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All You Need Is Trade: On the In(ter)dependence of Trade and Asset Holdings in Gravity Equations

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All You Need Is Trade: On the In(ter)dependence of Trade and Asset Holdings in Gravity Equations*

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Abstract

This paper looks at the interrelationship between trade in goods and asset holdings, as brought forward by some contributions to the empirical literature in international economics. These contributions argue that single-equation gravity models suffer from an endogeneity bias, culminating in a request for the estimation of systems of gravity equations. Yet, the theoretical basis for such an interrelationship is weak. In this paper we present baseline models of international trade in goods and bank asset holdings, which yield gravity equations that can be tested empirically. We then use these models to test three different explanations for the interrelationship between trade in goods and asset holdings that have been brought forward by the literature: (i) consumption hedging, (ii) sovereign risk, (iii) information spillovers. Our results indicate that none of these channels can explain the interrelationship. We therefore conclude that single-equation gravity models, as opposed to systems of gravity equations, are justified: All you need is trade!

Keywords: international trade, international banking, gravity equations

JEL Classification: F30, F10

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1 Introduction

In this paper, we examine the reasons to abandon the single equation gravity model in favor of a system approach. Gravity equations have been the workhorse model in international trade for four decades. By now, gravity equations explain many cross-border activities with a rather limited number of explanatory variables. Over the last years, they have also entered the empirical literature on international finance and international banking, where they are successfully employed to explain stocks of financial variables held in a foreign country. The structure of the empirical explanation of trade and cross-border asset holdings is very similar so that the idea arose that international trade and international asset holdings might not be independent. And in fact, in empirical studies an interrelation of trade and cross-border bank assets has been found in gravity equations.

It is without question that international trade and international bank asset holdings are closely interrelated. The empirical literature on the determinants of financial asset positions and flows points to the strong effect of trade in determining the pattern of cross-border financial asset positions (Portes and Rey 2005, Coeurdacier et al. 2010, Neugebauer 2011). Moreover, Aviat and Coeurdacier (2007) demonstrate a significant effect of financial asset positions in import equations and call for a system estimator to account for the supposed endogeneity bias. Since the correlation between trade and asset holdings exists, single equation models are only valid if the correlation does not represent a causal effect and gravity equations including the respectively other endogenous variable are misspecified.

If trade and bank assets are jointly determined, single-equation gravity models are misspecified and the estimated coefficients are biased. Given the importance of gravity models for empirical international economics, it is necessary to rule out such an endogeneity bias. When working with aggregated data, on the one hand, endogeneity is always an issue because many variables are determined in general equilibrium. On the other hand, many aggregated variables are correlated through the size of the economy without being jointly determined. Significance in a multivariate regression does not necessarily reflect an economic relationship between the respective variables. The regression might just be misspecified. In this case, applying a simultaneous equation model is not appropriate because not all equations in the system represent a causal relationship, i.e. not all equations are autonomous. Yet, each equation in a system must have an economic meaning, also in isolation, i.e. it must be autonomous for the simultaneous equation model to be appropriate. Wooldridge (2002) states that many applications of the simultaneous equation model fail the autonomy requirement and that these examples do often share the same structure: ”the endogenous variables in the system are all choice variables of the same economic unit" (Wooldridge 2002, p.210). That calls for a firm theoretical foundation of the system to be estimated.

In this paper we argue that the point against single-equation gravity models to estimate international trade results from such misspecifications of the trade and the financial asset holdings equations. To show this and to rule out that we use misspecified equations ourselves, we base our analysis strictly on regression equations derived from theoretical frameworks of international trade and international banking.

In section 2, we first present a trade model. We employ a multi-country setting in which each country hosts a large number of heterogeneous firms that produce differentiated products. Firms decide about their exports to each foreign market separately. The multi-country setting enables us to separate bilateral effects from multilateral or rest-of-the-world effects and gross positions in trade and assets from their respective net positions. In the trade model, banks only enter to conduct the cross-border payment for exporting firms. We then go on and present a simple model of cross-border banking. The cross-border banking model is completely unrelated to foreign trade. It yields a gravity equation for cross-border bank loans.

Using these two models, we present our main argument: bank assets turn out to be significant in a gravity equation for trade but that does not necessarily imply that they should enter the regression setup as an explanatory variable. In our setting, including a bank asset variable introduces a bias instead of correcting one. The trade model therefore motivates a single-equation regression approach for bilateral imports. Banks are needed in the model to conduct the cross-border payments and their activities are therefore correlated with the trade data. Yet, although trade and cross-border bank assets are correlated, there is no need to set up a system of equations, because there is just one decision taken by the exporting firm: how much to export to the foreign country. Since bank assets are partly determined by trade. Trade is necessarily significant in a regression explaining bank assets. The cross-border banking model, in turn, motivates a single-equation regression approach for bank assets. This foundation of the gravity equation for bank assets is completely independent from trade. The correlation only enters through the cross-border-payment function of the banks.

The bank asset variable in turn exerts a significant effect in the trade equation, because in parts the bank assets just mirror exports. Neither do bank assets affect foreign trade nor does trade affect the decision on the geographic distribution of cross-border bank assets. Including bank assets in the trade equation introduces an endogeneity bias that has not been there in the proper single-equation specification of the import regression equation. Thus, we construct a model of trade that is best estimated in a single equation framework although it seems to call for a simultaneous equation model. Yet, the two equations do not fulfil the autonomy requirement.

In section 3, we show that none of the sources of the interrelation between trade and bank asset holdings proposed in the literature so far satisfies all of the three following conditions: (i) it leads to the empirical specification employed, (ii) it fulfils the autonomy requirement, and (iii) it contains the interrelationship which is assumed in the empirical model. We model three different channels of how to determine the interrelationship between international trade in goods and assets, as proposed by Aviat and Coeurdacier (2007): (a) consumption hedging, (b) sovereign risk, and (c) information spillovers. As the last channel proves to be consistent with a classical gravity setup, we study this channel in more detail and introduce information spillovers into our baseline model. We then test whether this model can explain an interdependence between trade in goods and asset holdings, but find that it cannot. Section 4 concludes.

2 The Baseline Models of Cross-Border Activities

Gravity equations have been the workhorse model in international trade for decades (Anderson 1979, Bergstrand 1985, Deardorff 1998, Feenstra et al. 2001).[1] The reason is that they are easily set up and estimated. However, gravity equations are not too informative if their setup is not guided by theory. Over the last years, gravity equations have become widely used in the literature on international financial flows as well (Buch 2003, Portes and Rey 2005, Neugebauer 2011). The explanatory power of these equations proves to be comparable to that of gravity equations for trade in goods.

Gravity equations for financial stocks and flows are often used without proper reference to theory. There are only few papers that give the gravity equation for cross-border financial activities a theoretic foundation (Martin and Rey 2004, Okawa and van Wincoop 2010, Brüggemann et al. 2012). The two former models are based on portfolio choices, whereas Brüggemann et al. (2012) focuses on the relationship between banks and firms when closing a loan contract. As this approach proves suitable for our analysis, it will be explained in detail in section 2.2. First, however, we turn to foreign trade.

2.1 A Model for Cross-Border Trade

Our trade model is standard and based on Melitz (2003). In our baseline model of international trade, there is only a small add-on: We introduce a banking sector that does nothing else than managing (international) payments. The costs of doing so are zero. Furthermore, competition in the banking sector drives profits down to zero.

[1] See Anderson (2010) for a recent overview of the relevant literature.

Banks collect the payments for imports from the foreign firms. This might be simply because the firm holds its money in the form of deposits at the bank in a foreign currency account. The firms might also exchange the money into domestic currency and the banks hold the foreign currency. The bank might exchange some foreign currency at the central bank, yet a fraction α of the foreign currency income from exports is held by the bank to enable imports of foreign goods by domestic consumers.

Firms are heterogeneous with respect to productivity. Prices p_k, quantities sold x_k, and profits π_k are firm-specific. Firms engage in monopolistic competition. Utility is a CES aggregate of differentiated products. The degree of differentiation is given by $1/\rho$, the elasticity of substitution by $\sigma = 1/(1-\rho)$.

Sales of firm k at home country j are thus

$$p_{kj}x_{kj} = \frac{p_{kj}^{1-\sigma}}{P_j^{1-\sigma}}Y_j, \tag{1}$$

where P_j is the price index in j, and Y_j is real aggregate demand in j. The foreign country is indicated by i. Countries are separated by iceberg costs τ, i.e. $p_{kij} = p_{kj}\tau_{ij}$. Imports of goods from firm k from country j by consumers in i are given by

$$p_{k,i,j}x_{kij} = \frac{(p_{kj}\tau_{ij})^{1-\sigma}}{P_i^{1-\sigma}}Y_i. \tag{2}$$

The price p_{kij} is determined by setting a mark-up over marginal costs c_k. This constant mark-up is equal to $1/\rho$. (Homogenous) labor is the only production factor. Marginal costs c_k depend on the firm-specific productivity φ_k. Thus, prices are given by

$$p_{kj} = \frac{c_k}{\rho} = \frac{w_j}{\varphi_k\rho}, \tag{3}$$

where w is the wage rate. Total costs also include fixed costs of production $f_p w$ and exporting $f_{ex}w$. In such a setting, there exists a minimum productivity level necessary for production at home φ_j^{min}, which is derived from the zero profit condition of the least productive firm. The minimum productivity level φ_j^{min} is given by equation (4a). All less productive firms quit. The same reasoning yields the minimum productivity of exporting firms φ_{ij}^{ex} as given by (4b):

$$\varphi_j^{min} = \frac{w_j}{\rho}\left(\frac{Y_j}{\sigma f_p w_j}\right)^{1/(1-\sigma)} P_j^{-1} \tag{4a}$$

$$\varphi_{ij}^{ex} = \frac{w_j\tau_{ij}}{\rho}\left(\frac{Y_i}{\sigma f_{ex} w_j}\right)^{1/(1-\sigma)} P_i^{-1}. \tag{4b}$$

All firms with productivity lower than (4b) are not active in the foreign market. All firms with a productivity level at least as high as φ_{ij}^{ex} export. Their aggregated sales in the foreign country i are the foreign country's imports from home country j. We assume that firm-specific productivity is Pareto distributed with the shape parameter κ. Total imports of goods from country j by consumers in i are then given by

$$\begin{aligned} IM_{ij} &= M_j \int_{\varphi_{ij}^{ex}}^{\infty} \left(\frac{w\tau_{ij}}{\rho\varphi}\right)^{1-\sigma} \frac{Y_i}{P_i^{1-\sigma}} g(\varphi) d\varphi \\ &= \underbrace{\frac{\kappa}{\kappa-(\sigma-1)} \left(\frac{w}{\rho\varphi^{min}}\right)^{1-\sigma} M_j}_{s_j} \underbrace{\left(\frac{\varphi^{min}}{\varphi_{ij}^{ex}}\right)^{\kappa-(\sigma-1)} \tau_{ij}^{1-\sigma}}_{\lambda(dist_{ij})} \underbrace{\frac{Y_i}{P_i^{1-\sigma}}}_{m_i}, \end{aligned} \tag{5}$$

where M_j denotes the number of firms in country j, s_j is the supply capacity of the home country (home GDP), and m_i the market capacity of the host country (host GDP). The middle term is negatively affected by distance. Log-linearizing (5) yields the gravity equation to estimate:

$$ln(IM_{ij}) = ln(s_j) - ln(\lambda) + ln(m_i), \tag{6}$$

where s_j denotes the supply capacity of country j, m_i the demand capacity of country i, and λ is a function of distance.

The banking sector of country j collects the payments to the exporters that are made by the customers in i. Let a fraction γ of the trade be invoiced in importer's currency, and a fraction α of these payments for the imports in the foreign currency is kept by the bank.[2] Hence, the asset position of banks from country j in country i BA_{ji} is proportional to the imports IM_{ij} from j by customers from country i, according to

$$BA_{ji} = \alpha_{ij}\gamma_{ij}IM_{ij} + v_{ij}. \tag{7}$$

Solving for imports leaves them explained by cross-border asset holdings. It is easy to see that a simultaneous equation model based on this interrelationship would fail the autonomy requirement.[3]

But while cross-border asset holdings are certainly significant in the gravity equation for imports, they should not be included as the derivation of equation (6) shows. Including bank assets in a single equation gravity model explaining imports *introduces* an endogenous variable. In the setting described above, including bank assets results in a misspecification. Nevertheless, bank assets might be significant in the regression.

[2] For a firm-level analysis of invoice behavior of Japanese firms, see Ito et al. (2010).

[3] Some papers use the bank assets of banks of the importing country in the country of the exporter BA_{ij} as explanatory variable. Given the high correlation of bilateral exports and imports in the data, the direction of the asset flow does not matter for the result. The correlation is as high as 84%.

Moreover, bank assets would be explained by gravity variables, and imports would be significant in a gravity equation explaining cross-border bank asset holdings. However, there is no need to estimate a system of equations because there is just one economic decision. There is no interrelation of the variables, but correlation because of double-entry book-keeping. Therefore, the trade equation should be estimated in a single-equation framework without cross-border bank holdings as an explanatory variable.

2.2 A Model for Cross-Border Banking Assets

We are not going to argue that bank assets are well explained by the gravity equation because of double-entry book-keeping. Instead we sketch the theoretic foundation of the gravity equation for bank loans as proposed in Brüggemann et al. (2012). In their model, firms search for the best loan among several banks from different countries. This search involves a comparison of several criteria (amount, maturity, time schedule, collateral, disclosure requirements, fixed payments, interest rate) of loan offers by banks, tailored to the needs of the firm. Thus, loans result from differentiated deals that are specific to a firm-bank relationship. There is no perfect market in which the interest rate would be the only decisive variable.

Assume firms search for bank loans worldwide. Firm k from country j chooses the bank that offers the loan for the lowest cost c_{kl}, where l denotes the bank. The costs of the loan from bank l in country i depend on country-specific variables such as the prevailing interest rate r_i, bank-specific variables such as its efficiency a_l, and firm-bank-specific monitoring costs μ_{kl}. Only some of the variables comprising the costs c_{kl}, such as the interest rate r_i, are observable. Other variables, such as the firm-bank-relationship-specific monitoring costs μ_{kl}, are not. However, they depend systematically on observable variables such as firm size and distance d_{ij} between country i, home of the bank, and country j, home of the firm, which can have several dimensions (physical and cultural distance, familiarity with business or specific financing needs).

The firm's costs are described by the cost function $c_{kl} = \beta r_i + \gamma d_{ij} + \delta a_i + \varepsilon_{kl}$, where a_i denotes the average quality of the banking sector in i, which is observable by the researcher, and ε_{kl} collects all the random unobservable elements. They have zero mean, since the observable variables include only country averages, are independent and assumed to be normally distributed. We justify the assumption of a normal distribution of ε by the fact that the error term is a sum of many deviations from country averages. We denote the observable part of the costs by $\bar{c}_{kl}$.

Firm k searches for the loan with the lowest costs among the different banks. The probability V_{kl} that firm k from country j chooses the loan offer from a particular bank l in country i is then equal to the probability that this offer is the one with the lowest costs, which depends on the observable variables and the error term ε_{kl}:

$$
\begin{aligned}
V_{kl} &= Pr(c_{kl} = \min\{c_{1h}...c_{n_h h}\}; \quad h = 1...N) \\
&= Pr(\bar{c}_{ij} + \varepsilon_{kl} < \bar{c}_{ih} + \varepsilon_{1l}; ...; \bar{c}_{kl} + \varepsilon_{kl} < \bar{c}_{iN} + \varepsilon_{n_N N}),
\end{aligned}
$$

where N is the number of countries, indexed by h, and n_h is the number of banks in country h. The random components ε are i.i.d. The probability that a realization z of the error term yields the lowest costs for the loan, i.e. the cumulative distribution function of the extreme value function of the error term, is denoted by F, the corresponding density by f. The probability to be chosen by firm k depends on the observable variables $\bar{c}_{ij}$ and on the realization of the error term z. The observable variables are all country-specific. Therefore, the unobserved bank-firm-relationship-specific characteristics (which are collected in ε_{kl}) must decide on the lowest cost offer among all banks in country i. Compared to banks from other countries, this might not be enough. There might be countries with country characteristics that are more favorable for low loan costs and with many banks n_h to draw the minimum from. The firm-bank-relationship-specific component ε_{kl} must then compensate for this disadvantage if firm k chooses bank l's offer. For any realization z of the random component, bank l is chosen by firm k with probability density $\prod_{h=1}^{N} [1 - F(\bar{c}_{ij} - \bar{c}_{jh} + \ln n_h + z)]$, where we have accounted for all eligible bank offers.

The formation of a firm-bank-relationship depends on the extreme values of the random components. These extreme values are well approximated by a limiting distribution if the sample grows in size, i.e. if the firms search among a large number of banks. The minimum values of a normal distribution are Gumbel distributed.[4] Thus, we assume that $F(z)$ is Gumbel distributed with its double exponential form (Kotz and Nadarajah 2000). Accounting for all possible realizations of z and applying the Gumbel distribution, the probability that firm k chooses bank l is given by

$$
\begin{aligned}
V_{kl} = \int_{-\infty}^{\infty} \frac{1}{\sigma} \exp\left(\frac{z}{\sigma} - \gamma\right) \left\{\exp\left[-\exp\left(\frac{z}{\sigma} - \gamma\right)\right]\right\} \qquad (8) \\
\prod_{h=1}^{N} \prod_{l \neq m}^{n_h} \exp\left[-\exp\left(\frac{\bar{c}_{ij} - \bar{c}_{jh} + \ln n_h + z}{\sigma} - \gamma\right)\right] dz.
\end{aligned}
$$

Solving the integral (8), summing over all n_i banks from country i and multiplying by the demand for loans BL_j of all firms in country j yields total bank loans BA_{ij} from

[4] The Gumbel distribution is the limiting distribution that is obtained for the greatest or smallest value for n continuous random variables that are i.i.d. and normally, log-normally, or logistic distributed.

banks in i to firms in j as

$$BA_{ij} = \frac{n_i exp(-\beta r_i + \gamma d_{ij} + \delta a_i)}{\sum_{h=1}^{N} n_h exp(-\beta r_i + \gamma d_{ij} + \delta a_i)} BL_j. \tag{9}$$

Taking the log yields the gravity equation for bank loans. The sum in the denominator is best proxied by fixed effects for the loan-receiving country j. Banks' country fixed effects might proxy the average ability of the banking sector if no other variable is available. The distance component d_{ij} might include the log of the physical distance, a border dummy, cultural ties, proxied by a common language variable, and other distance related variables. The interest rate completes the set of cost components. In addition, two size variables must be included. These might be proxied by bank market size or by the GDPs of both countries.

2.3 Estimating the Baseline Setups

In this subsection we present the results from estimating gravity setups as proposed by equations (6) and (9). Both equations are independent. The trade equation does not require cross-border bank assets as a regressor and cross-border bank assets are not explained by trade. In the theoretical setup, the deposits of firms in banks discussed above do not affect either decision and should therefore not be included in either of the equations. They create an interrelationship in the data between trade and bank assets which is not relevant for either of the equations to be estimated.

2.3.1 Estimating the Trade Equation

When estimating equation (6), the supply capacity s_j is proxied by home country's GDP, the demand capacity m_i is proxied by foreign country's GDP, and λ is seen as a function of distance. Furthermore, we add some standard, mostly distance-related gravity variables when specifying the function λ. The logarithmic equation that we estimate has the form

$$\begin{aligned} ln(IM_{ij}) &= \beta_0 + \beta_1\ ln(Dist_{ij}) + \beta_2\ ln(GDP_j) + \beta_3\ ln(GDP_i) + \beta_4\ Z_j \\ &+ \beta_5\ Z_i + \beta_6\ Z_{ij} + u_{ij}, \end{aligned} \tag{10}$$

where IM_{ij} are imports of country i from country j, GDP_i and GDP_j is nominal GDP of country i and j, respectively, $Dist_{ij}$ is the geographical distance between the capital cities of countries i and j, Z_i and Z_j are characteristics of country i and j, Z_{ij} are variables capturing bilateral effects between the two countries, and u_{ij} is the error term. Equation (10) determines the bilateral imports from country j by consumers in i. Table 2 presents results from estimating equation (10).

All estimations in this paper are conducted for the year 2005.[5] As discussed in Helpman *et al.* (2008), the distance coefficient is biased because φ_{ex} is endogenous and related to the number of exporters. However, there is no bias that results from ignoring aggregated bank assets.

We start by using a very basic setup, including only distance, common language, former colonial relationship, and the GDPs of both countries as explanatory variables. The results are in line with expectations. Distance enters with a negative sign and is highly significant. Since distance captures trade costs in this setup, this is not surprising. Coefficients on dummies for common language and colonial relationship enter with a positive sign. This is as expected as these two variables are proxies for cultural similarities. Furthermore, GDPs of both countries enter with a coefficient of about one, which is predicted by theory.

In a next step, we add a variable that measures the perceived degree of corruption of the exporting country. The lower the value, the more corrupt a country is perceived to be. Results indicate that countries import more from other countries that are not considered being corrupt. We then add dummies on trade agreements. The dummies indicating the membership in the European Economic Community (EEC) or the Asia-Pacific Economic Cooperation turn out to be positive and significant. This is in line with expectations as trade agreements are supposed to foster bilateral trade relationships. Next, we add, in accordance with Aviat and Coeurdacier (2007), cross-border asset positions. These enter with a positive sign, but are insignificant. This results contrasts with Aviat and Coeurdacier (2007) as they find a highly significant impact of cross-border asset positions on trade. There are two reasons why our results differ from theirs. Firstly, we use the BIS Locational Statistics instead of the BIS Consolidated Statistics (see the data appendix for details on the difference between the two statistics). Furthermore, we use a different sample. However, if we try to match their sample as closely as possible, the coefficient on cross-border assets becomes significant. This shows that the results for this specification are not robust. As argued above, the significant result might only result because of the double-entry book-keeping. If this is true, then bank assets should not enter the equation anyway. Regression (4) in Table 2 would be misspecified. In a final step, we add importing country fixed effects (column (5)). Bilateral asset holdings are now significant, which is in line with Aviat and Coeurdacier (2007) but the regression is still misspecified if the theory is correct.

[5] Our analysis could also be conducted for any other year. We chose this particular year because the available data were most complete.

2.3.2 Estimating the Banking Equation

Taking the log of equation (9) yields the gravity equation for cross-border bank assets. After including some additional variables to specify the monitoring costs μ, the estimation setup is similar to that of the above trade equation:

$$\begin{aligned} ln(BA_{ij}) &= \beta_0 + \beta_1\ ln(Dist_{ij}) + \beta_2\ BL_i + \beta_3\ BL_j \beta_4\ r_i \\ &+ \beta_5\ Q_{ij} + u_{ij}, \end{aligned} \tag{11}$$

where BL_i and BL_j are total bank loans in country i and country j, respectively, r_i is the lending rate in country i, and Q_{ij} are distance- related variables.

Table 3 presents the regression results. As in the trade regression, distance is highly significant throughout the different specifications and enters with a negative sign. This confirms and explains the results of numerous studies (Buch 2003, Portes and Rey 2005, Neugebauer 2010) which show that distance has a large impact on cross-border bank holdings. The amounts of total bank loans in the exporting and importing country enter with a positive sign and are highly significant. As explained above, these variables are included to proxy for the masses of both countries. Furthermore, the more financing firms require, the higher the amount of cross-border banking assets if we assume that firms search for the cheapest loan worldwide. One important determinant of cross-border loans is the lending rate in the lending country. If banks in a country charge a high lending rate, this results in few cross-border loans as these become relatively expensive. In a next step, we add common language and former colonial dependence in order to control for the influence of cultural proximity. Including these variables leaves the overall results unchanged. Next, we also add bilateral imports, as several studies have found them to be an important determinant of cross-border financial flows (Portes and Rey 2005, Coeurdacier et al. 2010, Neugebauer 2011). Indeed, we also find trade to be highly significant in our setup, confirming the results of the aforementioned studies. In a final step, we include fixed effects of the capital importing country. Qualitative results remain unchanged.

3 The Joint Determination of Trade in Goods and Asset Holdings

The setup of the model in section 2 was chosen to illustrate a benchmark. Although there is no endogeneity in a correctly specified regression equation, endogeneity might be involuntarily introduced by including regressors that are not derived from theory.

Yet, the model structure above is very simple and possibly misses elements of a trade-bank-asset interrelationship which might again introduce endogeneity. We therefore study the theoretical explanations for a joint determination of trade and asset holdings that have been brought forward by the literature, include them into our theoretical setup, and assess these explanations empirically. To set the scene, we have already presented the empirical observation that trade in goods and in assets are, depending on the specification employed, significant regressors in the gravity equation of the other variable, respectively.

3.1 Earlier Empirical Observations

As mentioned above, several papers have found significant explanatory power of trade in the determination of bilateral asset holdings. However, Aviat and Coeurdacier (2007) go one step further by stating an effect of bilateral asset holdings on bilateral imports. Setting up a system of gravity equations, they find that a 10% increase of trade in goods enhances trade in asset holdings by 6% to 7%. They also find evidence for reverse causality, but this effect is much smaller. They conclude that setting up single-equation systems for trade in goods and asset holdings is not correct and that the two equations should always be estimated simultaneously. Yet, as we have shown in section 2, this might result from a misspecification of the econometric model. The question of why trade in goods should be enhanced by asset holdings remains. Aviat and Coeurdacier propose three different channels to which we turn now.

3.2 Theoretical Explanations

Aviat and Coeurdacier (2007) propose three channels that might justify the joint determination of trade in goods and asset holdings: (i) consumption hedging, (ii) sovereign risk, and (iii) information spillovers. Below, we take a closer look at each of these three channels.

3.2.1 Consumption Hedging and Sovereign Risk

Consumption hedging, as laid out in Obstfeld and Rogoff (2000), enriches the complete markets model of financial assets with trade costs. That helps to explain the home-bias puzzle. The complete markets model assumes costless trade of securities in a risky environment together with a complete set of securities to hedge against the risk. In Obstfeld and Rogoff's model, transaction costs lead to a home bias towards domestic securities. This is because agents incur transaction costs when repatriating their dividends earned on foreign assets. In a multi-country setting, the home biases relative to the partner countries would differ with the transport costs. Since both trade in goods and asset holdings are affected by trade costs, they are correlated. Yet, they are not jointly determined. Lane and Milesi-Feretti (2004) use, based on such a multi-country framework, imports as a *measure* for consumer preferences and transport costs because that fits their symmetric country model.

The second channel builds on Rose and Spiegel (2004) who analyze the effect of sovereign risk on inter-temporal trade. In their setup, creditors only lend to countries on which they can impose credible sanctions in the case of default. Rose and Spiegel argue that the exclusion from (gains of) trade is such a sanction. They assume that in the case of default, the lending country imposes a cut in trade to the borrowing country. The level of borrowing depends on the severity of sanctions in their setting. If a trade cut imposes a higher credible thread for the lending country, the goods exporting country can export more and the net lending rates can therefore be higher. In our context, it is important to stress that it is the *net lending* country that uses its trade as a threat and nothing is said about the relationship of *gross imports* and *gross asset holdings*. Moreover, there is no causal effect of asset holdings on imports in either of the two theories.

Thus both theories do not satisfy condition (iii) of the requirements laid out in section 1: the theoretical models do not contain the relationship assumed in the empirical analysis. We do not consider consumption hedging, because this does not constitute a causal relationship between trade and asset holdings in either direction. We do however assess the importance of the sovereign risk channel and analyze *net imports* in a gravity equation of net cross-border bank assets. We understand Rose and Spiegel (2002) as motivating a relationship of net imports and a negative net asset position. The corresponding gravity equations are given in (12).

$$\begin{aligned} ln(LIAB_{ij} - BA_{ij}) &= \beta_0 + \beta_1\ ln(Dist_{ij}) + \beta_2\ BL_i + \beta_3\ BL_j \beta_4\ r_j \\ &+ \beta_5\ Q_{ij} + \beta_6\ ln(IM_{ij} - EX_{ij}) + \beta_7\ D_i + \beta_8\ D_j + u_{ij} \end{aligned} \tag{12a}$$

$$\begin{aligned} ln(IM_{ij} - EX_{ij}) &= \beta_0 + \beta_1 ln(GDP_i) + \beta_2\ ln(Dist_{ij}) + \beta_3\ ln(GDP_j) \\ &+ \beta_4\ Z_i + \beta_5\ ln(LIAB_{ij} - BA_{ij}) + \beta_5\ Z_j + \xi_{ij} \end{aligned} \tag{12b}$$

The problem with equations (12) is that the log of net liabilities and net imports is only defined for countries with positive values in these variables. With net creditors and net debtors as well as net importers and net exporters in our sample, only a fraction of the observations for bilateral bank assets and bilateral net trade can be used for estimation, i.e. countries for which holds $LIAB - BA$ and $IM - EX > 0$. However, this inevitably introduces a selection bias into our setup.

Table 4 gives the results for estimating equations (12). The estimation is conducted using an IV estimator to account for the fact that net liabilities and net imports are endogenous in this setup. When selecting the variables for the instrumentation, we closely follow Aviat and Coeurdacier (2007). For net liabilities, we select the following instruments: same legal system, age of fiscal treaty, interest tax, and dividend tax. These variables are considered important determinants for cross-border banking assets. Furthermore, we employ a series of instruments to capture net imports: transport costs and squared transport costs[6], dummy variables indicating whether the respective countries are landlocked, and variables capturing the size of the country (in square kilometers). Looking at the results for the net-import equation we find them to be significantly different from the baseline trade equation. Many explanatory variables become insignificant. Most importantly, however, net liabilities enter with the wrong sign and are insignificant. Results for the net-liabilities equation are similar. Furthermore, net imports are also insignificant. These results also hold true when using fixed effects, even if these are not required by the theoretical model. These findings indicate that the sovereign risk story is not the driver behind the relationship between trade in goods and bilateral bank asset holdings. Keeping in mind that gravity equations should rely on gross positions, this is not surprising. We therefore go on and examine the third possibility for an interdependence between trade and asset holdings − information spillovers.

3.2.2 Information Spillovers

The third channel works through information spill-overs as proposed by Portes and Rey (2005). They suggest that information gained through trade relationships can foster trade in financial assets. Information flows affect both trade in goods and in financial assets positively. Goods and asset trade become complementary. This fits into a gravity framework, since information spillovers can affect bilateral exports *and* imports of goods and financial assets at the same time. Gross trade is meaningful in this setup. To assess whether information spillovers explain the data better than the double-entry book-keeping, we introduce spillovers into our baseline models of trade in goods and financial asset holdings.

[6] As in Aviat and Coeurdacier (2007), we measure transport costs by employing UPS shipping costs. We use the costs of a 10kg express parcel. We are aware that much of the freight is much heavier and shipped differently. However, we believe that our measure of transport costs is strongly correlated with the true costs of shipping.

3.3 Introducing Spillovers into the Baseline Model

We stick to the structure of the trade model setup above and augment it by a second decision firms have to take: from which bank they should lend capital. This decision does only make sense if we relax the assumption that production uses only labor. Instead, capital *and* labor are used. Production of firm k from country j is characterized by the cost function $c_{kj} = \frac{1}{\varphi_k}\left(\frac{w_j}{\theta}\right)^{\theta}\left(\frac{r_j}{1-\theta}\right)^{1-\theta}$, where w and r are the wage and interest rate, respectively. With this slight change, the gravity equation for trade (6) remains unchanged even if the supply capacity s_j has a slightly different form: $s_j = \frac{\kappa}{\kappa-(\sigma-1)}\left(\frac{1}{\rho\varphi^{min}}\left(\frac{w_j}{\theta}\right)^{\theta}\left(\frac{r_j}{1-\theta}\right)^{1-\theta}\right)^{1-\sigma} M_j$.

So far, we have two gravity equations explaining international trade and cross-border bank loans, respectively. They result from two distinct decisions and are independent of each other. Information spillovers, however, may interfere with the independence of trade in goods and asset holdings. Aviat and Coeurdacier (2007) suggest: "...trading partners share information, the information flows through trade will enhance asset stocks (and vice versa).... Therefore, trading in the goods market reduces informational asymmetries in the financial markets (and vice versa)" (p. 38).

We introduce the information spillover from loans in the gravity equation for trade as a firm- and import-country-specific demand shifter. Therefore, we slightly change the demand equation to include a demand shifter η_{ij}, which is the same for all firms from country j that sell in market i. To introduce the spillovers, let us assume that the realization of η_{ij} depends on the aggregate asset holdings of country i banks in country j. We assume that the distribution of η_{ij} is normalized to have zero mean and constant variance σ_η. Demand changes to $x_{kj} = \exp(\eta_{ij})\frac{p_{kij}^{-\sigma}}{P_i^{1-\sigma}}Y_i$. The empirical gravity equation now additionally includes bank assets BA_{ij} to proxy the demand shifter since the shift in demand is a positive function of assets of banks from country i in country j[7]:

$$\begin{aligned} ln(IM_{ij}) &= \beta_0 + \beta_1 ln(GDP_j) + \beta_2\ ln(Dist_{ij}) + \beta_3 ln(GDP_i) \\ &+ \beta_4\ ln(BA_{ij}) + u_{ij}. \end{aligned} \quad (13)$$

We see the information spillover from trade to bank loans as increasing country j firms' awareness of the opportunities of cross-border loan supply by banks from i. Hence, trade in goods increases the number of banks n_i screened by the firms in j. That would make n_i not only a function of bank market size or GDP, but also a function

[7] We use data on bank assets instead of bank loans as these are more readily available. However, as bank loans constitute the largest share of bank assets, this should be a valid approximation.

of trade in goods between the countries. The gravity equation explaining cross-border bank loans includes trade as a regressor since the trade variable reflects the information spillovers:

$$\begin{aligned} ln(BA_{ij}) &= \beta_0 + \beta_1\ ln(Dist_{ij}) + \beta_2\ BL_j + \beta_3\ BL_i + \beta_4\ r_j \\ &+ \beta_5\ Q_{ij} + \beta_6\ ln(IM_{ij}) + u_{ij} \end{aligned} \tag{14}$$

For both spill-over stories, we prefer to use the activity of the previous year to make sure that the decisions are made using information that are already available. Yet, gravity equations (13) and (14) are not distinguishable from the misspecifications discussed above. We therefore study the importance of information spillovers by analyzing two sub-samples of bank assets: (i) loans supplied to other banks and (ii) those supplied to firms and private persons. We do this because information spillovers from imports should not be relevant for activities in the interbank market. Hence, we expect the spillover story to hold only for the second sub-group.

3.4 Empirical Assessment of Intertemporal Trade and Information Spillovers

As mentioned above, Aviat and Coeurdacier (2007) test the information spillover channel using combined bilateral assets vis-à-vis banks and non-banks. However, this story only makes sense for assets vis-à-vis the non-bank sector. Therefore, we split our data set into two subgroups. One subgroup captures assets that banks have vis-à-vis other banks, and the other subgroup comprises of assets vis-à-vis non-banks. If the information-spillover-story is correct, the estimation containing assets vis-à-vis banks should turn out insignificant. The information-spillover-story requires a system estimator for the two equations. Therefore, we estimate equations 13 and 14 using a Three-Stage-Least-Squares approach with transport costs as the identifying restriction.

Table 5 reports the results. The first two columns give the results when using the full sample, i.e. assets vis-à-vis banks and vis-à-vis nonbanks. As in Aviat and Coeurdacier (2007), bilateral imports and asset holdings are highly significant. Furthermore, the crucial gravity variables are still significant and enter with the correct sign. We then go on and split the sample into assets vis-à-vis non-banks and vis-à-vis banks. Qualitative results remain by and large unchanged for the two subgroups. Most importantly, bilateral trade and bilateral asset holdings are significant in both setups. However, as mentioned before, if the information-spillover story was to hold, then only the specification using assets vis-à-vis nonbanks should be significant. This is not the case as we get strongly significant results for both subgroups. Summing up our results, we conclude that they do not provide conclusive evidence for the information spillover channel.

4 Conclusion

This paper has tried to find the link between trade in goods and asset holdings in gravity equations. Earlier literature has found an impact of trade on bilateral asset holdings (Coeurdacier 2010, Neugebauer 2010). Furthermore, Aviat and Coeurdacier (2007) have found a consistent impact of bilateral bank asset holdings on imports as well. They therefore argue that single-equation gravity models are misspecified and lead to an endogeneity bias, and they claim that gravity equations for trade in goods and gravity equations for asset holdings should be estimated simultaneously.

The question is where the interdependence between trade in goods and asset holdings comes from. Aviat and Coeurdacier (2007) propose three different channels: (i) consumption hedging, (ii) sovereign risk, and (iii) information spillovers. In this paper, we first derived gravity equations for bilateral imports and bilateral bank asset holdings from two separate models. These are then estimated using single-equation setups. While both endogenous variables are independent of each other, we introduce an "interrelationship" that stems from double-entry book-keeping and has found both variables affecting each other. Both single-equation models that include the other endogenous variable, apart from the simultaneous equation model, are nevertheless misspecifications if the theoretical models are correct. We finally model and test three transmission channels proposed in the literature to search for the interrelation. Our results do not find support for any of the three channels.

The paper has two main findings, a general and a specific one. Generally, we find systems of simultaneous equation models in even stronger need for a theoretical basis than single-equation approaches because of the autonomy restriction which can only be evaluated against the background of economic theory. Finding two variables to affect each other in a particular setup is not sufficient for the call for a system approach. With respect to our particular interest in trade, we find that single-equation gravity approaches to trade are justified as long as no channel of the interrelation is brought forward that backs the interrelation in a sense that the autonomy restriction is satisfied.

We arrive at this conclusion by employing a Melitz-type model of international trade, from which we derive a gravity equation for bilateral imports that does *not* include bilateral asset holdings and can therefore be estimated in a single-equation setup. Indeed, including bilateral asset holdings would mean introducing an endogeneity bias that stems from a misspecification of the econometric model. We then go on and set up a model of bilateral bank asset holdings as described in Brüggemann et al. (2012). The gravity equation derived from this model does not include bilateral imports. This means that estimating gravity equations for bilateral imports and bilateral asset holdings separately leads to unbiased results in our setup.

We then model scenarios which try to explain the interdependence between trade and bank asset holdings. The first two rely on consumption hedging (Obstfeld and Rogoff 2000) and sovereign risk (Rose and Spiegel 2002), respectively. Both explanations are based on net trade, which is unusual in standard gravity setups, as these usually rely on gross positions. Not surprisingly, the respective setup leads to insignificant results for net trade. We therefore conclude that consumption hedging and sovereign risk are not the drivers of the observed relationship between imports and asset holdings.

Finally, we test wether information spillovers explain the interrelationship, as proposed by Portes and Rey (2005). Indeed, the information spillover story is also consistent with gross trade. However, if we stick to our model, then spillovers should only play a role when looking at assets vis-à-vis non-banks. Interbank positions should not be affected by spillovers from goods trade. However, when estimating the setups using interbank positions, these turn out to be highly significant. This is not in accordance with the information spillover story.

Summing up, we conclude that none of the transmission channels proposed by Aviat and Coeurdacier (2007) seems to be supported by our theoretical models and the respective empirical results. The driver behind the interrelationship between trade in goods and asset holdings remains unclear. As long as this is the case, we conclude that the "interrelation" is somehow spurious. One avenue that might be worth pursuing is to study the role of multinational enterprises, which possibly draw financing from banks in their home countries and import intermediate goods from home. That could translate into a positive interdependence of imports and cross-border bank asset in bilateral gravity equations. However, whether this channel yields a theoretical basis for the interrelationship has not not been studied yet. Until this or another channel has been found, we conclude that single-equation gravity models for bilateral imports are justified: All you need is trade!

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Appendix

A. Data

BIS Locational Statistics

The banking statistics by the Bank for International Settlements (BIS) provide mostly quarterly time series on banks' international claims, liabilities, and securities holdings, broken down by residency or nationality, sector, counterparty, or maturity. A particular strength of the BIS banking statistics is their comprehensive coverage of international banking activity due to the fact that the largest international financial centers contribute to these statistics (Wooldridge 2002). The BIS provides two sets of statistics on bilateral cross-border banking activities. The Locational Banking Statistics aggregate cross-border and foreign currency positions of banks, regardless of whether or not these banks are affiliated with domestic banks. It has the advantage that it follows the principles of national accounts, money and banking as well as the balance of payments and external debt statistics. For the Locational Stastistics, domestic and foreign-owned banking offices in the reporting countries give positions on gross transactions. As mentioned in section 3.2.1, gravity equations require gross positions, so the locational statistics fit this concept very well.

Trade Data

We use bilateral imports and exports as taken from the STAN database provided by the OECD. These variables are taken to provide gross and net positions in cross-border trade between two countries. OECD bilateral trade data are derived from the OECD's International Trade by Commodity Statistics.

Gravity Variables and Other Indicators

Standard gravity variables are taken from CEPII.[8] We use great circle distances between the capital cities of two countries to account for the fact that countries that are far apart trade less with each other. In addition, we include a dummy that indicates whether two countries have a common border and whether a country is landlocked. We also use variables on cultural similarities as countries that have a similar cultural background are known to engage in trade more intensively. Among these variables are common language and former colonial dependence. Furthermore, we include the Corruption Perception Index, as compiled by Transparency International, to account for the fact that countries trade more with each other if the recipient country is perceived as being not corrupt. The index ranges from 1 to 10, 1 indicating a country that is perceived of being very corrupt. We add variables that indicate if two countries are

[8] Data are available from http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

part of the same trade agreement as this usually enhances the amount traded. Bilateral transport costs are collected from the UPS website. We use prices for a 10kg express saver parcel as the respective data is most complete. Finally fiscal variables are taken from the IBFD online database (http://www.ibfd.org). More specifically, we use the Latin American Taxation Database, the European Taxation Database, the Asia-Pacific Taxation Database, and the Tax Treaties Database.

Macroeconomic Data

We include GDP of the origin country and the destination country in the gravity framework. This variable is taken from the the IMF International Financial Statistics (IFS). As mentioned above, GDP proxies for the mass or size of a country. GDP of the origin country is expected to enter with a positive sign, since countries that are large in economic terms can also be expected to engage more heavily in cross-border banking. The same holds true for GDP of the destination country. The larger the destination country in economic terms, the more foreign capital it can absorb.

B. Technical Appendix

$$
\begin{aligned}
Ex_H &= M_H \int_{\varphi_{ex}}^{\infty} \left(\frac{w\tau}{\rho\varphi}\right)^{1-\sigma} \frac{Y_F}{P_F^{1-\sigma}} g(\varphi) d\varphi \\
&= M_H \int_{\varphi_{ex}}^{\infty} \left(\frac{w\tau}{\rho}\right)^{1-\sigma} \frac{Y_F}{P_F^{1-\sigma}} \varphi^{\sigma-\kappa} \kappa \varphi_{min}^{\kappa} d\varphi \\
&= M_H \left[-\frac{\kappa}{\kappa-(\sigma-1)}\varphi^{\sigma-\kappa+1}\right]_{\varphi_{ex}}^{\infty} \varphi_{min}^{\kappa} \left(\frac{w\tau}{\rho}\right)^{1-\sigma} \frac{Y_F}{P_F^{1-\sigma}} \\
&= M_H \left[0+\frac{\kappa}{\kappa-(\sigma-1)}\varphi_{ex}^{\sigma-\kappa+1}\right] \varphi_{min}^{\kappa} \left(\frac{w\tau}{\rho}\right)^{1-\sigma} \frac{Y_F}{P_F^{1-\sigma}} \\
&= \underbrace{\frac{\kappa}{\kappa-(\sigma-1)} \left(\frac{w}{\rho\varphi_{min}}\right)^{1-\sigma} M_H}_{s_H} \left(\frac{\varphi_{min}}{\varphi_{ex}}\right)^{\kappa-(\sigma-1)} \tau^{1-\sigma} \underbrace{\frac{Y_F}{P_F^{1-\sigma}}}_{m_F}
\end{aligned} \tag{15}
$$

Tables

Table 1: Descriptive Statistics

This Table reports descriptive statistics for the variables used.

Variable	No. of Obs.	Mean	Std. Dev.	Min	Max
Imports_{ij}	2442	2.28E+09	1.14E+10	41.04	2.92E+11
Exports_{ij}	2529	1.92E+09	8.76E+09	97.1	2.11E+11
Assets_{ij}	2416	6408238	3.78E+07	-1000	9.44E+08
Liabilities_{ij}	2420	5087446	3.20E+07	0	7.17E+08
GDP_i	2536	1.79E+09	2.77E+09	3.66E+07	1.24E+10
GDP_j	2223	2.83E+08	1.11E+09	66368.84	1.24E+10
Loans_i	2536	2.52E+09	5.09E+09	42400000	2.33E+10
Loans_j	1949	3.67E+08	2.04E+09	5.17E+03	2.33E+10
Lending rate_i	2069	5.699065	2.211528	1.677	10.55
Transport costs_{ij}	883	394.2741	139.5972	69.89706	1192.786
Distance_{ij}	2495	6365.179	4004.431	173.0333	19586.18
Common language_{ij}	2495	0.1174349	0.3220023	0	1
Colony_{ij}	2495	0.0673347	0.2506509	0	1
Corruption_j	2078	4.209913	2.229128	1.7	9.7
EEC_{ij}	2536	0.1313091	0.3378048	0	1
APEC_{ij}	2536	0.0153785	0.1230773	0	1

Table 2: Baseline Trade Regression

This Table reports the regression results for the baseline trade regression. The dependent variable is the log of imports. Estimation is conducted using robust standard errors. Estimation in column (5) is conducted using importing country fixed effects. ***, **, and * denote significance at the 1%-, 5%-, and 10%-level, respectively.

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: $\ln(\text{Imports}_{ij})$				
$\ln(\text{Distance}_{ij})$	-0.836***	-0.793***	-0.608***	-0.623***	-0.463***
	(0.041)	(0.042)	(0.057)	(0.060)	(0.058)
Common language$_{ij}$	0.284*	0.221	0.232	0.291*	0.346**
	(0.150)	(0.151)	(0.151)	(0.151)	(0.151)
Colony$_{ij}$	0.911***	0.890***	0.938***	0.766***	0.611***
	(0.166)	(0.168)	(0.165)	(0.171)	(0.174)
$\ln(\text{GDP}_i)$	1.255***	1.245***	1.235***	1.225***	
	(0.037)	(0.038)	(0.040)	(0.051)	
$\ln(\text{GDP}_j)$	1.183***	1.128***	1.124***	1.051***	0.957***
	(0.019)	(0.022)	(0.022)	(0.034)	(0.033)
Corruption$_j$		0.071***	0.026	0.030	-0.011
		(0.019)	(0.021)	(0.022)	(0.021)
EEC$_{ij}$			0.767***	0.657***	0.649***
			(0.124)	(0.130)	(0.132)
APEC$_{ij}$			0.425**	0.383*	1.155***
			(0.200)	(0.203)	(0.236)
$\ln(\text{Assets}_{ij})$				0.015	0.135***
				[0.024)	(0.025)
Number of observations	2150	1945	1945	1548	1548
R^2	0.746	0.737	0.740	0.749	0.799

Table 3: Baseline Asset Regression

This Table reports the regression results for the baseline asset regression. The dependent variable is the log of cross-border banking assets. Estimation is conducted using robust standard errors. Estimation in column (4) is conducted using fixed effects of the capital-importing country. ***, **, and * denote significance at the 1%-, 5%-, and 10%-level, respectively.

	(1)	(2)	(3)	(4)
	Dependent variable: $\ln(\text{Assets}_{ij})$			
$\ln(\text{Distance}_{ij})$	-0.930***	-0.938***	-0.830***	-1.120***
	(0.055)	(0.053)	(0.055)	(0.085)
$\ln(\text{Loans}_j)$	0.794***	0.824***	0.685***	
	(0.019)	(0.018)	(0.033)	
$\ln(\text{Loans}_i)$	0.808***	0.753***	0.610***	0.670***
	(0.046)	(0.046)	(0.052)	(0.045)
Lending rate_i	-0.170***	-0.170***	-0.197***	-0.224***
	(0.024)	(0.024)	(0.024)	(0.019)
Common language_{ij}		0.556***	0.551***	0.308**
		(0.147)	(0.143)	(0.146)
Colony_{ij}		1.282***	1.139***	1.193***
		(0.173)	(0.168)	(0.164)
$\ln(\text{Imports}_{ij})$			0.170***	0.160***
			(0.034)	(0.031)
Number of observations	1244	1244	1242	1521
R^2	0.690	0.714	0.721	0.815

Table 4: Sovereign Risk

This Table reports the regression results for the sovereign risk setup. The dependent variable is the log of net imports and net liabilities, respectively. Estimation is conducted using robust standard errors. ***, **, and * denote significance at the 1%-, 5%-, and 10%-level, respectively.

	(1)	(2)
	Rose/Spiegel	
	Net Imports	Net Liabilities
$\ln(\text{Distance}_{ij})$	-0.196	-0.228
	(0.193)	(0.221)
Common language_{ij}	0.097	0.831**
	(0.523)	(0.350)
Colony_{ij}	0.243	0.682
	(0.489)	(0.586)
$\ln(\text{GDP}_i)$	0.976***	
	(0.175)	
$\ln(\text{GDP}_j)$	0.974***	
	(0.213)	
Corruption_j	0.060	
	(0.055)	
EEC_{ij}	0.371	
	(0.364)	
APEC_{ij}	0.733*	
	(0.442)	
$\ln(\text{Loans}_j)$		0.469***
		(0.181)
$\ln(\text{Loans}_i)$		0.187
		(0.251)
Lending rate_i		-0.301***
		(0.076)
$\ln(\text{Net liabilities}_{ij})$	-0.188	
	(0.249)	
$\ln(\text{Net imports}_{ij})$		0.443
		(0.314)
Number of observations	199	142
R^2	0.645	0.464

Table 5: Spillovers

This Table reports the regression results for the information spillover setup. The dependent variable is the log of cross-border banking assets and the log of cross-border trade, respectively. Transport costs are added as identifying restriction in the trade equation. Regressions are conducted using 3SLS. ***, **, and * denote significance at the 1%-, 5%-, and 10%-level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	vis-a-vis all		vis-a-vis banks		vis-a-vis nonbanks	
	Imports	Assets	Imports	Assets	Imports	Assets
$\ln(\text{Distance}_{ij})$	-0.448***	-0.557***	-0.610***	-0.826***	-0.667***	-0.515***
	(0.060)	(0.067)	(0.049)	(0.075)	(0.050)	(0.074)
Common language$_{ij}$	0.308**	0.339	0.239**	0.528**	0.221*	0.276
	(0.142)	(0.236)	(0.113)	(0.258)	(0.114)	(0.256)
Colony$_{ij}$	0.051	0.866***	-0.031	0.853***	0.013	1.033***
	(0.175)	(0.292)	(0.141)	(0.323)	(0.141)	(0.318)
$\ln(\text{GDP}_i)$	0.608***		0.536***		0.581***	
	(0.040)		(0.033)		(0.031)	
$\ln(\text{GDP}_j)$	0.668***		0.629***		0.656***	
	(0.032)		(0.026)		(0.025)	
Corruption$_j$	-0.016		-0.010		0.033**	
	(0.018)		(0.015)		(0.014)	
EEC$_{ij}$	0.107		-0.256**		-0.229**	
	(0.137)		(0.112)		(0.114)	
APEC$_{ij}$	0.689***		0.951***		0.969***	
	(0.182)		(0.143)		(0.147)	
$\ln(\text{Loans}_j)$		0.497***		0.711***		0.457***
		(0.048)		(0.055)		(0.053)
$\ln(\text{Loans}_i)$		0.404***		0.549***		0.378***
		(0.067)		(0.076)		(0.074)
Lending rate$_i$		-0.189***		-0.107***		-0.249***
		(0.026)		(0.030)		(0.029)
$\ln(\text{Imports}_{ij})_{t-1}$		0.570***		0.418***		0.430***
		(0.057)		(0.065)		(0.063)
$\ln(\text{Assets}_{ij})_{t-1}$	0.154***		0.147***		0.142***	
	(0.022)		(0.018)		(0.017)	
$\ln(\text{Transport costs}_{ij})$	-0.517***		-0.211**		-0.283***	
	(0.130)		(0.105)		(0.106)	
Number of observations	660	660	600	600	644	644
R^2	0.779	0.676	0.827	0.669	0.839	0.578

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