we bring to bear the bilateral dimension of our data and obtain a measure of the effective allocation of capital across available destinations,

$$\phi_{HF}^{Alloc}(a) = \frac{k_{HF}(a)}{\sum_i k_{Hi}(a)}$$

where $a = \{FDI, Portfolio, Loans\}$, and $k_{Hi}(a)$ denotes foreign assets a held in country i by H. 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 in the 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

$$\phi_{HF}^{Share}(a) = \frac{k_{HF}(a)}{\sum_a k_{HF}(a)}$$

This simply extends the "share" measure to a bilateral context. As before, $\phi_{HF}^{Share}(a)$ is scale independent, but might conflate measurement error present in different datasets. It is also the best variable to evaluate the impact of portfolio composition on consumption risk sharing.

Panel B in Table 1 report some brief summary statistics. Contrary to Panel A of the Table, minimal values of zero are now possible and frequent, since we are considering bilateral cross holdings. In addition, all three values for $\phi_{HF}^{Alloc}(a)$ have identical mean, because the average number of borrowing countries is the same across all three asset classes. However, the composition of international portfolios is slightly different when considering a bilateral dimension. In particular, while debt and equity continue to hold the lion's share, around 43 percent on average, it is now FDI that comes second, with an average share of 30 percent. Bank loans are now relatively less prevalent, with 27 percent of the average portfolio. This may reflect the broader sample of borrowing economies considered here.

Measurement error is a potentially damaging issue in estimating equation (7), where a bilateral dimension is of the essence. And indeed the econometric issues raised here 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 as in Spolaore and Wacziarg (2006). Suppose data in country i is mis-measured: 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.[12] We follow two avenues. First, we allow for clustered standard errors, along the source dimension. Second, we include country-pair fixed effects, which encapsulate unobserved country-specific factors. This will soak up precisely the kind of heteroskedasticity measurement error may create in equation (7).[13]

Our approach to dealing with measurement error has two desirable side effects. First, the inclusion of country-pair specific intercepts in equation (7) also accounts for permanent differences between countries H, F and the rest of the world. The intercept controls for the *average* values of Δgy_t^{HF} (or indeed of $\Delta gy_t^{HF} - \Delta gc_t^{HF}$) computed across all alternative pairings involving either H or F. From the standpoint of risk sharing, this controls for the average desirability of diversifying with alternative partners, provided of course it is time-invariant.[14] Second, Petersen (2005) discusses adequate corrections for cross-sectional dependence in residuals, a feature rather frequent in financial data. Using Monte Carlo simulation, he suggests clustering standard errors along the dimension suspected of dependence provides satisfactory estimates. In the present instance, our bilateral panel focuses on the international allocation of assets across destination markets. It is likely that standard errors be correlated within source investing economies, and therefore natural (and efficient) to cluster our standard errors accordingly.

Table 3 presents our results. Specification (i) suggests that income insurance, albeit not perfect, is present in the whole sample. The estimate of γ_1 is significantly positive, though also significantly away from one (the perfect risk sharing case). Interestingly from column (ii), risk sharing is significantly more prevalent when the total stock of asset cross-holdings is high. Column (iii) suggests this is not happening via goods trade, even though γ_3 is also positive and (weakly) significant as predicted by Cole and Obstfeld (1991). The rows labeled "Risk Sharing" report the P-values associated with the hypothesis of perfect risk sharing, $H_0 : \gamma_1 + \gamma_2\ \phi_{HF}(a) + \gamma_3\ X_{HF} = 1$. We evaluate $\phi_{HF}(a)$ and X_{HF} at their mean and 90th

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

[13] 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 (7).

[14] This is similar to the "multilateral resistance" term introduced in Anderson and van Wincoop (2003).

percentile values, respectively. Full consumption risk sharing exists for relatively few country pairs, but pertains to the most financially open ones, for top decile values of ϕ_{HF}^{Hold}.

Specifications (iv) to (ix) in Panel A introduce the "allocation" measures. As in the multilateral case, countries that are bigger recipients of investment unanimously appear to achieve significant risk sharing, no matter the type of asset used. In particular, estimates of γ_2 are always significantly larger for high values of FDI, $Portfolio$ or $Loans$. Once again, γ_3 comes out systematically positive and significant, as if goods trade afforded some international consumption risk sharing. But the control affects estimates of γ_2 only marginally, with slightly smaller point estimates when bilateral trade is included. The countries that are high recipients of OECD foreign direct investment, portfolio 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. Panel B takes up that question and introduces the "share" variables. By definition, these isolate different sets of borrowing countries and thus make it possible to investigate putative differences between types of assets. Columns (i) to (vi) in Panel B suggest FDI and bank loans continue to have a special status. International investment in the form of equities or bonds significantly increase the extent of risk insurance, as testified by positive and significant estimates of γ_2 in specification (iii) and (iv). In contrast, international portfolios heavy in FDI or bank loans once again appear to be associated with lower risk sharing. In fact, the "Risk Sharing" tests show that it is only for top decile values of ϕ_{HF}^{Share}(Portfolio) that we sometimes cannot reject the null of perfect bilateral risk sharing. This is true no matter the intensity of bilateral goods trade (with estimates of γ_3 always positive and significant), and irrespective of the overall magnitude of asset holdings, ϕ_{HF}^{Hold}.

Table 3 confirms our findings in a bilateral setting.[15] And Table C2 in the Appendix confirm them in the alternative data we constructed on the basis of UNSTATS information.There, the importance of goods trade in achieving consumption insurance appears to be muted, but we continue to find evidence of a special status of portfolio investment. In particular, columns (iii) and (iv) of Panel B suggest that perfect risk sharing cannot be rejected, at conventional confidence levels, for top decile values of ϕ_{HF}^{Share}(Portfolio). The same is not true of ϕ_{HF}^{Share}(FDI) or ϕ_{HF}^{Share}(Loans).

[15] We also verified that our results are robust across samples. In particular, they continue to hold in samples focused on the post Bretton Woods period, and when the universe of borrowing 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.

International investment in equities or bonds achieves significant international risk sharing. FDI and bank loans, on the other hand, do not. In our model, this means transaction costs are higher for international loans or foreign direct investment. This may simply stem from exogenous differences in $\tau(a)$. International banking or multi-national ventures may well represent inherently illiquid, non-standardized, technologically costly transactions. Investment on bonds or equity markets, on the other hand tends to be inherently seamless, even across borders. Even though we note our results may well partly reflect these exogenously given aspects, in what follows we propose an alternative explanation. We contend that at least a component of $\tau(a)$ is actually endogenous to institutional conditions in the borrowing economy, and in particular to the likelihood for expropriation. We next examine this possibility empirically.

4 The Role of Institutions

We now reason the value of $\tau(a)$ is at least partly endogenous to the institutional circumstances of the borrowing economy. We start with an empirical confirmation that measures of institutional quality do indeed limit risk diversification as implied by equation (7). This takes the standard indices of institutional quality as exogenous, and simply assumes high corruption or poor contract enforcement (say) directly imply high values of $\tau(a)$. But this is a static argument. In reality, expropriation, repudiation or corruption have dynamic consequences. 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.[16] 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.

Such dynamic threat may well deter borrowers from acting to the detriment of foreign investors, even though measured institutional quality suggests they could. In other words, $\tau(a)$ may remain relatively low even though institutions are not conducive of international investment, provided the borrowing economy is open to international markets. In what follows, we test this possibility in two contexts. First, we show that our measures of risk sharing remain high in corrupt, yet open economies. Second, we show that international capital continues to flow to countries with poor institutions, provided they are also open.

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

4.1 Risk Sharing and Institutions

We first verify our approach confirms recent results in the literature that poor institutions act to hamper international risk diversification. To do so, we augment equation (7) with measures I_F of institutional quality in the borrowing economy, and estimate

$$\begin{aligned} \Delta gy_t^{HF} - \Delta gc_t^{HF} &= \alpha_{HF} + \gamma_1 \, \Delta gy_t^{HF} + \gamma_2 \, I_F \cdot \Delta gy_t^{HF} \\ &\quad + \gamma_3 \, X_{HF} \cdot \Delta gy_t^{HF} + \eta_{it} \end{aligned}$$

We anticipate positive values for γ_2, as would happen if effective risk diversification were increasing with the quality of institutions (since perfect risk sharing obtains for $\gamma = 1$). This is similar to findings in Volosovych (2006), who provides evidence that an index of investor protection is a significant determinant of the estimated amount of risk sharing - although in a multilateral framework.

The possibility that openness and institutional quality be substitutes in enabling international risk sharing calls for a triple interaction term in equation (7). In particular, we estimate

$$\begin{aligned} \Delta gy_t^{HF} - \Delta gc_t^{HF} &= \alpha_{HF} + \gamma_1 \, \Delta gy_t^{HF} + \gamma_2 \, I_F \cdot \Delta gy_t^{HF} \\ &\quad + \gamma_3 \, X_{HF} \cdot \Delta gy_t^{HF} + \gamma_4 \, I_F \cdot X_{HF} \cdot \Delta gy_t^{HF} + \eta_{it} \end{aligned} \tag{8}$$

We anticipate negative estimates of γ_4, corresponding to our hypothesis that the detrimental effect of poor institutions (low I_F) is muted in open economies (high X_{HF}). Note that X_{HF} is still the exogenous component of bilateral trade intensity, as predicted by an instrumentation on standard gravity variables.

Panel C in Table 1 reports some summary statistics pertaining to the measures of institutional quality we use here. The indexes all increase with the perceived quality of institutions, and across all four measures, the sample contains substantial cross-sectional dispersion. Table 4 presents our results. Specifications (i), (iii) and (v) paint a clear picture: low institutional quality significantly hampers consumption insurance. In all cases, γ_2 is positive, and as a result γ is significantly larger in samples with good institutions, regardless of bilateral trade intensity. Interestingly however, our estimates imply that some risk sharing continues to be possible even with borrowers with less than median institutions. In fact, the point estimates imply γ continues to be significantly non zero in sub-samples with low 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 in international

markets occurs. Specifications (ii), (iv) and (vi) add the interaction term described in equation (8), and show this to be the case in our data. Estimates of γ_4 are negative in all three cases, and significantly so in two of them.

The point estimates in columns (ii), (iv) and (vi) of Table 4 illustrate how in our sample the only countries where consumption risk is virtually non-diversified are ones where institutions are poor *and* goods markets are closed. Elsewhere, and in particular where institutions are poor *but* trade is high, our point estimates imply consumption risk sharing is present and significant (i.e. statistically different from zero). Of course, the quality of institutions does affect risk sharing as a whole: holding openness constant, γ is higher for good institutions. This is consistent with findings in Kose, Prasad and Terrones (2007), who uncover little evidence of risk sharing in the developing world taken as a whole.

Table 5 illustrates these non linearities in a more vivid manner. We now split our sample four ways according to threshold values for both both openness and institutional quality, and estimate the original test in equation (6) on each sub-sample. The threshold values for institutional quality are reported in the Table, and were chosen to ensure four non-empty sub-samples. 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 taken from Kaminsky and Schmukler (2003) - reasoning that the dynamic retaliation mechanism we underline may equally well be at work via financial markets.

The Table illustrates how the only countries where consumption risk is virtually non-diversified 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 and significant. It is even higher within closed economies endowed with good institutions, where, in fact γ is not significantly different from its value in samples of open economies with good institutions. In both sub-samples, we fail to reject the null hypothesis of perfect risk sharing that $\gamma = 1$.[17]

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 three indices we use in Table 5. Isolating closed (or open) economies is different from focusing on countries with poor (or good) institutions.

[17] The fact that risk sharing be higher in financially open economies is found elsewhere in the literature. For instance, Bekaert, Harvey and Lundblad (2006) show that consumption volatility is lower in countries with liberalized capital accounts.

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 a specific non linear response of capital flows to the legal environment.

4.2 Capital Flows and Institutions

The impact of institutions on international capital flows is quickly becoming a well charted research area. For instance, Kho, Stulz and Warnock (2006) show that poor institutions and governance in host countries increase the home bias vis-à-vis them. Lane and Milesi-Ferretti (2004) show that rich countries with developed stock markets have larger assets and liabilities of equity. Alfaro, Kalemli-Ozcan and Volosovych (forthcoming) argue the main reason why capital does not flow from rich to poor country is the quality of institutions at the borrowing end.

We do not propose to have the definite word on how institutional quality affects the magnitude and composition of international capital flows. 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 in a way that depends on openness to world markets? If they did, it would imply the substitutability just documented for the extent of risk sharing also applies to observed capital flows. We speculate risk sharing is still possible in open economies, even those with poor institutions, because $\tau(a)$ is effectively lower - thanks to the threat of dynamic retaliation. In contrast, capital invested in economies that are both closed and have poor institutions must reflect motives different from mere diversification strategies because of high anticipated values of $\tau(a)$. Inasmuch as it stems from different values of the transaction costs $\tau(a)$, it stands to reason the non linearity observed in risk sharing patterns should also obtain in international investment patterns. We now check this to be the case.

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

$$\phi_{HF}^{Alloc}(a) = \alpha_H + \tilde{\alpha}_F + \delta_1 \, Op_F \cdot I_F + \delta_2 \, Op_F + \delta_3 \, I_F + \delta' Z_{HF} + \varepsilon_{HF} \tag{9}$$

where Z_{HF} denotes a vector of controls for bilateral investment patterns between lending country H and borrowing country F. Op_F denotes the index of current account openness compiled by the International Monetary Fund (which takes value one in open economies) and I_F is an index of institutional quality,

e.g. corruption. We focus on the "allocation" measures because we seek to identify the determinants of investment allocation across destination markets for a given asset class a. We control for source specific intercepts, and destination specific random effects. Since our focus is on the cross-section formed by borrowing economies, this is the most we can do. See Daude and Fratzscher (2008) for a more general setting.

We are interested in the sign of δ_1, which captures whether the combination of institutional quality and market openness in borrowing countries matters. Negative estimates mean the detrimental effects of poor institutions on the ability to attract foreign capital are muted in open economies. Our focus stands in stark contrast with a large literature, some of it briefly mentioned above, which has mostly taken interest in the signs of δ_2 or δ_3.

In Table 6 we present estimation results for all values of a in equation (9). Several results deserve mention. First and foremost it is always true that δ_1 is significantly 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 income per capita in the borrowing economy, because it 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) and Daude and Fratzscher (2008), this is not necessarily true of the estimates of δ_3.

The results in Table 6 go some way towards explaining some of the discrepancies in the literature as regards the expropriability of FDI. Several recent studies have linked poor institutions to FDI. Albuquerque (2003) reasons that direct investment is hardest to expropriate, because it contains intangible know-how 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. Hausmann and Fernandez-Arias (2000) confirm that a higher share of FDI seems to go to poorer countries and often ones with weaker institutions. Daude and Fratzscher (2008) use information on FDI, portfolio investment and loans to find that countries with poor institutions are mostly recipient of FDI.

At face value, these papers seem to conclude against our results. But 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 in-sample realizations of I_F and Op_F. The same is true of the end effects of openness on the international allocation of capital. 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 institutional 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 -and the resulting extent of consumption risk sharing- to the 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 Conclusion

We use a simple model to show how transaction costs on international investment alter standard consumption risk sharing relations. Financial assets that entail large transaction costs enable little international risk sharing, in the sense that the representative investor's consumption plans remain significantly correlated with her idiosyncratic income. We show this is true in the conventional consumption insurance test introduced by Lewis (1996), and we extend it to a bilateral context.

We implement the model-implied tests on multilateral and bilateral data. In both cases, international risk sharing is far from perfect. But the 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. Interestingly, the bulk of risk sharing is achieved via international holdings of equity or bonds. Portfolios

heavy in foreign direct investment or bank loans do not appear to provide much diversification, at least on the basis of observed aggregate consumption behavior.

The model suggests this happens because transaction costs are high for FDI and international bank loans. This may well be true because of technological, exogenous differences between asset classes. We pursue an alternative, non-competing explanation, and argue transaction costs are endogenous to borrowers' economic circumstances. The likelihood of expropriation or contract repudiation, especially worrisome for FDI or bank loans, depends on the quality of institutions at the borrowing end. But because of the prospect of dynamic retaliation on international markets, the deterrent impact of poor institutions is muted in open economies. Given institutional quality, closed countries cannot be excluded from anything, and engage in expropriation more readily. Investors anticipate this. As a result, we should still see consumption risk sharing and international capital inflows in economies endowed with poor institutions, provided they are also open to world markets. We show both non-linearities prevail in our data. Openness and institutions are substitutes when it comes to attracting capital for the purpose of risk diversification.

Appendix C: UNSTATS Data

Table C1: Multilateral Risk Sharing - $gc_t^i = \alpha_t + \beta_1\ gny_t^i + \beta_2\ \phi_i(a) \cdot gny_t^i + \varepsilon_{it}$

Panel A		De jure	De Facto	Holdings		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
gny_t^i	0.2446^{***} (0.067)	0.2565^{***} (0.076)	0.2987^{***} (0.087)	0.1827^{**} (0.082)	0.3035^{***} (0.075)	0.2413^{***} (0.082)
Interactions						
De jure		-0.0164 (0.115)				
ϕ_i^{Hold}			-0.0298^{*} (0.017)			
ϕ_i^{Hold}(FDI)				0.1197^{*} (0.059)		
ϕ_i^{Hold}(Portfolio)					-0.0541^{***} (0.009)	
ϕ_i^{Hold}(Loans)						0.0067 (0.072)
Risk-sharing (Mean)	-	0.00	0.00	0.00	0.00	0.00
Risk-sharing (90%)	-	0.01	0.12	0.00	0.00	0.05
R^2	0.17	0.17	0.17	0.17	0.18	0.17
Obs.	550	550	550	550	550	550

Panel B	Shares		
	(i)	(ii)	(iii)
gny_t^i	0.1933	0.7556***	0.1936
	(0.121)	(0.129)	(0.120)
Interactions			
ϕ_i^{Hold}	−0.0217	−0.0089	−0.0295
	(0.016)	(0.013)	(0.017)
ϕ_i^{Share}(FDI)	0.3617		
	(0.237)		
ϕ_i^{Share}(Portfolio)		−0.8966***	
		(0.264)	
ϕ_i^{Share}(Loans)			0.5278
			(0.453)
Risk-sharing (Mean)	0.00	0.00	0.00
Risk-sharing (90th pctile)	0.00	0.10	0.00
R^2	0.18	0.20	0.18
Obs.	550	550	550

Notes: All regressions include Source effects. gny_t^i denotes the growth rate in output net of investment and government consumption, gc_t^i denotes the growth in private households consumption. "De Jure" is financial openness in the Source economy as implied by Kaminsky and Schmukler (2003). ϕ_i^{Hold} are holdings of overall financial assets or the respective category measured in proportion of source country GDP, ϕ_i^{Share} are measured as a proportion of total holdings. "Risk-sharing" reports P values associated with the hypothesis of perfect risk sharing, H_0: $\beta_1 + \beta_2\ \phi_i(a) = 0$, for mean or top decile values of $\phi_i(a)$. Numbers in parentheses are standard errors, clustered by source country. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table C2: Bilateral Risk Sharing

$$\Delta gny_t^{HF} - \Delta gc_t^{HF} = \alpha_{HF} + \gamma_1\ \Delta gny_t^{HF} + \gamma_2\ \phi_{HF}(a) \cdot \Delta gny_t^{HF} + \gamma_3\ X_{HF} \cdot \Delta gny_t^{HF} + \eta_{HFt}$$

Panel A	Allocation					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Δgny_t^{HF}	0.9057^{***} (0.023)	0.9236^{***} (0.026)	0.9056^{***} (0.023)	0.9231^{***} (0.026)	0.9060^{***} (0.232)	0.9247^{***} (0.026)
Interactions						
ϕ_{HF}^{Hold}						
ϕ_{HF}^{Alloc} (FDI)	0.0459 (0.349)	0.0653^{*} (0.031)				
ϕ_{HF}^{Alloc} (Portfolio)			0.0479 (0.034)	0.0649^{*} (0.030)		
ϕ_{HF}^{Alloc} (Loans)					0.0427 (0.036)	0.0665^{**} (0.029)
X_{HF}		−7.7788 (5.014)		−7.4700 (4.948)		−8.3427 (5.072)
Risk-sharing (Mean)	0.00	0.01	0.00	0.01	0.00	0.01
Risk-sharing (90%)	0.00	0.03	0.00	0.03	0.00	0.03
R^2	0.84	0.85	0.84	0.85	0.84	0.85
Obs.	4,908	4,697	4,908	4,697	4,908	4,697

Panel B	Shares					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Δgny_t^{HF}	0.9359*** (0.038)	0.9373*** (0.039)	0.8706*** (0.042)	0.8751*** (0.046)	0.9235*** (0.039)	0.9289*** (0.042)
Interactions						
ϕ_{HF}^{Share} (FDI)	−0.0652 (0.100)	−0.0545 (0.100)				
ϕ_{HF}^{Share} (Portfolio)			0.0952 (0.077)	0.0911 (0.073)		
ϕ_{HF}^{Share} (Loans)					−0.0647 (0.139)	−0.0804 (0.139)
ϕ_{HF}^{Hold}		−5.0263** (1.754)		−4.9506** (1.786)		−5.2349** (1.811)
X_{HF}		4.0759 (6.808)		5.0936 (7.189)		5.6596 (6.385)
Risk-sharing (Mean)	0.00	0.01	0.00	0.01	0.00	0.01
Risk-sharing (90%)	0.02	0.05	0.17	0.19	0.01	0.01
R^2	0.84	0.85	0.84	0.85	0.84	0.85
Obs.	4,908	4,697	4,908	4,697	4,908	4,697

Notes: All regressions include country-pair effects, and standard errors are clustered by source country. Δgny_t^{HF} denotes the international difference in net output growth rates, and Δgc_t^{HF} the international difference in household consumption growth rates. X_{HF} denotes bilateral trade intensity, as predicted by bilateral distance, geographic area and the presence of a common border. ϕ_i^{Hold} are holdings of overall financial assets of the respective category measured in proportion of source country GDP, ϕ_i^{Share} are measured as a proportion of total holdings. "Risk-sharing" reports P values corresponding to the hypothesis of perfect risk sharing, H_0: $\gamma_1 + \gamma_2\ \phi_{HF}(a) + \gamma_3\ X_{HF} = 1$, for mean or top decile values of $\phi_{HF}(a)$ and X_{HF}. Numbers in parentheses are standard errors. * (**, ***) corresponds to 10% (5%, 1%) significance level.

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Table 1: Summary Statistics

Panel A: Multilateral Sample (in %)				Panel B: Bilateral Sample (in %)			
	Mean	Min	Max		Mean	Min	Max
De jure	0.66	0.0	1.0				
ϕ_i^{Hold}	176.4	5.2	834.0	ϕ_{HF}^{Hold}	1.0	0.0	17.2
ϕ_i^{Hold}(FDI)	42.7	0.1	281.0	ϕ_{HF}^{Alloc} (FDI)	7.4	0.0	100.0
ϕ_i^{Hold}(Portfolio)	79.5	0.1	652.8	ϕ_{HF}^{Alloc} (Portfolio)	7.4	0.0	100.0
ϕ_i^{Hold}(Loans)	54.2	2.0	462.8	ϕ_{HF}^{Alloc} (Loans)	7.4	0.0	100.0
ϕ_i^{Share}(FDI)	26.3	0.9	60.7	ϕ_{HF}^{Share} (FDI)	30.1	0.0	100.0
ϕ_i^{Share}(Portfolio)	44.1	1.3	78.9	ϕ_{HF}^{Share} (Portfolio)	42.9	0.0	96.9
ϕ_i^{Share}(Loans)	29.6	2.8	84.2	ϕ_{HF}^{Share} (Loans)	27.0	0.0	99.2

Panel C: Institutions			
	Mean	Min	Max
Expropriation	9.4	7.4	10.0
Repudiation	9.0	6.2	10.0
Corruption	2.9	1.3	5.5
Enforcement	6.7	3.8	8.9

Notes: Panels A and B reports percentages: of GDP for the "holding" measures, of total financial assets for the "share" measures and of total assets in each category for the "allocation" measures. Panel C uses effective index numbers.

Table 2: Multilateral Risk Sharing - $gc_t^i = \alpha_t + \beta_1\ gy_t^i + \beta_2\ \phi_i(a) \cdot gy_t^i + \varepsilon_{it}$

Panel A		De jure	De Facto	Holdings		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
gy_t^i	0.4927*	0.9011***	0.6311***	0.6514***	0.6297***	0.5352**
	(0.271)	(0.072)	(0.213)	(0.205)	(0.210)	(0.255)
Interactions						
De jure		−0.4866*				
		(0.254)				
ϕ_i^{Hold}			−0.2156			
			(0.151)			
ϕ_i^{Hold}(FDI)				−0.8883		
				(0.580)		
ϕ_i^{Hold}(Portfolio)					−0.3381	
					(0.256)	
ϕ_i^{Hold}(Loans)						−0.2383*
						(0.261)
Risk-sharing (Mean)	-	0.00	0.32	0.40	0.21	0.18
Risk-sharing (90%)	-	0.15	0.62	0.66	0.87	0.89
R^2	0.68	0.69	0.72	0.72	0.73	0.69
Obs.	1,344	1,111	1,344	1,344	1,344	1,344

Panel B	Shares		
	(i)	(ii)	(iii)
gy_t^i	0.2626	1.6226***	0.1768
	(0.411)	(0.232)	(0.322)
Interactions			
ϕ_i^{Hold}	−0.1828	−0.0842	−0.1308
	(0.148)	(0.117)	(0.641)
ϕ_i^{Share}(FDI)	1.7386		
	(1.108)		
ϕ_i^{Share}(Portfolio)		−1.9067***	
		(0.603)	
ϕ_i^{Share}(Loans)			1.6946***
			(0.641)
Risk-sharing (Mean)	0.00	0.00	0.00
Risk-sharing (90th pctile)	0.00	0.24	0.00
R^2	0.74	0.82	0.79
Obs.	1,344	1,344	1,344

Notes: All regressions include Source effects and Year effects. "De Jure" is financial openness in the Source economy as implied by Kaminsky and Schmukler (2003). ϕ_i^{Hold} are holdings of overall financial assets or the respective category measured in proportion of source country GDP, ϕ_i^{Share} are measured as a proportion of total holdings. "Risk-sharing" reports P values associated with the hypothesis of perfect risk sharing, H_0: $\beta_1 + \beta_2\ \phi_i(a) = 0$, for mean or top decile values of $\phi_i(a)$. Numbers in parentheses are robust standard errors, clustered by source country. * (**, ***) corresponds to 10% (5%, 1%)

significance level.

Table 3: Bilateral Risk Sharing

$$\Delta gy_t^{HF} - \Delta gc_t^{HF} = \alpha_{HF} + \gamma_1\ \Delta gy_t^{HF} + \gamma_2\ \phi_{HF}(a) \cdot \Delta gy_t^{HF} + \gamma_3\ X_{HF} \cdot \Delta gy_t^{HF} + \eta_{HFt}$$

Panel A	Holdings			Allocation					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Δgy_t^{HF}	0.6127***	0.5596***	0.5107***	0.5570***	0.5060***	0.5492***	0.4877***	0.5818***	0.5119***
	(0.143)	(0.139)	(0.172)	(0.134)	(0.167)	(0.145)	(0.165)	(0.142)	(0.172)
Interactions									
ϕ_{HF}^{Hold}		12.275***	7.497***						
		(3.469)	(2.358)						
ϕ_{HF}^{Alloc} (FDI)				0.9773***	0.6767**				
				(0.324)	(0.269)				
ϕ_{HF}^{Alloc} (Portfolio)						1.0191**	0.8438***		
						(0.397)	(0.264)		
ϕ_{HF}^{Alloc} (Loans)								0.5466**	0.4068***
								(0.200)	(0.125)
X_{HF}			21.012*		20.911*		22.098**		23.704**
			(11.672)		(11.708)		(8.448)		(10.224)
Risk-sharing (Mean)	-	0.01	0.03	0.00	0.02	0.01	0.01	0.01	0.01
Risk-sharing (90%)	-	0.35	0.16	0.07	0.08	0.02	0.03	0.01	0.02
R^2	0.56	0.59	0.61	0.59	0.62	0.60	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	Shares					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Δgy_t^{HF}	0.7138^{***} (0.116)	0.6059^{***} (0.156)	0.2176 (0.203)	0.1047 (0.181)	0.8008^{***} (0.122)	0.7058^{***} (0.149)
Interactions						
ϕ_{HF}^{Share} (FDI)	-0.3875 (0.249)	-0.3619 (0.235)				
ϕ_{HF}^{Share} (Portfolio)			0.7610^{***} (0.206)	0.7730^{***} (0.155)		
ϕ_{HF}^{Share} (Loans)					-0.8549^{***} (0.130)	-0.9219^{***} (0.137)
ϕ_{HF}^{Hold}		7.105^{***} (2.398)		10.015^{***} (2.151)		11.498^{***} (3.913)
X_{HF}		21.044^{**} (9.485)		18.484^{**} (7.573)		17.916 (13.207)
Risk-sharing (Mean)	0.02	0.01	0.00	0.00	0.00	0.00
Risk-sharing (90%)	0.02	0.01	0.07	0.03	0.00	0.00
R^2	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: All regressions include country-pair effects, and standard errors are clustered by source country. X_{HF} denotes bilateral trade intensity, as predicted by bilateral distance, geographic area and the presence of a common border. ϕ_i^{Hold} are holdings of overall financial assets of the respective category measured in proportion of source country GDP, ϕ_i^{Share} are measured as a proportion of total holdings. "Risk-sharing" reports P values corresponding to the hypothesis of perfect risk sharing, H_0: $\gamma_1 + \gamma_2\ \phi_{HF}(a) + \gamma_3\ X_{HF} = 1$, for mean or top decile values of $\phi_{HF}(a)$ and X_{HF}. Numbers in parentheses are standard errors. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table 4: Non-Linearities: Bilateral Risk Sharing

$$\Delta gy_t^{HF} - \Delta gc_t^{HF} = \alpha_{HF} + \gamma_1\ \Delta gy_t^{HF} + \gamma_2\ I_F \cdot \Delta gy_t^{HF} + \gamma_3\ X_{HF} \cdot \Delta gy_t^{HF} + \gamma_4\ I_F \cdot X_{HF} \cdot \Delta gy_t^{HF} + \eta_{HFt}$$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Δgy_t^{HF}	−0.0989	−0.3150	−1.3670***	−1.472***	0.0846	−0.0147
	(0.174)	(0.205)	(0.372)	(0.429)	(0.225)	(0.269)
Non-Linearity						
$I_F \cdot X_{HF}$		−8.137***		−5.781		−7.309**
		(1.443)		(11.269)		(3.471)
Interactions						
Enforcement	0.1080***	0.1435***				
	(0.015)	(0.021)				
Repudiation			0.2290***	0.2402***		
			(0.030)	(0.036)		
Corruption					0.1229***	0.1465***
					(0.021)	(0.032)
X_{HF}	18.224	73.282***	9.1340	64.024	17.476	51.008**
	(14.391)	(13.534)	(8.961)	(110.69)	(12.870)	(23.154)
R^2	0.65	0.66	0.72	0.72	0.63	0.63
Obs.	9,597	9,597	11,008	11,008	11,008	11,008

Notes: All regressions include country-pair effects, and standard errors are clustered by source country. X_{HF} denotes bilateral trade intensity, as predicted by bilateral distance, geographic area and the presence of a common border. "Enforcement" denotes the index of contract enforcement computed by La Porta et al (1998). Repudiation comes from ICRG and Corruption from the World Development Report. All values increase in the quality of the institutional environment. Numbers in parentheses are standard errors. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table 5: Bilateral Risk Sharing: Sample Splits - Financial Openness

$$\Delta gy_t^{HF} - \Delta gc_{tt}^{HF} = \alpha_{HF} + \gamma\ \Delta gy_t^{HF} + \eta_{HFt}$$

	Closed		Open	
	Low	High	Low	High
Enforcement	0.0869*** (0.014)	0.9112*** (0.064)	0.5311*** (0.102)	0.8970*** (0.055)
H_0: $\gamma = 1$	0.00	0.18	0.00	0.06
Obs	1,149	941	4,329	2,901
	High Risk	Low Risk	High Risk	Low Risk
Repudiation	0.0694*** (0.015)	0.8937*** (0.060)	0.2335* (0.122)	0.9148*** (0.027)
H_0: $\gamma = 1$	0.00	0.08	0.00	0.01
Obs	871	1,779	1,894	5,336
	High	Low	High	Low
Corruption	0.0714*** (0.014)	0.8831*** (0.073)	0.5175*** (0.109)	0.9207*** (0.085)
H_0: $\gamma = 1$	0.00	0.11	0.00	0.14
Obs	711	1736	3453	3777

Notes: The Table reports estimates of γ in equation (2). All regressions include country-pair effects, and standard errors are clustered by source country. 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. Corruption stems from the World Development Report, "high" means an indicator below 2.5. H_0: $\gamma = 1$ reports P values corresponding to the hypothesis of perfect risk sharing, $\gamma = 1$. Numbers in parentheses are standard errors. * (**, ***) corresponds to 10% (5%, 1%) significance level.

Table 6: Non-linearities: Capital Flows

$$\phi_{HF}^{Alloc}(a) = \alpha_H + \tilde{\alpha}_F + \delta_1\ Op_F \cdot I_F + \delta_2\ Op_F + \delta_3\ I_F + \delta' Z_{HF} + \varepsilon_{HF}$$

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	FDI	FDI	Portfolio	Portfolio	Loans	Loans
$Op_F \cdot I_F$	-0.0131^{**} (0.006)	-0.0162^{***} (0.007)	-0.0128^{***} (0.005)	-0.0109^{**} (0.050)	-0.0155^{**} (0.007)	-0.0232^{***} (0.010)
Op_F	0.0560^{**} (0.025)	0.0711^{**} (0.034)	0.0623^{***} (0.030)	0.0568^{***} (0.025)	0.0704^{***} (0.029)	0.1067^{***} (0.044)
I_F	0.0001 (0.002)	0.0088^{**} (0.004)	0.0006 (0.001)	0.0065^{*} (0.003)	-0.0001 (0.001)	0.0096^{**} (0.004)
Per Capita GDP		-0.8889 (0.688)		-0.5563 (0.411)		-1.5699^{**} (0.644)
GDP		0.0223^{***} (0.008)		0.0269^{***} (0.006)		0.0194^{***} (0.008)
Distance		-0.0223^{***} (0.010)		-0.0168^{***} (0.006)		-0.0311^{***} (0.007)
Language		0.0343^{***} (0.014)		0.0212^{*} (0.010)		0.0149 (0.011)
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: I_F denotes the corruption index compiled by the World Development Report. Op_F is the index of Current Account openness as collected by AREAR. "Language" takes value one when both source and host countries share the same language. Numbers in parentheses are standard errors, clustered by Host country. * (**, ***) corresponds to 10% (5%, 1%) significance level.

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