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## The Geography of Trade in Goods and Asset Holdings

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**Abstract**

Gravity equations have been a very useful and powerful tool to model international trade in goods and asset portfolios. However, the negative impact of distance (justified by transportation costs for trade in goods and by transaction costs for trade in assets) is surprisingly high.

This paper shows that bilateral asset holdings and trade in goods are strongly correlated. The causality can run in both ways: it could be that asset holdings enhances trade in goods and/or that trade in goods enhances asset holdings. This relationship raises the question about the robustness of the results obtained by the gravity literature when considering only one of these variables. To address this problem, we jointly study trade in goods and asset portfolios which lead us to build adequate instruments for trade in goods (mainly geographical determinants and transportation costs) and bilateral financial claims (legal and fiscal environments). Taking endogeneity into account, we find that the causality between bilateral asset holdings and trade in goods runs significantly in both ways and that these effects are strong. Furthermore, we find that distance very weakly affects asset holdings once trade in goods is included. In turn, the impact of distance on trade in goods remains significant but is reduced.

**Keywords:** gravity models, international finance, international trade, simultaneous equations.

**JEL classification:** F36, F10

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# 1 Introduction

The determinants of international asset holdings have recently received renewed attention. Existing models are mostly based on portfolio choice models and puts forward risk-sharing as the main motive for cross-border asset trade. However, this literature has been empirically extremely disappointing. Indeed, Capital Asset Pricing Models predictions do not fit data on international portfolios for two main reasons. First, those models were unable to replicate the size of the "home bias" in country portfolios. If twenty years ago the segmentation of financial markets could well explain the "home bias puzzle", it is not likely to be the case today. Second, countries seem to invest much more in geographically close economies. Portes and Rey [1999] highlight the very large impact of geography on cross-border equity flows: when the physical distance is doubled, capital flows are at least divided by two. They argue that informational asymmetries lead to higher transaction costs between distant economies. Moreover, as they point out, since distant economies should be a better hedge for regional risk, this result is hard to justify in a world where investors want to diversify their risk . Those results suggest that barriers to international investment are still large, which is at odds with the popular view of an intense and widespread financial globalization.

This puzzling effect of distance on capital flows leads to the following question: is it simply that distance directly affects international investment or is it that the negative impact of distance highlights another feature of globalization? In this paper, we argue that distance affects bilateral asset holdings mainly through its impact on trade in goods. The argument is the following: assume that trade in goods is a powerful determinant of asset portfolios. In that case, since distance, understood as transport costs, reduce international trade in goods, it is likely to also reduce bilateral asset holdings. Indeed, we show that the "distance puzzle" documented by Portes and Rey is drastically reduced once we control for trade in goods. Depending on the methodology, we find that the distance effect on asset holdings is either statistically unsignificant or divided by three. The remaining challenge is to explain why asset portfolios are induced by trade in goods.

Thus the second motivation of this paper is to analyze the complementarity between bilateral trade in goods and bilateral financial claims. Indeed, apart from the literature on foreign direct investment, international finance theory and international trade theory are mainly two separate fields[1]: however, there are good reasons to think that trade in goods and trade in assets are

[1] Obstfeld and Rogoff [2000], Rose [2000] and Rose and Spiegel [2002] are notable exceptions.

closely related. First, due to information asymmetries, it might be that entrepreneurs learn about each other by trading goods and that this private information enhances corporate financing (and vice versa). Second, in the complete markets model developed by Obstfeld and Rogoff [2000], trade costs (transportation costs or other barriers to international trade) induce a bias in investor portfolio towards domestic securities and securities of trading partners. As a consequence, trade patterns would reflect country portfolios. Lane and Milesi–Feretti [2003] test this model in a $N$–countries set–up and find the expected effects. However, the argument can easily be reversed: it may be that transaction costs in financial markets (pure transaction costs or informational costs) make agents exchange goods with countries with whom they can easily exchange securities. As a consequence, international investment patterns would impact trade flows.

Are those relations between trade and finance of first–order magnitude: in other words, can we still model international trade and international investment separately ? We investigate this question empirically and the answer is an unambiguous no: we find a very robust and significant effect of trade on financial asset holdings. Moreover, the causality runs significantly in both ways although the impact of asset holdings on trade in goods is smaller.

In line with Portes and Rey [1999], we consider the "home bias" as given and focus on the determinants of geographical asset holdings using a "gravity equation" set-up[2]. We use a dataset[3] which breaks down international banking assets by countries[4]. We find that informational frictions decrease bilateral financial claims, institutional and cultural proximity affect positively international asset holdings and standard financial motives have marginal effects. Those results are consistent with the findings of Portes and Rey. However, we also show that bilateral trade patterns are a very strong determinant of bilateral asset holdings.

In order to address the issue of reverse causality (here between bilateral trade and bilateral asset holdings), the use of good instruments is crucial. Finding instruments for bilateral trade is not a very difficult task as geographical variables and trade agreements can be used. However, different instruments for bilateral financial asset holdings are needed: using data on bilateral tax treaties (fiscal taxation of foreign capital and bilateral agreements to avoid double-taxation) and some institutional proximity variables, we provide a reasonable set of instruments which allows us to properly address the reverse causality issue. We estimate that a 10% increase in bilateral trade

[2] "Gravity models" in which bilateral trade flows are explained by the size of the two partners and the distance between them, have been used since the 1960s and have provided a powerful predictor of bilateral trade flows.

[3] The Bank for International Settlements (BIS) consolidated International Banking Statistics.

[4] We use stock data whereas Portes and Rey use equity flow data.

induces at least a 7% increase in bilateral financial assets holdings so that the effect of trade in goods on asset portfolios is quantitatively important. A 10% increase in bilateral financial asset holdings induces a 4% increase in bilateral trade. This empirical methodology also allows us to identify the channel through which some variables affect bilateral trade (resp. bilateral holdings of financial assets): we find that institutional and cultural proximity affect mainly bilateral asset holdings while, as mentioned before, distance affects country portfolio mainly through its impact on trade. This suggests that globalization has gone much further on the financial side than on the real side. Finally, as a by-product, we find some interesting results on the "distance puzzle"[5] in the gravity equation of international trade: depending on the methodology, we reduce the impact of distance on trade in goods by a 20 to 40 percents. In order to test the robustness of our findings, we reestimated our gravity models using the same empirical methodology but with a different dataset (the "Coordinated Portfolio Investment Survey") which breaks down securities holdings by countries[6]. All our results are confirmed qualitatively and quantitatively.

In section 2, we give some insights on the standard gravity models in international trade in goods and international asset portfolios : although it is not the main purpose of the paper, we reestimate the standard "gravity equations" for comparison purposes. In section 3, we properly address the question of the complementarity between international financial asset holdings and trade flows and give the estimates for the system of two simultaneous gravity equations. We analyze our main results and comment on the "correlation puzzle" that emerges from the empirics: we find that, even after controlling for trade and distance, investors still hold more financial assets from countries whose returns are positively correlated with their domestic stock market. We then try to give a satisfactory answer to this puzzle. In section 4, we give the links between our empirical results and the existing theory on the complementarity between trade in goods and trade in assets. In section 5, we conclude.

## 2 Gravity Models and the Distance Puzzle

The "gravity equation" has been extensively used in the international trade literature from both a theoretical and an empirical point of view. The idea is very simple: bilateral trade flows ($\text{Trade}_{ij}$) are explained by country size (GDP) and bilateral physical distance ($\text{Dist}_{ij}$). This simple rule

[5]What we call the "distance puzzle" is the fact that the negative impact of distance on bilateral trade is very large relative to transport costs (see Grossmann [1998]).

[6]This dataset is quite different to the BIS dataset as it includes a larger part of securities and excludes cross-border bank lending

leads to the following regression (where $\lambda$ and $\mu$ should be close to one):

$$\log(\text{Trade}_{ij}) = \alpha + \lambda \log(\text{GDP}_i) + \mu \log(\text{GDP}_j) - \beta \log(\text{Dist}_{ij}) + \varepsilon_{ij} \tag{1}$$

Portes and Rey [1999] apply this rule to asset trade and show that bilateral cross-border equity flows can also be described by market size and physical distance. From now on, a "gravity equation" refers to this type of rule.

## 2.1 Gravity Models for International Trade in Goods

### Theoretical Background

There is a huge literature on international trade based on a "gravity equation" framework. We will not focus on the theoretical foundations, we will just recall that a standard model with monopolistic competition and CES preferences where a set of countries are producing differentiated goods and where trading goods between country $i$ and country $j$ is subject to some trade costs ($\tau_{ij}$) gives the following "gravity equation"[7]:

$$\log(\text{Trade}_{ij}) = \alpha_{ij} + \log(\text{GDP}_i) + \log(\text{GDP}_j) - \theta \log(1 + \tau_{ij})$$

Once we suppose that trade costs are positively correlated with physical distance ($\text{Dist}_{ij}$) and that countries with a common border trade more ($\text{Border}_{ij}$)[8]:

$$\log(1 + \tau_{ij}) = \upsilon + \phi \log(\text{Dist}_{ij}) - \chi \text{Border}_{ij} + \zeta_{ij}$$

We easily deduce the standard "gravity equation" model:

$$\log(\text{Trade}_{ij}) = \alpha + \log(\text{GDP}_i) + \log(\text{GDP}_j) - \beta \log(\text{Dist}_{ij}) + \gamma \text{Border}_{ij} + \varepsilon_{ij}$$

One can get more sophisticated "gravity equation" considering more control variables: Frankel *et al.* [1995] and Frankel and Rose [2002] show that Trade Agreements and Currency Unions boost trade. Rauch [1999,2001] puts forward the informational content of international trade costs. In other words, trade between people who know each other is less costly and as a consequence people who belong to the same social networks trade more; for example, countries which share a common language or had colonial links should trade more. And the data confirm his arguments. Combes *et al.* [2002] also provide some insights about the informational content of trade costs using French data. Anderson and Marcouiller [1999] show the importance of the contractual environment and

[7] see Anderson [1979]

[8] Both variables are proxies for transportation costs.

find that "trade is reduced in response to hidden transaction costs associated with the insecurity of international exchange and a lack of contract enforcement".

**The "Distance Puzzle"**

The "gravity equation" has been extensively estimated with different sets of regressors ; however the coefficient on physical distance is systematically very high ($\beta$ between 0.8 and $1,2$ in many regressions): therefore, everything else equal, trade drops very fast with distance (a 10% increase in distance reduces trade by 8%). This estimate is huge compared to what transport costs would suggest (see Grossman [1998] or Anderson *et al.* [2003]) and has not decreased over time (although transportation costs have diminished). One can argue that the "gravity model" might be misspecified: an omitted variable (correlated with physical distance) might lead to an overestimation of $\beta$ but the difficulty consists in finding the missing variable. The right variable has not been found yet. Theory based on network effects (Rauch [1999]) or informational asymmetries (Portes and Rey [1999]) help to solve the "Distance Puzzle" but $\beta$ remains very high[9].

## 2.2 Gravity Models for International Financial Claims

The adaptation of the "gravity equation" framework to describe international trade in assets is much more recent. The seminal paper is Portes and Rey [1999][10] which shows that a "gravity equation" explains cross-border equity transactions at least as well as trade in goods transactions. They find that physical distance is also strongly negatively correlated with asset trade flows and argue that distance is a proxy for some informational costs. Using some proxies for information flows (telephone traffic between countries, newspaper circulation, bank branches), they confirm that informational flows enhance significantly asset trade. Although those information variables reduce the coefficient on distance, the latter remains high and very significant[11]: $\beta$ is around 0.7 in most specifications which makes the "distance puzzle" even worse than for trade in goods. As underlined by Portes and Rey, financial assets are "weightless" and are not subject to transportation costs. Moreover, if investors want to diversify their risk, they should bias their portfolio towards distant country assets as returns in those countries should be less correlated with domestic returns.

Some other papers use the "gravity equation" framework to describe bilateral foreign direct investment (Buch [2003], Mody *et al.* [2002,2003]): such a model accounts well for bilateral FDI

[9] Their estimate of $\beta$ ranges from 0.28 to 0.55 using a sample of industrialized countries.

[10] Buch[2002] and Papaionnaou [2004] test a Gravity Model for Bilateral Banking Flows and Lane and Milesi-Feretti [2003] for Bilateral Equity Holdings.

[11] $\beta$ is decreasing from 0.88 to 0.67.

flows. However, we think that the determinants of bilateral FDI flows are quite different from those of portfolio and debt flows. Especially, we should be very cautious with the impact of distance on FDI flows as FDI can be seen as a substitute of trade flows.

From a theoretical standpoint, Martin and Rey [1999] propose a model where a "gravity equation" of international trade in assets emerges. In their set-up, international trade in assets and international stock holdings coincides. We think that it is more natural to derive theoretically a "gravity equation" of stock holdings and the transposition to asset flows is not obvious. However, as underlined by Portes and Rey, when data on bilateral stocks and flows exist, it is easy to check that they are highly correlated.

Let's call $a_i$ the wealth of a country $(i)$ and $\omega_{ij}$ the share of wealth of country $(i)$ invested in country $(j)$. We assume that departures from the "world market portfolio" (which portfolio shares are $\frac{a_j}{a}$) are negatively related with transaction costs between the two markets $(\tau_{ij})$ and positively related with risk-adjusted return $(\pi_j)$ of country $j$. This leads to the following portfolio shares:

$$\omega_{ij} = \theta \frac{a_j}{a} (1 + \tau_{ij})^{-\gamma} \pi_j^{\delta}$$

If we denote $a_{ij}$ the wealth from country $(i)$ invested in country $(j)$, we get:

$$\log(\omega_{ij}) = \log\left(\frac{a_{ij}}{a_i}\right) = \alpha + \log(a_j) - \gamma \log(1 + \tau_{ij}) + \delta \log(\pi_j) + \varepsilon_{ij}$$

Which leads to the equivalent of the "gravity equation" in international trade:

$$\log(a_{ij}) = \alpha + \log(a_i) + \log(a_j) - \theta \log(1 + \tau_{ij}) + \delta \log(\pi_j) + \varepsilon_{ij}$$

Of course, the main question remains to exhibit determinants of transaction costs (pure transaction costs, taxation of profit repatriation, informational costs...).

## 2.3 Empirics

### 2.3.1 Data Presentation

Our dataset concerns the year 2001.

In order to estimate a "gravity equation" of international trade, we use data on bilateral trade flows from the dataset CHELEM (CEPII, Paris). The dependant variable ($\log(\text{Trade}_{ij})$) is the log of exports plus imports between country $i$ and country $j$. Because of sample restrictions in our dataset of country financial assets, we restrict our dataset on trade flows to 19 "source" countries ($i$) and 62 "destination" countries ($j$)[12].

For the "gravity equation" of bilateral international asset holdings, we use data on bilateral banking financial assets in 2001 from the Bank of International Settlements[13]. The dependant variable ($\log(\text{Asset}_{ij})$) is the log of financial claims in country ($j$) of banks of country ($i$). It might be surprising to use data on the banking sector to estimate our "gravity model". However our choice can be justified with three main arguments: first, the reliability of the dataset since it is often a very difficult task to collect data on stocks; second, banking financial assets do not include Foreign Direct Investment and as we said before there are good reasons to think that FDI does not obey the same rule as a standard geographical portfolio[14]; finally, to explain portfolio flows, we have to consider borrowing and lending since it is the main part of international investment (see Kraay *et al.* [2000])[15]. The main drawback of our dataset is that we cannot differentiate the type of assets (especially between equities, bonds and cross-border bank lending): indeed, it could be that informational costs differ for different types of assets (see Portes *et al.* [2001])[16]. In the appendix, table A.2 gives some insights on the nature of international banking assets: a disaggregation by sector shows that banking assets are for half interbank assets, the rest is financing of the corporate sector (35%) and of the public sector (15%). A disaggregation by type of assets show that a big part is loan and deposit (around two thirds) but a non-negligible part consist in negotiable securities (bonds and equities).

We use "source" and "destination" countries' GDPs ($\text{GDP}_i$ and $\text{GDP}_j$) to correct for market size[17]. We add the product of "source" country population and "destination" country Population ($\text{Pop}_i\text{Pop}_j$) to improve our measure of market size in the model for Trade in Goods[18].

The distance between the two main cities is used for bilateral distance ($\text{Dist}_{ij}$)[19]. In the Gravity Model of Trade in Goods, we add other geographical variables: $\text{Border}_{ij}$, which is unity if

[12] For a country list, see Appendix.

[13] See http://www.bis.org/statistics/bankstats.htm. To get more robust results, we average quaterly data for portfolio stocks in 2001.

[14] Moreover, banking assets include a marginal part of trade credit (as it is mainly inter-firm finance) which avoid any spurious relationship between asset holdings and trade in goods.

[15] Especially in developing countries where bond and equity markets are underdeveloped, see table A.2.

[16] However, we have for some countries (namely France and UK) a certain level of disaggregation between bonds & equities and cross-border lending. Geographical allocation of different types of assets have very similar patterns.

[17] One can argue that market capitalization could be a better proxy for market size in the Gravity Model of Financial Claims but we could not get such data for the whole sample. However, we used market capitalisation for a smaller sample and none of the results depend on the use of GDP.

[18] We first added GDP/Capita in the Asset Holdings Regression to control for the development of financial markets but the results were mixed because of interaction with our corruption variable. However, no one of the following results depend on this specification

[19] We first added a "Time Difference" variable to control for different working hours of stock markets but we dropped it because it did not modify any of the results.

country $i$ and $j$ have a common border and zero otherwise, $\text{Island}_{ij}$ which is one if either country $i$ or country $j$ is an island, $\text{Area}_i\text{Area}_j$, the product of the countries' areas, and $\text{LandLock}_{ij}$ the number of landlocked countries in the country pair.

Because physical distance is an imperfect indicator of transportation cost, we add data on transport costs: $\text{TranspCost}_{ij}$ is the bilateral cost of shipping a ton between two cities, using UPS services[20]. We are aware that this variable is no more than an estimate of transport costs as it is only airline freight (whereas the biggest part of goods transportation is sea freight or truck freight). However we argue that this variable is a good proxy.

We construct Trade Zone dummies when both countries belong to a Trade agreement in 2001. We have three dummy variables: $\text{NAFTA}_{ij}$ for the NAFTA Agreement, $\text{EC}_{ij}$ for the European Community and $\text{APEC}_{ij}$ for the Asia-Pacific Economic Cooperation. We do not consider currency union because the Euro Zone is the only one in our dataset and the effect is already captured by the European Community dummy.

To take into account the informational determinants of trade in goods and assets, we use a "Common Language" dummy ($\text{Language}_{ij}$) if country $i$ and country $j$ share the same language and a "Colonial Link" dummy ($\text{ColonialDep}_{ij}$) if country $j$ has been a colony of country $i$ (or vice versa).

Following Anderson *et al.* [1999] and Papaioannou [2004][21], we use an index of corruption for the "source" and the "destination" countries ($\text{Corruption}_i$ and $\text{Corruption}_j$) since it is likely that hidden bribes reduce transactions in international markets. This index is developed by *Transparency International*[22] and gives some insights on the degree of corruption as seen by business people, academics and risk analysts.

We also add some fiscal and legal determinants of transaction costs in financial markets:

- First, we use a dummy for the proximity of legal systems from La Porta *et al.* [1997,1998]. We distinguish between "common law" systems (or "English law"), "French law", "German law" and "Swedish law". The dummy variable $\text{Legal}_{ij}$ equals one when source and destination countries have the same legal system. Indeed, legal system similarities might also reduce information asymmetries and contracting costs.

[20] We compute the cost per kg, in USD.

[21] Papaionnou [2004] finds a large impact of institutional quality on cross-border bank flows.

[22] http://www.transparency.org, "Corruption Perception Index"

- Second, we use bilateral tax treaties[23] to describe the taxation of foreign capital. Although most of the countries we study have a residence–based tax system, they charge withholding taxes when foreigners repatriate dividends, capital gains or interests. To limit double–taxation, several bilateral tax treaties regulate those withholding taxes. We built two different variables that describe bilateral tax on dividends (and capital gains) and on interests (from loans, deposits or debt securities), resp. $\text{DividendTax}_{ij}$ and $\text{InterestTax}_{ij}$, in percents. Both of them should affect banking assets[24]. When such tax treaty does not exist, we use the regulatory tax rate applied to foreigners.

- Third, we suppose that countries that have old fiscal agreements should exchange more in financial markets for historical reasons. We add the age of the fiscal treaty (if there is one, zero otherwise) to catch this effect ($\text{FiscalTreaty}_{ij}$). We also add a variable $\text{TaxHaven}_{ij}$ to control for countries with very favorable fiscal treatment. $\text{TaxHaven}_{ij}$ is the number of tax havens in the country pair. We consider five Tax Havens in our sample, namely Belgium, Luxembourg, the Netherlands, Panama, and Switzerland.

Finally, we use stock market data (monthly stock prices in US $ from 1990 to 2000 of the main index of country stock markets[25]) to compute the means over variance of stock returns as a proxy for risk-adjusted return of the destination countries ($\text{Ret\_Risk}_j$) and the correlation between the stock returns of the country pair ($\text{Correlation}_{ij}$).

### 2.3.2 Estimation of a Gravity Model for Trade in Goods

We consider the following regression where $Z^1_{ij}$ is a set of control variables:

$$\log(\text{Trade}_{ij}) = \alpha + \lambda \log(\text{GDP}_i) + \mu \log(\text{GDP}_j) - \beta \log(\text{Dist}_{ij}) + \gamma Z^1_{ij} + \varepsilon_{ij}$$

Our estimations of the standard "gravity equation" are presented in table 1. We estimate the equation both with and without source country fixed–effects and region of destination fixed–effects[26] in order to correct for some unobservable country–specific variables that affect trade patterns (within–estimator[27]). With fixed–effect, we have the following regression:

$$\log(\text{Trade}_{ij}) = \alpha_i + \mu \log(\text{GDP}_j) - \beta \log(\text{Dist}_{ij}) + \gamma Z^1_{ij} + \delta \text{Reg}_j + \varepsilon_{ij}$$

[23] http://www.ibfd.org

[24] Those taxes are far from being negligible, ranging from 0% for some agreements to 40%, and as we mentioned before, equity shares are a non–negligible part of banking assets.

[25] Most data on stock returns are from Martin and Rey [2002].

[26] Our regional fixed–effect are: Europe, Central and Eastearn Europe, North America, Latin America, Asia–Oceania and Africa dummies.

[27] Note that the dimension across which we estimate is the destination–countries dimension rather than the time dimension as in conventionnal within–estimators.

| | $\text{Trade}_{ij}{}^{b}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\text{GDP}_i{}^{b}$ | $0.808^{**}$ (0.028) | | $0.791^{**}$ (0.028) | | $0.646^{**}$ (0.04) | | $0.643^{**}$ (0.039) | |
| $\text{GDP}_j{}^{b}$ | $0.819^{**}$ (0.024) | $0.777^{**}$ (0.031) | $0.824^{**}$ (0.024) | $0.797^{**}$ (0.03) | $0.672^{**}$ (0.036) | $0.669^{**}$ (0.041) | $0.687^{**}$ (0.036) | $0.702^{**}$ (0.04) |
| $\text{Pop}_i\text{Pop}_j{}^{b}$ | $0.063^{**}$ (0.025) | 0.025 (0.032) | $0.049^{**}$ (0.024) | 0.01 (0.031) | $0.248^{**}$ (0.04) | $0.182^{**}$ (0.047) | $0.221^{**}$ (0.04) | $0.146^{**}$ (0.046) |
| $\text{Dist}_{ij}{}^{b}$ | $-0.589^{**}$ (0.032) | $-0.701^{**}$ (0.041) | $-0.598^{**}$ (0.033) | $-0.657^{**}$ (0.042) | $-0.621^{**}$ (0.031) | $-0.708^{**}$ (0.04) | $-0.622^{**}$ (0.032) | $-0.652^{**}$ (0.041) |
| $\text{TranspCost}_{ij}{}^{b}$ | $-0.864^{**}$ (0.146) | $-0.569^{**}$ (0.182) | $-0.706^{**}$ (0.147) | $-0.318^{*}$ (0.181) | $-0.65^{**}$ (0.143) | $-0.41^{**}$ (0.178) | $-0.486^{**}$ (0.144) | $-0.147$ (0.177) |
| $\text{Border}_{ij}$ | $0.582^{**}$ (0.14) | $0.516^{**}$ (0.132) | $0.538^{**}$ (0.14) | $0.501^{**}$ (0.132) | $0.382^{**}$ (0.14) | $0.332^{**}$ (0.133) | $0.336^{**}$ (0.139) | $0.32^{**}$ (0.132) |
| $\text{Area}_i\text{Area}_j{}^{b}$ | $-0.097^{**}$ (0.013) | $-0.07^{**}$ (0.017) | $-0.101^{**}$ (0.013) | $-0.064^{**}$ (0.017) | $-0.107^{**}$ (0.013) | $-0.073^{**}$ (0.017) | $-0.112^{**}$ (0.013) | $-0.068^{**}$ (0.017) |
| $\text{Island}_{ij}$ | $0.119^{**}$ (0.051) | $0.133^{*}$ (0.077) | 0.044 (0.051) | 0.081 (0.075) | 0.072 (0.05) | 0.087 (0.075) | 0.003 (0.05) | 0.041 (0.073) |
| $\text{LandLock}_{ij}$ | $-0.252^{**}$ (0.064) | $-0.216^{**}$ (0.086) | $-0.249^{**}$ (0.064) | $-0.174^{**}$ (0.085) | $-0.223^{**}$ (0.062) | $-0.19^{**}$ (0.084) | $-0.215^{**}$ (0.062) | $-0.137^{*}$ (0.083) |
| $\text{ColonialDep}_{ij}$ | | | | | $0.47^{**}$ (0.126) | $0.597^{**}$ (0.123) | $0.529^{**}$ (0.124) | $0.669^{**}$ (0.121) |
| $\text{Language}_{ij}$ | | | | | $0.347^{**}$ (0.093) | $0.263^{**}$ (0.093) | $0.333^{**}$ (0.092) | $0.229^{**}$ (0.091) |
| $\text{Corruption}_i$ | | | | | $-0.04^{**}$ (0.02) | | $-0.042^{**}$ (0.02) | |
| $\text{Corruption}_j$ | | | | | $-0.113^{**}$ (0.019) | $-0.097^{**}$ (0.02) | $-0.104^{**}$ (0.019) | $-0.085^{**}$ (0.02) |
| $\text{EC}_{ij}$ | | | 0.052 (0.089) | $-0.016$ (0.095) | | | 0.099 (0.087) | 0.068 (0.093) |
| $\text{NAFTA}_{ij}$ | | | 0.427 (0.435) | 0.632 (0.408) | | | 0.56 (0.421) | $0.879^{**}$ (0.397) |
| $\text{APEC}_{ij}$ | | | $0.902^{**}$ (0.134) | $1.087^{**}$ (0.14) | | | $0.873^{**}$ (0.13) | $1.043^{**}$ (0.137) |
| Number of Obs. | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 |
| $R^2$ | 0.83 | 0.81 | 0.83 | 0.82 | 0.84 | 0.82 | 0.85 | 0.83 |
| Within Estimator[a] | No | Yes | No | Yes | No | Yes | No | Yes |

Table 1: Gravity Model for Trade in Goods (OLS Estimator)

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).

[a] OLS Estimator:

$$\log(\text{Trade}_{ij}) = \alpha + \lambda \log(\text{GDP}_i) + \mu \log(\text{GDP}_j) + \rho \log(\text{Dist}_{ij}) + \delta Z^{1}_{ij} + \varepsilon_{ij}$$

OLS Within–Estimator:

$$\log(\text{Trade}_{ij}) = \alpha_i + \mu \log(\text{GDP}_j) + \rho \log(\text{Dist}_{ij}) + \delta Z^{1}_{ij} + \gamma Reg_j + \varepsilon_{ij}$$

[b] in log.

Our estimate of "gravity models" of trade supports the consensus view of a strong and significant impact of physical distance on trade in goods; $\beta$ is estimated between 0.6 and 0.8 depending on the specification: this figure is in line with previous studies and as we already mentioned surprisingly high. Adding "Transportation Costs", "Language", "Colonial Link" and "Trade Zone" dummies does not solve the "distance puzzle" although those variables are significant[28]. Moreover, we find that corruption reduces trade significantly.

### 2.3.3 Estimation of a Gravity Model for International Financial Claims

We estimate the following regression where $Z_{ij}^2$ is a set of control variables:

$$\log(\text{Asset}_{ij}) = \alpha + \lambda \log(\text{GDP}_i) + \mu \log(\text{GDP}_j) - \beta \log(\text{Dist}_{ij}) + \gamma Z_{ij}^2 + \varepsilon_{ij}$$

Our estimation of the standard "gravity equation" is presented in table 2. Like for trade in goods, we add "source" country fixed–effects and region of destination fixed–effects in order to correct for some unobservable country–specific variables that might affect international investment patterns (within–estimator).

As in Portes and Rey, we find a strong negative impact of physical distance on bilateral asset holdings; $\beta$ is estimated between 0.4 and 0.7 depending on the specification[29] and the "distance puzzle" is worse than for trade flows. Adding "Language", "Colonial Link" and "Legal System" dummies as proxies for information flows helps to solve the puzzle (in our most complete specification, $\beta$ is equal to 0.43) but $\beta$ remains very high and significant. We confirm here the importance of information as our three variables boost significantly international asset holdings (more than trade in goods) and help to reduce the impact of distance.

Our fiscal variables are significant with the expected contribution[30]: the effects of fiscality are small but statiscally significant (indeed, a 10% increase of bilateral dividend withholding tax leads to 0.2% decrease in bilateral banking claims).

As expected, our measure of risk–adjusted return affects positively portfolio shares and corruption reduces significantly asset holdings (probably by reducing returns or by increasing risks).

[28]Surprisingly, trade zone dummies are not very robust, the APEC effect being the only robust (and positive) effect; $\beta$ is consistently estimated around 0.65.

[29]For comparison, in Portes and Rey, $\beta$ is around 0.6 in most specifications.

[30]The age of the fiscal treaty is the less robust one.

**The "Correlation Puzzle"**

More surprisingly, even when we control for distance and informational variables[31], we find that a country will hold more financial assets from a country whose stock market is highly correlated with his own one. This effect is quite large, very significant and absolutely at odds with the finance literature predictions. We refer to this result as the "Correlation Puzzle".

| | $\text{Assets}_{ij}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\text{GDP}_i{}^{\text{b}}$ | 1.051** (0.043) | | 1.068** (0.041) | | 1.109** (0.039) | | 1.07** (0.039) | |
| $\text{GDP}_j{}^{\text{b}}$ | 0.917** (0.033) | 0.657** (0.035) | 0.86** (0.032) | 0.704** (0.033) | 0.895** (0.033) | 0.784** (0.037) | 0.799** (0.034) | 0.716** (0.039) |
| $\text{Dist}_{ij}{}^{\text{b}}$ | −0.726** (0.047) | −0.539** (0.06) | −0.599** (0.045) | −0.422** (0.058) | −0.469** (0.047) | −0.438** (0.058) | −0.453** (0.047) | −0.426** (0.057) |
| $\text{ColonialDep}_{ij}$ | | | 1.357** (0.245) | 1.579** (0.223) | 1.415** (0.227) | 1.462** (0.218) | 1.428** (0.223) | 1.497** (0.219) |
| $\text{Language}_{ij}$ | | | 0.897** (0.187) | 0.779** (0.173) | 0.371** (0.179) | 0.52** (0.175) | 0.231 (0.176) | 0.407** (0.176) |
| $\text{Corruption}_i$ | | | −0.142** (0.039) | | −0.099** (0.037) | | −0.067* (0.036) | |
| $\text{Corruption}_j$ | | | −0.18** (0.021) | −0.019 (0.024) | −0.177** (0.021) | −0.075** (0.025) | −0.089** (0.023) | −0.024 (0.026) |
| $\text{LegalSystem}_{ij}$ | | | | | 0.637** (0.112) | 0.384** (0.108) | 0.592** (0.109) | 0.376** (0.107) |
| $\text{FiscalTreaty}_{ij}$ | | | | | 0.01** (0.003) | 0 (0.003) | 0.006* (0.003) | −0.002 (0.003) |
| $\text{DividendTax}_{ij}{}^{\text{c}}$ | | | | | −0.024** (0.005) | −0.025** (0.005) | −0.027** (0.006) | −0.026** (0.005) |
| $\text{InterestTax}_{ij}{}^{\text{c}}$ | | | | | −0.01 (0.007) | −0.003 (0.006) | −0.008 (0.007) | −0.006 (0.007) |
| $\text{TaxHaven}_{ij}$ | | | | | 1.913** (0.156) | 1.75** (0.258) | 1.8** (0.153) | 1.556** (0.259) |
| $\text{Correlation}_{ij}$ | | | | | | | 2.528** (0.301) | 1.925** (0.306) |
| $\text{Ret\_Risk}_j$ | | | | | | | 0.036** (0.018) | 0 (0.019) |
| Number of Obs. | 987 | 987 | 987 | 987 | 983 | 983 | 955 | 955 |
| $R^2$ | 0.57 | 0.58 | 0.64 | 0.62 | 0.70 | 0.65 | 0.72 | 0.66 |
| Within Estimator[a] | No | Yes | No | Yes | No | Yes | No | Yes |

Table 2: Gravity Model for Financial Banking Assets excluding Trade (OLS Estimator)

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).

[a] OLS Estimator: $\log(\text{Asset}_{ij}) = \alpha + \lambda \log(\text{GDP}_i) + \mu \log(\text{GDP}_j) + \rho \log(\text{Dist}_{ij}) + \delta \text{ Z}^2_{ij} + \varepsilon_{ij}$
OLS Within–Estimator: $\log(\text{Trade}_{ij}) = \alpha_i + \mu \log(\text{GDP}_j) + \rho \log(\text{Dist}_{ij}) + \delta \text{ Z}^2_{ij} + \gamma \text{ Reg}_j + \varepsilon_{ij}$

[b] in logs.

[c] in percents.

[31] We also controlled for GDP/Capita to be sure that this result was not just catching the fact that rich countries have higher correlations and higher trading volumes.

# 3 Asset Portfolios and Trade in Goods Complementarity ?

## 3.1 A misspecified regression ?

Our previous results and especially the strong impact of distance let us think that both "gravity equations" might be misspecified. The idea is very simple: let us suppose that for any reason trade in goods enhances asset trade (and vice et versa). Then, omitting bilateral trade in goods in the "gravity equation" for international asset holdings is likely to lead to a bias in the estimates of some coefficients. Especially, we might expect that the coefficient $\beta$ on distance in the "Asset Regression" is biased upwards as distance affects negatively bilateral trade in goods. Put differently, part of the effect of distance on international banking portfolios might go through trade. On the other hand, in the "gravity model" for trade in goods, there is no reason to exclude bilateral banking claims.

Figure 1 showing the strong correlation between Asset Holdings and Trade is in line with this argument.

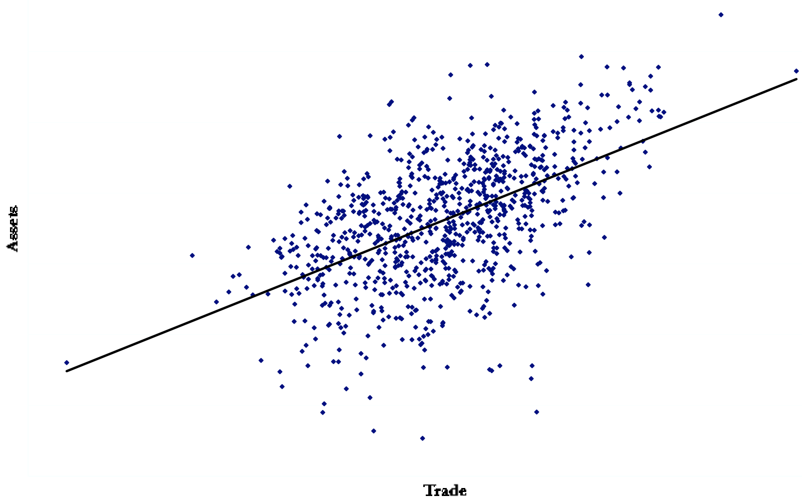


Figure 1: $\log(\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j})$ versus $\log(\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j})$.

In other words, if trade in goods and asset holdings are complementary, estimating independently the previous gravity models is not appropriate. The OLS estimator of the gravity models including financial asset holdings in the "trade in goods model" (resp. trade in the "financial assets model") confirms this intuition (see Appendix, table A.3, second column): trade seems to affect positively geographical portfolios (and respectively countries that have bilateral financial relationships trade more)[32]. These are first–order effects since for example, a 10% increase in bilateral trade leads to a 6% increase in bilateral banking claims. Moreover, we get that physical distance does affect bilateral asset holdings only through its impact on trade. On the other hand, its impact on trade in goods is a bit smaller.

Of course the variables we consider in those estimations are jointly determined and the estimation may suffer from an endogeneity bias. Still, what we show here is that we should take into account the complementarity of asset holdings and trade in goods in our gravity modeling.

From a theoretical point of view, the channel through which bilateral trade affects country portfolios is not clear and we will give some insights on the theoretical explanation in the last part. A simple story could be based on information asymmetries: because trading partners share information, this information flows through trade will enhance asset stocks (and vice et versa). But whatever the story, we need to confirm our empirical result and especially address the endogeneity problem.

## 3.2 Instrumental Variables Estimation

### 3.2.1 Identification Methodology

To confirm the strength of the reciprocal effect of bilateral trade in goods on bilateral asset holdings, we need to correct for endogeneity. This implies providing two sets of instruments for international trade and international banking assets. We do not need completely different instruments but to correctly estimate our system of equations, we need a large set of instruments that affect both differently (or, better, instruments that affect only one of our endogenous variables)[33]: we argue that the "exogenous" variables we presented in the first part will do the job.

Indeed, providing instruments for trade is not a very difficult task since we can use our set of geographical variables, our variable of transport costs and our trade zone dummies. For international asset holdings, we claim that our fiscal variables ($\text{DividendTax}_{ij}$, $\text{Interest}_{ij}$ and $\text{FiscalTreaty}_{ij}$), our dummy variable of legal system similarity and our informational variables ($\text{ColonialDep}_{ij}$, $\text{Language}_{ij}$) will provide good instruments. Of course, we use the whole set of instruments in

[32] We normalize both variables with GDP to be sure that we do not catch market size effects.

[33] In the extreme case, it is obvious that if we instrument both variables with distance, the system cannot be identified.

both First–Stage regressions. Then, the full set of instruments is[34]:

$$Z_{ij} = \left\{ \begin{array}{c} \text{Pop}_i\text{Pop}_j, \text{Dist}_{ij}, \text{TranspCost}_{ij}, \\ \text{Landlock}_{ij}, \text{Island}_{ij}, \text{Border}_{ij}, \text{Area}_i\text{Area}_j, \\ \text{ColonialDep}_{ij}, \text{Language}_{ij}, \text{LegalSystem}_{ij}, \\ \text{InterestTax}_{ij}, \text{DividendTax}_{ij}, \text{FiscalTreaty}_{ij}, \\ \text{APEC}_{ij}, \text{NAFTA}_{ij}, \text{EC}_{ij}, \text{Corruption}_i, \text{Corruption}_j \end{array} \right\}$$

leading to the following First–Stage Regressions:

$$\begin{cases} \log(\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j}) = \sigma_1 + \varphi_1 Z_{ij} + \xi_{ij}^1 \\ \log(\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}) = \sigma_2 + \varphi_2 Z_{ij} + \xi_{ij}^2 \end{cases}$$

Those instruments catch a large part of the variations[35], which allows us to estimate the full system. The high $R^2$ of our first–stage regression suggest that we do not have "weak instruments" problems (see Appendix Table A.4).

Then, using predicted value for Trade in Goods and Banking Assets, we estimate the following system (2SLS and 3SLS estimator):

$$\begin{cases} \log(\text{Assets}_{ij}) & = & \alpha_1 + \lambda_1 \log(\text{GDP}_i) + \mu_1 \log(\text{GDP}_i) + \rho_1 \log(\text{Dist}_{ij}) \\ & & +\phi_1 \log(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}) + \delta_1 Z_{ij}^1 + \varepsilon_{ij}^1 \\ \log(\text{Trade}_{ij}) & = & \alpha_2 + \lambda_2 \log(\text{GDP}_i) + \mu_2 \log(\text{GDP}_i) + \rho_2 \log(\text{Dist}_{ij}) \\ & & +\phi_2 \log(\widehat{\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j}}) + \delta_2 Z_{ij}^2 + \varepsilon_{ij}^2 \end{cases}$$

### 3.2.2 Empirical Results

Our 2SLS and 3SLS estimators without fixed–effects (see table 3, first two columns) confirm the results of the OLS estimator. Trade patterns affect strongly international asset holdings: the elasticity of bilateral trade with respect to bilateral banking claims is very high ($\phi_1$ is between 0.8 and 0.9 in all specifications) and remarkably robust: a 1% increase in bilateral goods trade induces almost a 1% increase bilateral financial asset holdings. Reciprocally, cross–border asset holdings between two countries affect positively their bilateral trade: the effect is very robust although less strong (the elasticity of bilateral asset holdings with respect to trade is between 0.4 and 0.5 in all specifications).

[34]We have excluded $\text{TaxHaven}_{ij}$ from the set of instruments because it was not statistically a valid instrument (it was not satisfying the hypothesis of exogeneity).

[35]The First–SLS gives an $R^2$ of 0.64 for $\text{Trade}_{ij}/[\text{GDP}_i\text{GDP}_j]$ and 0.40 for $\text{Asset}_{ij}/[\text{GDP}_i\text{GDP}_j]$ (see Appendix Table A.4).

This simultaneous equations set–up solves (partly) the "distance puzzle" mentioned before: for international asset holdings, we do find that distance does not matter anymore once we control for bilateral trade. This result is pretty intuitive as asset trade is not subject to transportation costs. Physical distance affects international investment only through its impact on trade. Respectively, we help to solve the "distance puzzle" for international trade although the effect is not as large as expected: indeed, the coefficient $\beta$ on distance in the "trade regression" drops to 0.4 in the most complete specification (which is significantly less than the 0.65 found earlier).

Moreover, we find that the informational variables affect trade in goods mainly through their impact on financial claims. The "Common Language" and the "Colonial Link" variables are not significant anymore in the "trade regression" once asset holdings is included. This suggest that informational asymmetries play a bigger role in international financial markets than in goods markets.

Our fiscal variables have the expected effect on asset holdings (and are generally significant): high withholding taxes on foreign capital reduce cross–border investment. Similarly, institutional variables (the quality of institutions[36], the proximity of legal systems and the existence of old fiscal agreements) still affects positively asset portfolios. The robustness of those variables is also remarkable. We also find that corruption has a smaller impact in the "trade regression" than in the "asset regression". Hidden bribes and corrupted counterparties seem to be a bigger concern for financial markets than for goods markets.

#### 3.2.3 Robustness Checks

**Estimating an upper bound for $\beta$**

Using bilateral distance as an instrument can cast doubt on our results since distance has a very powerful explaining power on bilateral trade: indeed, in the previous set–up, one could argue that we do not give much of a chance to distance to affect banking assets once we include distance–instrumented trade in the gravity equation for asset holdings. We do not think that the multicollinearity problem between instrumented trade and distance is that large as our estimates are quite consistent and robust. Morever, as shown in appendix (table A.4), the explanatory power of all our variables except distance in the First–Stage–Regression is far from being negligible.

However, we propose another identification methodology: we simply drop distance from the set of instruments (see Table 3, last two columns). Our first–stage regression still has a good

[36] Our "corruption" variable.

explaining power. This methodology can be seen as an extreme robustness check of the previous results: the instrumented variables are not estimated with distance, so that the estimated $\beta$s in the second and third stages are upper bounds of the effect of distance on assets holdings. Indeed, distance is not by itself a component of instrumented trade and the distance effect caught by asset holdings will be maximum.

We still find that trade in goods strongly affects portfolio holdings (the elasticity is still around 0.8) and that asset portfolios enhance trade in goods (elaticity around 0.5). This estimation strategy gives remarkably comparable estimates. However, the effect of distance on asset holdings remains significant. But with a point estimate smaller than 0.2 for $\beta$, the magnitude of the asset "distance puzzle" has been divided by three. Thus, the main message of the article remains unchanged: with this simultaneous equations set–up, we reduce dramatically the effect of distance on asset portfolios (and slightly the effect of distance on trade flows).

#### Within Estimation

Then, we replicate the 2SLS and 3SLS estimations with fixed–effects (see table A.3) and for both instrumentation methodologies (with and without distance as an instrument): adding "source" country fixed–effect and "regional destination" fixed–effect does not change any of the result neither qualitatively nor quantatively.

#### Using Securities Holdings

We propose exactly the same identification methodology using a different dataset on bilateral portfolio holdings: this dataset[37] provided by the IMF breaks down securities holdings by countries. It gives the aggregate bilateral portfolio stocks (including Equities, Long–Term Debt Securities and Short–Term Debt Securities) in USD for a large sample of countries in 2001; we restrict this dataset to our sample of source countries (excluding Taiwan) and destination countries. Those data include a larger part of negotiable securities than the BIS database but exclude bank lending.

We redo the same regressions with this new dataset on foreign capital stocks, using exacly the same simultaneous equations set–up (and the same instrumentation methodology): the results confirm our previous findings since we get remarkably similar estimates (see Appendix, table A.5). Asset Holdings and Goods Trade are enhancing each other and the elasticities we have estimated

[37] Coordinated Portfolio Investment Survey Data, http://www.imf.org/external/np/sta/pi/datarsl.htm

| | Dist $\in Z$ | | | | Dist $\notin Z$ | | | |
|---|---|---|---|---|---|---|---|---|
| | 2SLS[a] | | 3SLS[a] | | 2SLS[a] | | 3SLS[a] | |
| | Asset[b] | Trade[b] | Asset[b] | Trade[b] | Asset[b] | Trade[b] | Asset[b] | Trade[b] |
| $\text{GDP}_i$ [b] | 1.232** | 0.575** | 1.24** | 0.553** | 1.284** | 0.57** | 1.291** | 0.535** |
| | (0.042) | (0.043) | (0.041) | (0.033) | (0.043) | (0.042) | (0.042) | (0.035) |
| $\text{GDP}_j$ [b] | 1.019** | 0.634** | 1.03** | 0.562** | 1.016** | 0.631** | 1.023** | 0.575** |
| | (0.036) | (0.04) | (0.035) | (0.03) | (0.034) | (0.039) | (0.033) | (0.031) |
| $\text{Pop}_i\text{Pop}_j$ [b] | | 0.243** | | 0.295** | | 0.255** | | 0.312** |
| | | (0.045) | | (0.03) | | (0.044) | | (0.033) |
| $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ [b] | 0.875** | | 0.908** | | 0.753** | | 0.761** | |
| | (0.13) | | (0.129) | | (0.086) | | (0.086) | |
| $\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j}$ [b] | | 0.451** | | 0.391** | | 0.426** | | 0.398** |
| | | (0.081) | | (0.08) | | (0.074) | | (0.073) |
| $\text{Dist}_{ij}$ [b] | 0.13 | −0.501** | 0.164* | −0.397** | −0.195** | −0.581** | −0.184** | −0.556** |
| | (0.101) | (0.041) | (0.098) | (0.037) | (0.056) | (0.035) | (0.054) | (0.033) |
| $\text{TranspCost}_{ij}$ [b] | | −0.089 | | −0.984** | | 0.014 | | −0.46** |
| | | (0.216) | | (0.166) | | (0.221) | | (0.191) |
| $\text{Border}_{ij}$ | | 0.347** | | 0.316** | | 0.261* | | 0.046 |
| | | (0.145) | | (0.091) | | (0.143) | | (0.108) |
| $\text{Area}_i\text{Area}_j$ [b] | | −0.028 | | −0.044** | | −0.029 | | −0.037** |
| | | (0.019) | | (0.014) | | (0.018) | | (0.015) |
| $\text{Island}_{ij}$ | | 0.028 | | 0.045 | | 0.048 | | 0.109** |
| | | (0.057) | | (0.034) | | (0.056) | | (0.04) |
| $\text{LandLock}_{ij}$ | | −0.478** | | −0.367** | | −0.491** | | −0.448** |
| | | (0.075) | | (0.059) | | (0.074) | | (0.06) |
| $\text{ColonialDep}_{ij}$ | 1.03** | −0.22 | 1.055** | −0.2 | 1.089** | −0.188 | 1.114** | −0.202 |
| | (0.224) | (0.172) | (0.223) | (0.17) | (0.22) | (0.163) | (0.22) | (0.162) |
| $\text{Language}_{ij}$ | 0.156 | −0.171 | 0.132 | −0.103 | 0.135 | −0.146 | 0.106 | −0.082 |
| | (0.174) | (0.129) | (0.171) | (0.125) | (0.174) | (0.122) | (0.171) | (0.119) |
| $\text{Corruption}_i$ | −0.094** | −0.002 | −0.081** | −0.011 | −0.111** | −0.007 | −0.103** | −0.015 |
| | (0.036) | (0.024) | (0.035) | (0.023) | (0.036) | (0.023) | (0.035) | (0.023) |
| $\text{Corruption}_j$ | −0.13** | −0.062** | −0.123** | −0.06** | −0.136** | −0.071** | −0.133** | −0.081** |
| | (0.022) | (0.022) | (0.02) | (0.018) | (0.021) | (0.021) | (0.02) | (0.018) |
| $\text{EC}_{ij}$ | | −0.082 | | 0.156** | | −0.135 | | −0.061 |
| | | (0.093) | | (0.058) | | (0.093) | | (0.07) |
| $\text{NAFTA}_{ij}$ | | 0.253 | | 0.234 | | 0.259 | | 0.18 |
| | | (0.43) | | (0.264) | | (0.42) | | (0.301) |
| $\text{APEC}_{ij}$ | | 0.856** | | 0.417** | | 0.863** | | 0.523** |
| | | (0.134) | | (0.101) | | (0.131) | | (0.1) |
| $\text{LegalSystem}_{ij}$ | 0.455** | | 0.416** | | 0.395** | | 0.388** | |
| | (0.111) | | (0.092) | | (0.111) | | (0.095) | |
| $\text{FiscalTreaty}_{ij}$ | 0.012** | | 0.013** | | 0.005 | | 0.006** | |
| | (0.003) | | (0.002) | | (0.003) | | (0.002) | |
| $\text{DividendTax}_{ij}$ [c] | −0.011** | | −0.01** | | −0.013** | | −0.011** | |
| | (0.005) | | (0.004) | | (0.005) | | (0.004) | |
| $\text{InterestTax}_{ij}$ [c] | −0.009 | | −0.012** | | 0.001 | | 0 | |
| | (0.006) | | (0.004) | | (0.007) | | (0.005) | |
| $\text{TaxHaven}_{ij}$ | 1.924** | | 2.175** | | 1.894** | | 2.119** | |
| | (0.153) | | (0.102) | | (0.152) | | (0.116) | |
| Number of Obs. | 978 | 978 | 978 | 978 | 978 | 978 | 978 | 978 |
| $R^2$ | 0.73 | 0.87 | 0.73 | 0.87 | 0.73 | 0.87 | 0.73 | 0.87 |

Table 3: Simultaneous Gravity Models for Financial Assets and Trade (2SLS & 3SLS Estimator)

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).

[a] The estimated system is:

$$\begin{cases} \log(\text{Asset}_{ij}) = \alpha_1 + \lambda_1 \log(\text{GDP}_i) + \mu_1 \log(\text{GDP}_j) + \rho_1 \log(\text{Dist}_{ij}) + \phi_1 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_1 Z^1_{ij} + \varepsilon^1_{ij} \\ \log(\text{Trade}_{ij}) = \alpha_2 + \lambda_2 \log(\text{GDP}_i) + \mu_2 \log(\text{GDP}_j) + \rho_2 \log(\text{Dist}_{ij}) + \phi_2 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_2 Z^2_{ij} + \varepsilon^2_{ij} \end{cases}$$

where $\log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ and $\log\left(\widehat{\frac{\text{Asset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ are predicted values of Trade and Asset Holdings in the First–Stage Regression).

[b] in logs.

[c] in percents.

with banking assets are very stable. Moreover, we also find that distance affects very weakly securities holdings once we control for trade in goods and we reduce a little the distance puzzle in the Gravity Equation for Trade.

Those results with a different dataset show the robustness of our findings.

#### 3.2.4 Back to the "correlation puzzle"

Adding trade in the regression does not solve the "correlation puzzle" we mentioned in the first section. Indeed, we could have expected that this "correlation puzzle" was due to a misspecification of the regression. Because business cycles are more correlated between trading partners (see Frankel and Rose [1998], Imbs [1999]), we could have expected that the correlation variable was spuriously catching the effect of trade on cross–border asset holdings. As the "puzzle" remains once we control for trade, this intuition is not confirmed by the data (see table A.6).

We think that the "correlation puzzle" comes from an estimation bias in the regression. Indeed, stock market correlation may be endogenous, and adding it roughly in the regression may be inappropriate. There is very few empirical (and theoretical) work that takes the correlation[38] as endogenous. However we have good reasons to think that it is the case: well financial integrated markets have higher correlation of their business cycle (and in the extreme case, in a complete market world, countries should have perfectly correlated business cycles as they can insure their idiosyncratic risks).

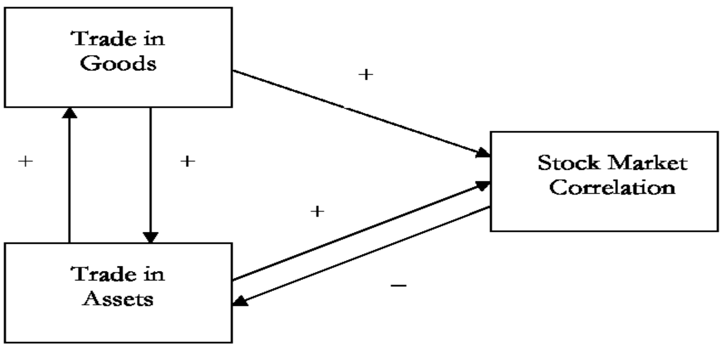


Figure 2: A way to solve the "Correlation Puzzle"

To correct for this endogenity bias, we propose to instrument the stock–market correlation

[38] Imbs [1999] is a notable exception even if he does not consider the impact of the correlation on effective bilateral flows.

(Correlation$_{ij}$) with our set of instruments[39]. Maybe surprisingly, physical distance is not the only powerful instrument and our First–Stage–Regression performs well. Our 2SLS and 3SLS regression with the predicted value of the correlation confirm our intuition (see table A.6 in appendix): once we control for endogeneity, the stock market correlation does not affect anymore bilateral financial asset holdings (or at least not robustly). We restore then the basis of the finance literature on portfolio choice which emphasizes diversification as the main motive for portfolio allocations.

# 4 Relation with the existing theoretical literature

Our empirical results on the two–way relationship between asset holdings and trade in goods reveal the necessity to consider the interaction between trade and finance in a common theoretical set–up. As we said in the introduction, there are few theoretical papers in international finance that deal with asset and goods trade complementarity. There is an extensive literature on Foreign Direct Investment (FDI) that shows that it might be either complementary to or substitute for Trade but we do not want to go much into it as we consider FDI as a very different type of asset (for a survey see Venables [1999,2000]).

There are two notable theoretical works that lead to a complementarity between asset holdings and trade in goods based on two different stories: Obstfeld and Rogoff [2000] and Spiegel and Rose [2002].

**Obstfeld and Rogoff [2000]: "The Consumption Hedging Story"**

Obstfeld and Rogoff [2000] argue that adding trade costs into a complete markets model with two countries (where agents can insure their consumption basket with Arrow–Debreu Securities) helps to explain the "home bias" puzzle. In their model, trade costs imply a bias towards domestic securities. They provide their model to solve the "home bias puzzle". However, a simple extension with many countries (and bilateral trade costs) would lead to a bias towards securities of trading partners (relative to other countries). Lane and Milesi–Feretti [2003] provide a N–country generalization of Obstfeld and Rogoff's model. In their model, trade in goods enhances asset portfolios as equity biases reflect in large measure goods market biases. They give empirical evidence of it although they do not address the endogeneity issue. They do not provide reasons why asset trade would increase trade in goods.

[39] To avoid multicollinearity problems, we do not instrument Trade in Goods since distance is a powerful predictor of stock market correlation

Even if it is difficult to test properly their model with our data, one way to confirm their theory is based on the different role played by imports and exports in their model; indeed, only trade costs on imports matters for bilateral asset stocks: agents wants to hedge their consumption basket and bias their portfolio towards securities of countries from which they import goods. Then, as long as bilateral imports and bilateral exports are not completely symmetrical (which is the case)[40], we should expect that imports patterns are the main determinant of geographical portfolio holdings.

We do a regression for bilateral financial assets including bilateral imports and bilateral exports and, surprisingly, exports are the main determinant of portfolio holdings (see Appendix, table A.7): of course, we should be cautious with this result as we cannot address the endogeneity problem with those two variables (because we do not have different instruments). However, the results are quite appealing and reveal that their story might not be the whole story.

#### Rose and Spiegel [2002]: "The Sovereign Risk Story"

Rose and Spiegel [2002] propose a model of international lending where bilateral lending is sustainable because of bilateral trade in goods. Their paper is in line with the "sovereign debt" literature (for a survey, see Eaton and Fernandez [1995]). Because debt contract cannot be enforced internationally, creditors lend to foreign countries only when they can threaten the debtor with a credible sanction in case of default[41]. In their model, penalties go through trade: creditors exclude their defaulting partners from trade relationship (cutting trade credits for example). In a sense, trade is a collateral which relaxes partly borrowing constraints. As a consequence, bilateral trade affects bilateral lending[42].

Even if this story is very attractive, it is hard to believe that sovereign risk is a major concern for industrialized countries and we find that the effect of bilateral trade on asset holdings is even larger for rich countries than for emerging countries (see Appendix, table A.8).

[40] Trade Costs might not be symmetrical either!
[41] In those models, the maximum sustainable lending is exactly the sanction value.
[42] The reverse causality is not considered.

## 5 Conclusion

This research links two literatures that have hardly met so far: international trade in goods and international asset portfolios. Numerous papers have shown that international trade in goods can be very well described by gravity models and some recent papers have pointed out that international asset portfolios could also be described by these kind of models: if the distance between two countries doubles, bilateral asset holdings are almost divided by two. This far from negligible impact seems somewhat puzzling, since geography should not shape asset trade in a globalized world.

Portes and Rey [1999] justifies the impact of distance on asset flows by information costs, distance acting as a proxy for the informational asymmetries. We chose here to investigate another idea, namely that trade in goods and asset holdings are mutually reinforcing. The strong impact of distance on asset holdings is the consequence of the complementarity between trade in goods and trade in assets.

Using bilateral data on international trade flows and international banking claims, we have examined what of the effect of distance remains once we take into account the fact that trade in goods and bilateral financial claims are mutually determined. The set of instruments we use to identify the system is one crucial aspect of this study. As usual in the related literature, we have used geographical variables and data on transport costs to instrument trade in goods. To instrument asset holdings, we followed LaPorta *et al.* [1997,1998] and used data on legal environments; furthermore, we built a set of variables which describe some aspects of the bilateral fiscal relationships between the countries (bilateral withholding taxes on dividends and interests and fiscal agreements).

Our results show that only trade in goods has an undisputable gravity structure, *i.e.* a structure in which distance (understood as a proxy for transportation and transaction costs) is a major determinant. The asset part of the system we have estimated shows that the gravity structure almost vanishes when trade in goods is included: the magnitude of the so–called distance puzzle is divided by three or more.

The existing scenarios (Obstfeld and Rogoff's consumption hedging, Rose's sovereign risk) cannot be formally eliminated so far, even if we have shown that some of our results cast doubt on each one of them. Another assumption based on scale economies in the transaction technology could be a more natural match to our result.

Let us suppose that transaction costs in the goods markets (resp. in the asset market) are negatively correlated to the volume of transactions in both markets. Transaction costs on the cross–country foreign exchange markets could potentially justify this assumption. Indeed, the larger the volume of trade between two countries, the more liquid and efficient are foreign exchange markets and consequently the more attractive the financial transactions between the two. The appealing part of such an assumption is that it also explains the reverse causality. Frankel and Rose [2002] reveal a surprisingly large effect of currency unions on trade[43], which is consistent with our assumption since a common currency reduces transaction costs on both markets. Thus, the increase in bilateral trade in goods is reinforced by an increase in bilateral asset holdings (and vice-versa), leading to a kind of "accelerator effect". One would argue that transaction costs are rather small especially between developed countries[44] : however according to our assumption, it is not surprising that those costs are small between countries that trade a lot in international markets. The estimation of those trade costs is probably more than ever on the agenda.

Moreover, it would be misleading to consider transaction costs in a purely literal sense. In line with Portes and Rey's paper, it might be that both trade in assets and trade in goods are subject to some information costs : in other words, because information flows (or social networks) positively affect both cross–border finance and trade, trade in goods and trade in assets become in a sense complementary: firm managers learn about each other by trading goods and/or securities. Therefore, trading in the goods market reduces informational asymmetries in the financial markets (and vice versa). Those information spillovers would need to be very large to have the observed result but we do think that this explanation is the most convincing. We have plenty of anecdotal evidence where an exporting firm brings its financial intermediary to help financing an investment plan of a potential client. We guess that the financial intermediary can propose better credit terms because it can get private information from its exporting client. As a consequence trade in goods enhances corporate financing. The apparent gravity structure of asset trade would therefore rely mainly on information flows induced by trade in goods.

However, we do not pretend to submit a full theory explaining what we observed in the data. We just want to insist on the robustness and the strength of our empirical results which shed light on the necessity to model trade and financial linkages together. It is a new challenge for the

[43] We can not replicate those results because of sample limitation.
[44] Transaction costs with developing countries are difficult to estimate.

economic theory. Furthermore, our framework leads to an other puzzle: the higher the correlation between two countries stock returns, the larger the volume of asset trading between the two. This result still holds true once we control for trade in goods. This reinforces the need for a theoretical study on the interactions between trade in goods, trade in assets and diversification.

Finally, these results raise some interesting questions about the coherence of liberalization policies. We show in this paper that trade in goods and in assets reinforce each other. Trade policies and capital account liberalization cannot be considered independently. This kind of policy should be therefore thought of in a cost–benefit framework.

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# 6 Appendix

## 6.1 Data

### 6.1.1 Data Sources

- **Bilateral Exports and Imports**: in 2001, in US Dollars from the CHELEM dataset (Centres d'Etudes Propectives et d'Informations Internationales, CEPII, Paris).

- **Bilateral Financial Banking Assets**: in US dollars, average over quaterly data in 2001, from the Bank of International Settlements.

- **Bilateral Securities Holdings**: in US dollars, in 2001, from the Coordinated Portfolio Investment Survey, http://www.imf.org/external/np/sta/pi/datarsl.htm

- **GDP and Population**: from the International Financial Statistics.(GDP in US dollars in 2001, exchange rates used are also from the IFS).

- **Bilateral Distance**: in km, from S–J Wei's website and from various sources ("How far is it ?", http://www.indo.com/distance )

- **Transportation Costs**: cost of shipping a ton between the two main cities of two countries (in USD, per kg) with UPS. From UPS websites of the different source countries.

- **Other Geography Variables:** various sources (especially A. Rose's website)

- **Trade Agreements** : various sources (especially A. Rose's website)

- **Corruption**: "Corruption Perception Index" from *Transparency International*[45] ranking from 0 to 10 (actually we use the opposite of the standard index to have the maximum value for the most corrupted country)

- **Common Language and Colonial Link**: various sources (for colonial link, mainly summaries of country history in Encyclopedias.)

- **Legal Variable**: mainly La Porta *et al.* [1998], various sources for missing countries [46].

- **Fiscal Variables:** IBFD online products (http://www.ibfd.org); Latin American Taxation Database, European Taxation Database, Asia–Pacific Taxation Database, Tax Treaties Database.

- **Stock Market Returns**: monthly data from 1990 to 2000 in UDS Dollars from Martin and Rey [2002] (World Bank and Bloomberg) and some stock markets websites.

[45] http://www.transparency.org
[46] http://www.llrx.com

### 6.1.2 Geographical Sample

- **Source Countries**: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland,Taiwan, United Kingdom, United States;
- **Destination Countries**:
  - **Europe**: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland,United Kingdom;
  - **Central & Eastern Europe**: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Israel, Lithuania, Poland, Russia, Slovakia, Slovenia, Turkey
  - **Asia & Oceania**: Australia, China, Hong Kong, India, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore, South Korea, Taiwan, Thailand
  - **North America**: Canada, United States
  - **South America**: Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Panama, Peru, Uruguay, Venezuela
  - **Africa**: Algeria, Côte d'Ivoire, Egypt, Morocco, Nigeria, South Africa, Tunisia

## 6.2 Empirical Results

| | Mean | Std | Median | Min | Max | N |
|---|---|---|---|---|---|---|
| $\log(\text{Assets}_{ij})$ | 6.559 | 0.082 | 6.694 | 0 | 13.160 | 987 |
| $\log(\text{CPIAssets}_{ij})$ | 5.76 | 3.22 | 5.93 | –0.69 | 13.13 | 1005 |
| $\log(\text{Trade}_{ij})$ | 7.034 | 0.060 | 7.038 | 1.530 | 12.769 | 1152 |
| $\log(\text{GDP}_i)$ | 13.174 | 0.037 | 12.555 | 11.650 | 16.126 | 1159 |
| $\log(\text{GDP}_j)$ | 11.731 | 0.046 | 11.677 | 8.631 | 16.126 | 1159 |
| $\log(\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j})$ | –18.662 | 0.059 | –18.597 | –24.931 | –12.658 | 987 |
| $\log(\frac{\text{CPIAssets}_{ij}}{\text{GDP}_i\text{GDP}_j})$ | –19.36 | 2.39 | –19.10 | –27.73 | –11.42 | 1005 |
| $\log(\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j})$ | –18.057 | 0.038 | –18.035 | –23.444 | –12.944 | 1152 |
| $\log(\text{Distance}_{ij})$ | 8.249 | 0.032 | 8.693 | 4.025 | 9.884 | 1159 |
| $\text{TranspCost}_{ij}$ | 1.150 | 0.23 | 1.156 | 0.134 | 1.571 | 1098 |
| $\text{Area}_i\text{Area}_j$ | 24.738 | 0.077 | 24.550 | 16.840 | 32.956 | 1159 |
| $\text{Return–Risk}_{ij}$ | 0.834 | 0.076 | 0.866 | –11.274 | 8.257 | 1064 |
| $\text{Correlation}_{ij}$ | 0.275 | 0.006 | 0.271 | –0.255 | 0.812 | 1064 |
| $\text{Corruption}_i$ | –7.716 | 0.038 | –7.7 | –5.2 | –9.7 | 1159 |
| $\text{Corruption}_j$ | –5.595 | 0.07 | –4.9 | –1.6 | –9.7 | 1140 |
| $\text{InterestTax}_{ij}$ | 8.505 | 0.217 | 10 | 0 | 40 | 1155 |
| $\text{DividendTax}_{ij}$ | 13.429 | 0.237 | 15 | 0 | 40 | 1155 |
| $\text{FiscalTreaty}_{ij}$ | 15.862 | 0.450 | 14 | 0 | 76 | 1159 |

Table A. 1: Descriptive Statistics

Table A. 2: International Banking Assets Breakdown by Types of Assets and Sectors (in Billions USD, 2001)

| | | Total Assets | Loans and Deposits | Bonds and Equities | Loans and Deposits (%) | Bonds and Equities (%) |
|---|---|---|---|---|---|---|
| **Developed** | Europe[a] | 3487.3 | 2363.0 | 1124.2 | 67 | 33 |
| | North–America | 2387.5 | 1684.9 | 702.5 | 70 | 30 |
| | Asia–Oceania | 632.0 | 519.0 | 113.0 | 82 | 18 |
| **Emerging** | Africa | 42.6 | 37.3 | 5.4 | 87 | 13 |
| | Asia[b] | 255.4 | 213.6 | 41.7 | 83 | 17 |
| | Eastern Europe | 142.2 | 114.2 | 28.1 | 80 | 20 |
| | South America[c] | 259.0 | 193.3 | 65.7 | 74 | 26 |
| Financial Centers[d] | | 1086.2 | 965.8 | 120.5 | 89 | 11 |
| Total | | 8292.3 | 6091.1 | 2201.2 | 73 | 27 |

| Disaggregation by sector (%) | Banking Sector | Public Sector | Corporate Sector | Unallocated |
|---|---|---|---|---|
| | 48 | 16 | 35 | 1 |

[a]Excluding Luxembourg, Switzerland and United Kingdom.
[b]Excluding Hong–Kong and Singapore.
[c]Excluding Panama.
[d]Hong–Kong, Luxembourg, Panama, Singapore, Switzerland and United Kingdom.

Table A. 3: Simultaneous Gravity Models for Financial Assets and Trade.

| | | | | | | Dist $\in Z$ | | | | Dist $\notin Z$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Naive OLS | | System OLS | | 2SLS | | 3SLS | | 2SLS | | 3SLS | |
| | | Asset | Trade | Asset | Trade | Asset | Trade | Asset | Trade | Asset | Trade | Asset | Trade |
| **Normal**[a] | $\text{dist}_{ij}$ | $-0.469^{**}$ (0.047) | $-0.622^{**}$ (0.032) | $-0.09$ (0.057) | $-0.588^{**}$ (0.03) | 0.13 (0.101) | $-0.501^{**}$ (0.041) | $0.164^{*}$ (0.098) | $-0.397^{**}$ (0.037) | $-0.195^{**}$ (0.056) | $-0.581^{**}$ (0.035) | $-0.184^{**}$ (0.054) | $-0.556^{**}$ (0.033) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | $0.584^{**}$ (0.054) | | $0.875^{**}$ (0.13) | | $0.908^{**}$ (0.129) | | $0.753^{**}$ (0.086) | | $0.761^{**}$ (0.086) | |
| | $\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | | $0.165^{**}$ (0.015) | | $0.451^{**}$ (0.081) | | $0.391^{**}$ (0.08) | | $0.426^{**}$ (0.074) | | $0.398^{**}$ (0.073) |
| | Number of Obs. | 983 | 1150 | 979 | 982 | 978 | 978 | 978 | 978 | 978 | 978 | 978 | 978 |
| | $R^2$ | 0.70 | 0.85 | 0.73 | 0.87 | 0.73 | 0.87 | 0.73 | 0.87 | 0.73 | 0.87 | 0.73 | 0.87 |
| **Within**[b] | $\text{dist}_{ij}$ | $-0.438^{**}$ (0.058) | $-0.652^{**}$ (0.041) | $-0.098^{*}$ (0.058) | $-0.57^{**}$ (0.031) | 0.09 (0.099) | $-0.531^{**}$ (0.039) | 0.129 (0.097) | $-0.439^{**}$ (0.033) | $-0.184^{**}$ (0.054) | $-0.574^{**}$ (0.037) | $-0.162^{**}$ (0.052) | $-0.574^{**}$ (0.034) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | $0.447^{**}$ (0.056) | | $0.753^{**}$ (0.133) | | $0.785^{**}$ (0.132) | | $0.614^{**}$ (0.087) | | $0.625^{**}$ (0.086) | |
| | $\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | | $0.137^{**}$ (0.016) | | $0.467^{**}$ (0.094) | | $0.469^{**}$ (0.094) | | $0.462^{**}$ (0.092) | | $0.473^{**}$ (0.091) |
| | Number of Obs. | 983 | 1150 | 979 | 982 | 978 | 978 | 978 | 978 | 978 | 978 | 978 | 978 |
| | $R^2$ | 0.65 | 0.83 | 0.64 | 0.86 | 0.82 | 0.90 | 0.82 | 0.90 | 0.82 | 0.90 | 0.82 | 0.90 |

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).
Point estimates of the control variables are not shown here but are available on request.

[a] Estimated equations :

$$\begin{cases} \log(\text{Asset}_{ij}) = \alpha_1 + \lambda_1 \log(\text{GDP}_i) + \mu_1 \log(\text{GDP}_j) + \rho_1 \log(\text{dist}_{ij}) + \phi_1 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_1 Z^1_{ij} + \varepsilon^1_{ij} \\ \log(\text{Trade}_{ij}) = \alpha_2 + \lambda_2 \log(\text{GDP}_i) + \mu_2 \log(\text{GDP}_j) + \rho_2 \log(\text{dist}_{ij}) + \phi_2 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_2 Z^2_{ij} + \varepsilon^2_{ij} \end{cases}$$

where $\log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ and $\log\left(\widehat{\frac{\text{Asset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ are predicted values of Trade and Asset Holdings (First-Stage Regression on $Z$).

[b] Estimated equations :

$$\begin{cases} \log(\text{Asset}_{ij}) = \alpha_1 + \mu_1 \log(\text{GDP}_j) + \rho_1 \log(\text{dist}_{ij}) + \phi_1 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_1 Z^1_{ij} + \varepsilon^1_{ij} \\ \log(\text{Trade}_{ij}) = \alpha_2 + \mu_2 \log(\text{GDP}_j) + \rho_2 \log(\text{dist}_{ij}) + \phi_2 \log\left(\widehat{\frac{\text{Asset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_2 Z^2_{ij} + \varepsilon^2_{ij} \end{cases}$$

where $\log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ and $\log\left(\widehat{\frac{\text{Asset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ are predicted values of Trade and Asset Holdings (First-Stage Regression on $Z$).

Table A. 4: Explanatory Power of The Instrument Set on Bilateral Asset Holdings and Bilateral Goods Trade

| | $\frac{\text{Trade}}{\text{GDP}_i\text{GDP}_j}$ | $\frac{\text{Asset}}{\text{GDP}_i\text{GDP}_j}$ |
|---|---|---|
| All Instruments | 0.64 | 0.40 |
| All Instruments Without Distance | 0.61 | 0.40 |
| Distance only | 0.44 | 0.19 |
| Transportation Costs only | 0.19 | / |
| Fiscal and Legal Variables[a] | / | 0.17 |
| Informational and Institutional Variables[b] | 0.08 | 0.18 |
| Other Geographical Variables and Trade Agreements[c] | 0.37 | / |
| Number of Observation | 1151 | 987 |

In the table we report the $R^2$ of the following regressions with different sets of Instruments:

$$\begin{cases} \log\left(\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}\right) = \hat{\sigma}_1 + \hat{\varphi}_1 Z_{ij} \\ \log\left(\frac{\text{Asset}_{ij}}{\text{GDP}_i\text{GDP}_j}\right) = \hat{\sigma}_2 + \hat{\varphi}_2 Z_{ij} \end{cases}$$

[a] $\text{LegalSystem}_{ij}$, $\text{InterestTax}_{ij}$, $\text{DividendTax}_{ij}$.
[b] $\text{ColonialDep}_{ij}$, $\text{Language}_{ij}$, $\text{Corruption}_i$, $\text{Corruption}_j$
[c] $\text{Pop}_i\text{Pop}_j$, $\text{Landlock}_{ij}$, $\text{Island}_{ij}$, $\text{Border}_{ij}$, $\text{Area}_i\text{Area}_j$

Table A. 5: Simultaneous Gravity Models for Financial CPI Assets and Trade.

| | | | | | | Dist $\in Z$ | | | | Dist $\notin Z$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Naive OLS | | System OLS | | 2SLS | | 3SLS | | 2SLS | | 3SLS | |
| | | CPIAsset | Trade | CPIAsset | Trade | CPIAsset | Trade | CPIAsset | Trade | CPIAsset | Trade | CPIAsset | Trade |
| **Normal**[a] | $\text{dist}_{ij}$ | $-0.644^{**}$ (0.065) | $-0.622^{**}$ (0.032) | $-0.404^{**}$ (0.07) | $-0.59^{**}$ (0.032) | ([c]) | $-0.393^{**}$ (0.062) | ([c]) | $-0.243^{**}$ (0.053) | $-0.243^{**}$ (0.075) | $-0.578^{**}$ (0.042) | $-0.278^{**}$ (0.073) | $-0.592^{**}$ (0.039) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | $0.323^{**}$ (0.066) | | $0.997^{**}$ (0.08) | | $1.003^{**}$ (0.078) | | $1.023^{**}$ (0.124) | | $0.97^{**}$ (0.123) | |
| | $\frac{\text{Equities}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | | $0.105^{**}$ (0.014) | | $0.448^{**}$ (0.087) | | $0.483^{**}$ (0.084) | | $0.42^{**}$ (0.08) | | $0.445^{**}$ (0.079) |
| | Number of Obs. | 1002 | 1150 | 974 | 1002 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 |
| | $R^2$ | 0.63 | 0.84 | 0.74 | 0.85 | 0.71 | 0.86 | 0.71 | 0.86 | 0.72 | 0.86 | 0.72 | 0.86 |
| **Within**[b] | $\text{dist}_{ij}$ | $-0.545^{**}$ (0.074) | $-0.652^{**}$ (0.041) | $-0.477^{**}$ (0.066) | $-0.612^{**}$ (0.033) | $-0.117$ (0.125) | $-0.476^{**}$ (0.05) | $-0.152$ (0.122) | $-0.329^{**}$ (0.045) | $-0.316^{**}$ (0.069) | $-0.597^{**}$ (0.042) | $-0.336^{**}$ (0.067) | $-0.542^{**}$ (0.038) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | $0.249^{**}$ (0.065) | | $0.769^{**}$ (0.174) | | $0.739^{**}$ (0.173) | | $0.88^{**}$ (0.121) | | $0.871^{**}$ (0.12) | |
| | $\frac{\text{Equities}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | | $0.092^{**}$ (0.014) | | $0.386^{**}$ (0.076) | | $0.351^{**}$ (0.075) | | $0.427^{**}$ (0.085) | | $0.411^{**}$ (0.083) |
| | Number of Obs. | 1002 | 1150 | 974 | 1002 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 |
| | $R^2$ | 0.71 | 0.83 | 0.74 | 0.84 | 0.80 | 0.88 | 0.80 | 0.88 | 0.80 | 0.88 | 0.80 | 0.88 |

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).
Point estimates of the control variables are not shown here but are available on request.

[a]Estimated equations :

$$\begin{cases} \log(\text{CPIAsset}_{ij}) = \alpha_1 + \lambda_1 \log(\text{GDP}_i) + \mu_1 \log(\text{GDP}_j) + \rho_1 \log(\text{dist}_{ij}) + \phi_1 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_1 Z^1_{ij} + \varepsilon^1_{ij} \\ \log(\text{Trade}_{ij}) = \alpha_2 + \lambda_2 \log(\text{GDP}_i) + \mu_2 \log(\text{GDP}_j) + \rho_2 \log(\text{dist}_{ij}) + \phi_2 \log\left(\widehat{\frac{\text{CPIAsset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_2 Z^2_{ij} + \varepsilon^2_{ij} \end{cases}$$

where $\log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ and $\log\left(\widehat{\frac{\text{CPIAsset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ are predicted values of Trade and Asset Holdings (First-Stage Regression on $Z$).

[b]Estimated equations :

$$\begin{cases} \log(\text{CPIAsset}_{ij}) = \alpha_1 + \mu_1 \log(\text{GDP}_j) + \rho_1 \log(\text{dist}_{ij}) + \phi_1 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_1 Z^1_{ij} + \varepsilon^1_{ij} \\ \log(\text{Trade}_{ij}) = \alpha_2 + \mu_2 \log(\text{GDP}_j) + \rho_2 \log(\text{dist}_{ij}) + \phi_2 \log\left(\widehat{\frac{\text{CPIAsset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_2 Z^2_{ij} + \varepsilon^2_{ij} \end{cases}$$

where $\log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ and $\log\left(\widehat{\frac{\text{CPIAsset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ are predicted values of Trade and Asset Holdings (First-Stage Regression on $Z$).

[c]We drop distance from this specification for multicollinearity problems with instrumented trade.

Table A. 6: Correlation Puzzle: Asset gravity model.

| | | | | Correlation exogenous | | | | Correlation instrumented | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Dist $\in Z$ | | Dist $\notin Z$ | | Dist $\in Z$ | | Dist $\notin Z$ | |
| | | OLS | | 2SLS | 3SLS | 2SLS | 3SLS | 2SLS | 3SLS | 2SLS | 3SLS |
| **Normal**[a] | $\text{dist}_{ij}$ | $-0.453^{**}$ (0.047) | $-0.122^{**}$ (0.056) | $-0.017$ (0.097) | 0.031 (0.094) | $-0.265^{**}$ (0.055) | $-0.249^{**}$ (0.054) | $-0.147^{**}$ (0.062) | $-0.131^{**}$ (0.061) | $-0.189^{***}$ (0.059) | $-0.213^{***}$ (0.057) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | $0.532^{**}$ (0.054) | $0.654^{**}$ (0.126) | $0.679^{**}$ (0.124) | $0.534^{**}$ (0.086) | $0.518^{**}$ (0.085) | $0.538^{**}$ (0.058) | $0.639^{**}$ (0.057) | $0.495^{***}$ (0.102) | $0.68^{***}$ (0.089) |
| | $\text{Correlation}_{ij}$ | $2.528^{**}$ (0.301) | $2.108^{**}$ (0.289) | $2.272^{**}$ (0.292) | $2.553^{**}$ (0.221) | $2.017^{**}$ (0.299) | $2.381^{**}$ (0.243) | 1.441 (0.937) | $-0.349$ (0.899) | $3.751^{***}$ (1.054) | 0.08 (0.886) |
| | $\text{Ret\_Risk}_j$ | $0.036^{**}$ (0.018) | $0.036^{**}$ (0.018) | 0.028 (0.018) | 0.015 (0.013) | 0.027 (0.018) | 0.016 (0.014) | $0.042^{**}$ (0.019) | 0.011 (0.017) | 0.007 (0.018) | $-0.044^{***}$ (0.013) |
| | Number of Obs. | 955 | 952 | 951 | 951 | 951 | 951 | 951 | 951 | 951 | 951 |
| | $R^2$ | 0.72 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| **Within**[b] | $\text{dist}_{ij}$ | $-0.426^{**}$ (0.057) | $-0.138^{**}$ (0.058) | $-0.043$ (0.097) | $-0.001$ (0.094) | $-0.252^{**}$ (0.054) | $-0.225^{**}$ (0.052) | $-0.123^{**}$ (0.057) | $-0.096^{*}$ (0.056) | $-0.073$ (0.06) | $-0.084$ (0.06) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | $0.382^{**}$ (0.057) | $0.545^{**}$ (0.13) | $0.549^{**}$ (0.129) | $0.405^{**}$ (0.089) | $0.385^{**}$ (0.087) | $0.381^{**}$ (0.057) | $0.456^{**}$ (0.057) | $0.391^{**}$ (0.057) | $0.45^{**}$ (0.057) |
| | $\text{Correlation}_{ij}$ | $1.925^{**}$ (0.306) | $1.901^{**}$ (0.307) | $2.027^{**}$ (0.286) | $2.498^{**}$ (0.219) | $1.887^{**}$ (0.292) | $2.379^{**}$ (0.234) | $3.533^{**}$ (0.794) | $1.443^{*}$ (0.773) | $3.356^{**}$ (0.977) | 1.397 (0.957) |
| | $\text{Ret\_Risk}_j$ | 0 (0.019) | 0.029 (0.018) | $0.03^{*}$ (0.017) | $0.032^{**}$ (0.013) | $0.031^{*}$ (0.017) | $0.033^{**}$ (0.013) | $0.048^{**}$ (0.017) | 0.023 (0.016) | $0.047^{**}$ (0.017) | 0.027 (0.016) |
| | Number of Obs. | 955 | 952 | 951 | 951 | 951 | 951 | 951 | 951 | 951 | 951 |
| | $R^2$ | 0.66 | 0.66 | 0.82 | 0.82 | 0.82 | 0.82 | 0.81 | 0.81 | 0.81 | 0.81 |

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).
Point estimates of the control variables are not shown here but are available on request.

[a]Estimated equation :

$$\log(\text{Asset}_{ij}) = \alpha + \lambda \log(\text{GDP}_i) + \mu \log(\text{GDP}_j) + \rho \log(\text{Dist}_{ij}) + \phi \log\left(\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}\right) + \psi\,\widehat{\text{Correlation}}_{ij} + \delta Z^1_{ij} + \varepsilon_{ij}$$

where $\widehat{\text{Correlation}}_{ij}$ are predicted values of Stock–Market Correlations (First-Stage Regression on $Z$).

[b]Estimated equations :

$$\log(\text{Asset}_{ij}) = \alpha_i + \mu \log(\text{GDP}_j) + \rho \log(\text{Dist}_{ij}) + \phi \log\left(\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}\right) + \psi\,\widehat{\text{Correlation}}_{ij} + \delta Z^1_{ij} + \gamma \text{Reg}_{ij} + \varepsilon_{ij}$$

where $\widehat{\text{Correlation}}_{ij}$ are predicted values of Stock–Market Correlations (First-Stage Regression on $Z$).

| | $\text{Asset}_{ij}$ [a] | | |
|---|---|---|---|
| $\text{GDP}_i$ [b] | $1.232^{**}$ (0.041) | $1.261^{**}$ (0.04) | $1.216^{**}$ (0.04) |
| $\text{GDP}_j$ [b] | $0.974^{**}$ (0.031) | $1.011^{**}$ (0.033) | $0.921^{**}$ (0.035) |
| $\frac{\text{Export}_{ij}}{\text{GDP}_i\text{GDP}_j}$ [b] | $0.521^{**}$ (0.063) | $0.457^{**}$ (0.058) | $0.405^{**}$ (0.058) |
| $\frac{\text{Import}_{ij}}{\text{GDP}_i\text{GDP}_j}$ [b] | $0.111^{**}$ (0.049) | $0.153^{**}$ (0.045) | $0.136^{**}$ (0.048) |
| $\text{Dist}_{ij}$ [b] | $-0.157^{**}$ (0.059) | $-0.06$ (0.058) | $-0.099^{*}$ (0.057) |
| $\text{ColonialDep}_{ij}$ | $1.038^{**}$ (0.231) | $1.137^{**}$ (0.214) | $1.175^{**}$ (0.213) |
| $\text{Language}_{ij}$ | $0.658^{**}$ (0.176) | 0.192 (0.168) | 0.089 (0.167) |
| $\text{Corruption}_i$ | $-0.165^{**}$ (0.037) | $-0.118^{**}$ (0.035) | $-0.088^{**}$ (0.035) |
| $\text{Corruption}_j$ | $-0.143^{**}$ (0.02) | $-0.14^{**}$ (0.02) | $-0.072^{**}$ (0.022) |
| $\text{LegalSystem}_{ij}$ | | $0.516^{**}$ (0.106) | $0.498^{**}$ (0.104) |
| $\text{FiscalTreaty}_{ij}$ | | $0.008^{**}$ (0.003) | 0.005 (0.003) |
| $\text{DividendTax}_{ij}$ [c] | | $-0.015^{**}$ (0.005) | $-0.021^{**}$ (0.005) |
| $\text{InterestTax}_{ij}$ [c] | | $-0.01$ (0.006) | $-0.006$ (0.006) |
| $\text{TaxHaven}_{ij}$ | | $1.917^{**}$ (0.149) | $1.833^{**}$ (0.147) |
| $\text{Correlation}_{ij}$ | | | $2.137^{**}$ (0.29) |
| $\text{Ret\_Risk}_j$ | | | $0.035^{**}$ (0.018) |
| Number of Obs. | 982 | 978 | 951 |
| $R^2$ | 0.68 | 0.74 | 0.76 |

Table A. 7: Gravity Model of Financial Assets Including Exports **and** Imports (OLS) (not instrumented)

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).

[a] The estimated equation is:
$\log(\text{Asset}_{ij}) = \alpha + \lambda\log(\text{GDP}_i) + \mu\log(\text{GDP}_j) + \phi^{\text{Imp}}\log(\frac{\text{Imports}_{ij}}{\text{GDP}_i\text{GDP}_j}) + \phi^{\text{Exp}}\log(\frac{\text{Exports}_{ij}}{\text{GDP}_i\text{GDP}_j}) + \delta\text{Z}_{ij} + \varepsilon_{ij}.$

[b] in logs.

[c] in percents.

Table A. 8: Simultaneous Gravity Models for Financial Assets and Trade, Rich vs. Emerging Countries.

| | | | | | | Dist $\in Z$ | | | | Dist $\notin Z$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Naive OLS | | System OLS | | 2SLS | | 3SLS | | 2SLS | | 3SLS | |
| | | Asset | Trade | Asset | Trade | Asset | Trade | Asset | Trade | Asset | Trade | Asset | Trade |
| **Rich** | $\text{dist}_{ij}$ | $-0.626^{**}$ (0.053) | $-0.565^{**}$ (0.048) | $-0.114$ (0.073) | $-0.483^{**}$ (0.044) | $-0.07$ (0.121) | $-0.498^{**}$ (0.05) | 0.001 (0.119) | $-0.47^{**}$ (0.048) | $-0.259^{**}$ (0.077) | $-0.561^{**}$ (0.044) | $-0.234^{**}$ (0.076) | $-0.565^{**}$ (0.043) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | $0.763^{**}$ (0.078) | | $0.813^{**}$ (0.157) | | $0.89^{**}$ (0.155) | | $0.718^{**}$ (0.111) | | $0.743^{**}$ (0.11) | |
| | $\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | | $0.179^{**}$ (0.019) | | $0.177^{**}$ (0.059) | | $0.166^{**}$ (0.059) | | $0.177^{**}$ (0.057) | | $0.175^{**}$ (0.057) |
| | Number of Obs. | 456 | 472 | 453 | 453 | 452 | 452 | 452 | 452 | 452 | 452 | 452 | 452 |
| | $R^2$ | 0.74 | 0.91 | 0.79 | 0.92 | 0.79 | 0.92 | 0.80 | 0.92 | 0.80 | 0.92 | 0.80 | 0.92 |
| **Emerging** | $\text{dist}_{ij}$ | $-0.335^{**}$ (0.081) | $-0.681^{**}$ (0.046) | 0.005 (0.093) | $-0.643^{**}$ (0.044) | $-0.025$ (0.149) | $-0.55^{**}$ (0.064) | 0.045 (0.148) | $-0.495^{**}$ (0.063) | $-0.234^{**}$ (0.088) | $-0.629^{**}$ (0.052) | $-0.196^{**}$ (0.086) | $-0.595^{**}$ (0.051) |
| | $\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | $0.488^{**}$ (0.073) | | $0.472^{**}$ (0.176) | | $0.513^{**}$ (0.175) | | $0.493^{**}$ (0.129) | | $0.52^{**}$ (0.129) | |
| | $\frac{\text{Assets}_{ij}}{\text{GDP}_i\text{GDP}_j}$ | | | | $0.158^{**}$ (0.022) | | $0.449^{**}$ (0.137) | | $0.396^{**}$ (0.134) | | $0.441^{**}$ (0.121) | | $0.405^{**}$ (0.119) |
| | Number of Obs. | 527 | 678 | 526 | 529 | 526 | 526 | 526 | 526 | 526 | 526 | 526 | 526 |
| | $R^2$ | 0.60 | 0.77 | 0.62 | 0.80 | 0.60 | 0.80 | 0.60 | 0.80 | 0.60 | 0.80 | 0.60 | 0.80 |

Standard errors in parenthesis.
Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***).
Point estimates of the control variables are not shown here but are available on request.
Estimated equations :

$$\begin{cases} \log(\text{Asset}_{ij}) = \alpha_1 + \lambda_1 \log(\text{GDP}_i) + \mu_1 \log(\text{GDP}_j) + \rho_1 \log(\text{dist}_{ij}) + \phi_1 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_1 Z^1_{ij} + \varepsilon^1_{ij} \\ \log(\text{Trade}_{ij}) = \alpha_2 + \lambda_2 \log(\text{GDP}_i) + \mu_2 \log(\text{GDP}_j) + \rho_2 \log(\text{dist}_{ij}) + \phi_2 \log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right) + \delta_2 Z^2_{ij} + \varepsilon^2_{ij} \end{cases}$$

where $\log\left(\widehat{\frac{\text{Trade}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ and $\log\left(\widehat{\frac{\text{Asset}_{ij}}{\text{GDP}_i\text{GDP}_j}}\right)$ are predicted values of Trade and Asset Holdings (First-Stage Regression on $Z$).