The geography of asset trade and the euro: insiders and outsiders

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Abstract

This paper analyzes the determinants of cross-border asset trade on cross-country data and a Swedish data set. We focus our analysis on the impact of the euro for the determinants of trade in bonds, equity and banking assets. With the help of a theoretical model, we disentangle the different effects that the euro may have on cross-border asset holdings for both euro zone countries and countries outside of the euro zone. We find evidence that the euro implies 1) a unilateral financial liberalization which makes it cheaper for all countries to buy euro zone assets. For bonds and equity holdings, this translates into approximately 14% and 17% lower transaction costs; 2) a preferential financial liberalization which on top of the previous effect lowers transaction costs inside the euro zone by approximately 17% and 10% for bonds and equity respectively; 3) a diversion effect due to the fact that lower transaction costs inside the euro zone entail euro countries to purchase less equity from outside the euro zone. Our empirical analysis also suggests that the elasticity of substitution between bonds inside the euro zone is three times higher than between bonds denominated in different currencies.

Keywords: International Asset Trade, Gravity Equation, euro.

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1 Introduction

Financial integration has been one the major trends characterizing the world economy in the recent past and partially explains the increase in cross-border asset holdings. All industrialized countries have been affected by this process. The creation of the euro can at least partially be interpreted as affecting this process of financial integration but in an asymmetric way for countries inside and outside the euro zone. From that point of view, an interesting question is to what extent the euro can be considered as unilateral or preferential financial liberalization. The question is important especially for countries outside the euro zone but which trade a lot with the euro. If one believes that financial integration and financial flows generate gains in terms of risk diversification and allocation efficiency, it is important to estimate both the opportunity cost of being outside the euro zone and the cost or gain of the creation the euro for outsiders.

To analyze these questions we use two data sets: a cross-country one on bilateral asset holdings and a Swedish data set on both holdings of foreign assets and outflows. Sweden is interesting to study because it is a very open country for both trade and financial flows, it is a member of the largest and most integrated regional trade agreement, the European Union, but at the same time remains an outsider of the euro zone.

Our paper is very much related to the analysis of Lane (2006) on the impact of EMU on bond portfolios and Lane and Milesi-Feretti (2007) on portfolio equity investment by euro-area countries. It also builds on recent papers that have analyzed the financial gravity equation such as Portes and Rey (2005), Portes, Oh and Rey (2001) and Aviat and Coeurdacier (2007). De Santis and Gerard (2006) also analyze the impact of EMU on portfolio weights rebalancing and Berkel (2006) on the effect of EMU on gross German portfolio flows.

Our additional contribution is both theoretical and empirical. Based on the model of Martin and Rey (2004 and 2006), we derive a testable financial gravity equation that informs us on the different potential effects of the euro on cross border asset holdings. Empirically, we analyze, not only the determinants of bond holdings, but also of equity and banking assets. Also, we attempt to disentangle the different effects that the euro may have on asset holdings for both euro zone countries and countries outside of the euro zone. In this context, we interpret, somewhat restrictively, the creation of the euro in terms of a change in transaction costs on cross-border trade in financial assets. For example, the elimination of currency risk had several effects. It decreased transaction costs of trading across different financial markets in the euro zone. It led to more integration of national equity markets. In particular, due to local currency mandates on many institutional investors, the replacement of national currencies by the euro meant that the feasible universe for such investors was greatly enlarged (Lane 2008). In theory therefore, the euro may have several effects on the cost of transacting assets: on transactions inside the euro zone,

on purchases of euro assets by countries outside the euro zone and on purchases of non euro assets by euro countries. As in trade theory, these changes in transaction costs may also result in diversion. In addition, and as noted by Lane (2006), the euro may increase the elasticity of substitution between assets of the euro zone because a single monetary policy increases the correlation of returns. This actually may have a negative effect on the holdings of euro assets by countries in the euro zone. The reason is that the increased elasticity magnifies the impact of any remaining transaction cost (due to different legal systems in the euro zone for example) on cross-border holdings of euro assets in the euro zone. Hence, at least theoretically, it is not obvious that the euro increases the cross-border demand for assets inside the euro zone. We attempt to analyze these different effects from a theoretical point of view and quantify those with the help of cross-country data on asset holdings and Swedish data on foreign asset purchases. We find evidence that the euro affects both transaction costs and the elasticity of substitution but the effect is different for different classes of assets and also different whether countries are in or out of the euro zone.

Our estimates (which depend on our estimated elasticity of substitution between assets) suggest that the transaction cost to buy assets from the euro zone are lower by around 17% for equity and 14% for bonds. This benefits both those countries that are in and outside of the euro zone. On top of this effect, those countries inside the euro zone benefit from a decrease of transaction costs for bonds and equities respectively of around 17% and 10% . Hence, for a country inside the euro zone the transaction cost for the cross border purchase of a euro bond or equity is lower by around 31% and 24% respectively. The euro effect can be interpreted as both preferential and unilateral financial liberalization. This resembles some recent results (see Baldwin (2006) and Flam and Nordstrom (2003)) in the literature on the euro effect on trade in goods. However, contrary to this literature we find no evidence that the euro decreases the transaction cost for euro countries of purchasing equity outside the euro zone. In fact, for equities we find evidence that some diversion takes place in the sense that euro countries buy less equities from outside the euro zone. This evidence is based on comparing asset trade between euro countries and the nordic countries in (Finland) and out (Sweden, Norway, Denmark) of the euro zone. This diversion effect does not come from an absolute increase in transaction costs for buying assets from the rest of the world but from a relative cost effect. On Swedish data, we also confirm that the euro works like unilateral liberalization: the portfolio bias towards the euro zone is found quantitatively large for equity and bond holdings. Interestingly, we also find that this bias is larger for flows than for asset holdings. This suggests that the effect of the euro was to decrease costs to trade euro assets across borders (which led to an increase of the turnover) rather than . It on euro assets in transaction costs due to the euro is partly due to an increase in the liquidity of euro assets which in turn has increased the .

Finally, our empirical analysis suggests that the elasticity of substitution between bonds inside the

euro zone is higher than between bonds denominated in different currencies. Our estimate is that it is almost three times higher. This actually depresses cross border asset holdings in the euro zone as it magnifies the negative impact of remaining transaction costs in the euro. We illustrate this effect for transaction costs generated by the difference in the legal system.

The first section introduces a simple theoretical framework in order to generate testable financial gravity equations. We then present empirical evidence on determinants of cross border financial asset holdings and in particular the effect of the euro on both insiders and outsiders. We do this by using both a cross country data set and a data set on Swedish holdings of foreign assets and Swedish capital outflows.

2 Theoretical framework

We use a simplified version of Martin and Rey (2004 and 2006) to derive a gravity equation for international trade in assets with financial transaction costs[1]. There are N countries populated with L_i $(i \in N)$ risk averse agents who live for two periods. Agents are endowed with projects and assets correspond to claims on those risky projects. The number of traded assets (n_j for country j) is therefore taken to be exogenous here (in Martin and Rey (2006), it is endogenous). The number of shares per asset is normalized to one. The cost of an asset issued by an agent in country j and bought by an agent in country i is $p_j\tau_{ij}$ where p_j is the price of the asset and $(\tau_{ij} - 1)$ is the bilateral financial transaction cost between the two countries. As in the trade literature, the simplifying assumption is that this cost takes a iceberg form meaning here that the transaction fee is paid in units of the asset itself. We have a very broad interpretation of these transaction costs which include currency risk, trading and liquidity related costs, taxation differentials, differences in accounting and legal standards, and information asymmetry.

In the second period, there are Z exogenous and equally likely states of nature (the number of states of nature is assumed to be larger that the number of traded assets), and the realization is revealed at the beginning of that period after all decisions have been taken. As in Acemoglu and Zilibotti (1997) and Martin and Rey (2004), the technology implies that each project gives dividends in only one state of nature. In all other states of nature, the dividends are zero. All risky claims to operating profits are traded on the stock market at the end of period one, so that each claim corresponds to an Arrow-Debreu asset. No duplication occurs in equilibrium so that each investment/asset in the world is unique[2]. This modelling introduces a simple incentive for agents to diversify their portfolios.

A representative agent in country i maximizes utility subject to the first period budget constraint (in

[1] See also Aviat and Coeurdacier (2007) for a derivation of financial gravity equation in a related framework.

[2] In Martin and Rey (2006) where the number of assets is endogenous, this is shown to be an equilibrium as agents have no incentive to replicate an existing asset.

second period consumption is the dividend of shares purchased in first period):

$$\begin{aligned} \underset{C_{1i},C_{2i},s_{ij}}{Max}\ E(U_i) &= \ln C_{1i} + \beta \ln \left[\sum_{z=1}^{Z} \frac{1}{Z} C_{2i}(z)^{1-1/\varepsilon} \right]^{\frac{1}{1-1/\varepsilon}} \\ &= \ln C_{1i} + \beta \ln \frac{1}{N^{\frac{1}{1-1/\varepsilon}}} + \beta \ln \left[\sum_{h=1}^{N} \sum_{l_h=1}^{n_h} \left(d_{l_h}\ s_{il_h} \right)^{1-1/\varepsilon} \right]^{\frac{1}{1-1/\varepsilon}} \\ s.t. \quad : \quad y_i &= C_{1i} + \sum_{h=1}^{N} \sum_{l_h=1}^{n_j} \tau_{ih} p_h s_{il_h} \end{aligned}$$

which is of the non-expected form introduced by Epstein and Zin (1989) and Weil (1990). This allows the intertemporal elasticity of substitution (which we assume to be 1 for simplicity) to be different from the coefficient of relative risk aversion $(1/\varepsilon)$. C_{1i} and C_{2i} are consumption in first and second period respectively. y_i is per capita income and s_{il_j} is the demand by an agent of country i for the asset of agent l_j of country j. Remember that assets are all different in the sense that they give dividends in different states of nature (this is the reason why agents want to diversify their portfolio and buy all existing assets) but they are symmetric in the sense that they all give in only one state of nature. This symmetry implies that the "typical" demand by an agent of country i for an asset of country j can be denoted as: $s_{il_j} = s_{ij}$.

Note that for the second period, this utility function is similar to the one introduced by Dixit and Stiglitz (1977) to represent preferences for differentiated products and ε can be interpreted as the elasticity of substitution between assets. In what follows, we impose $\varepsilon > 1$ to have financial home bias and realistic asset demands.

If we call $r_j = d_j/p_j Z$, the expected return of asset j, the value of the aggregate demand by country i agents for assets issued in country j is (exclusive of transaction costs):

$$Asset_{ij} = L_i p_j n_j s_{ij} = \frac{\beta L_i y_i n_j}{(1+\beta)} \left(\frac{r_j Q_i}{\tau_{ij}} \right)^{\varepsilon - 1}, \quad Q_i = \left[\sum_{h=1}^{N} n_h \left(\frac{r_h}{\tau_{ih}} \right)^{\varepsilon - 1} \right]^{\frac{1}{1-\varepsilon}} \tag{1}$$

Note that as in the trade literature a "price index" Q_i specific to each country appears in the demand for assets. We can think of it in our context as a financial price index for all assets that compete with the imported asset. It measures financial remoteness (see Anderson and van Wincoop (2003) and Head and Mayer (2004) for the trade version). A country with a low Q_i (for example because its own financial markets are very diversified and it issues many assets) is a country to which (for a given relative return and bilateral transaction cost) it is difficult to sell financial assets. Note that an empirical difficulty (again common to the trade in goods literature) is that this price index is supposed to contain all potential asset suppliers in the world.

What are the effects of the euro in this theoretical context? The euro can most obviously be interpreted as a decrease in transaction costs τ_{ij} between two countries i and j inside the euro zone. This should increase the cross-border demand of euro assets by euro countries. Note that this decreases the "financial"

price index Q_i of the euro countries and therefore exerts a negative impact on the demand by euro countries for assets outside the euro zone.

However, we may also think that the euro makes it easier for non euro countries to buy euro assets, which we would interpret as a decrease in τ_{hj} where country j is in the euro but not h. This increases the demand for euro assets. Symmetrically, the euro could make it easier for euro countries to buy non-euro assets (a decrease in τ_{jh} where country j is in the euro but not h).

Finally, it is intuitive to believe that the euro increases the elasticity of substitution between assets of the euro zone. One reason is that with a single monetary policy the correlation between asset returns (dividends and even more so interest rates) should increase. This effect cannot be straightforwardly captured in our simple model with a very specific structure of returns because the elasticity of substitution between assets is the same for all assets and is the inverse of the coefficient of relative risk aversion which is the same for all agents. However, it should still be true that for two countries i and j, the demand by country j for assets of country i depends on the interaction between bilateral transaction costs τ_{ij} and the specific elasticity of substitution between these two countries ε_{ij} in the following way[3]: $(\tau_{ij})^{1-\varepsilon_{ij}}$. This has important implications. Suppose we divide bilateral transaction costs into those related to the euro and all others related to cross-border asset transactions that are not affected by the euro (for example the difference in legal systems among euro zone countries). For a country pair inside the euro zone, transaction costs are lower so this should exert a positive impact on their bilateral cross border asset holdings. However, the negative impact of difference in legal systems τ_{ij} is magnified by the introduction of the euro if we believe that ε_{ij} is larger for euro zone countries

We are now ready to produce the financial version of the gravity equation for the holdings of assets of country j by country i (ignoring constants and assuming for the moment that the elasticity of substitution is the same for all countries) which will the base of our empirical specification:

$$\log(Asset_{ij}) = \log L_i y_i + \log n_j - (\varepsilon - 1)\log \tau_{ij} + (\varepsilon - 1)\log r_j + (\varepsilon - 1)\log Q_i \tag{2}$$

The first term is a size factor and corresponds to the GDP of country i. The second one is the number of assets in country j. This latter variable may be related to economic size (GDP and market capitalization) but also to the financial sophistication of the country that may be linked to its status as a recognized financial center. In Martin and Rey (2006) where the number of assets issued by a country is endogenous, it is shown to increase with the income of the country and with financial openness of the country when the country is relatively rich. The third term indicates that transaction costs between the two countries have a negative impact on asset holdings. The effect depends on the elasticity of substitution which may

[3]To keep the model tractable, we have to assume that assets have uncorrelated pay-offs. Hence, the elasticity of demand is only driven by the coefficient of risk aversion. With a more sophisticated stochastic structure, the elasticity of substitution between assets will also depend on the correlation of their pay-offs and an increase in the substitutability ε_{ij} between assets i and j is equivalent to an increase in the correlation of their pay-offs.

be different for different assets: typically higher for bonds than for equities. The fourth term implies that countries with high expected returns should get more demand for their assets. The last term is the financial price index which is specific to each country. Note that only one variable is country pair specific: the bilateral transaction costs and we will focus our attention on the determinants of those costs in the empirical section. All other terms are country specific. Note also that, in a given class of assets (bonds or equities), the reaction of the demand to a change in transaction costs depends on ε, the elasticity of substitution between assets. It therefore assumes that this elasticity is not affected by the change in the transaction cost itself. In the case of the euro, we will need to relax this assumption as the euro is both a decrease in transaction costs and potentially a factor that increases the substitutability of assets of the euro zone.

3 Empirical evidence

3.1 Empirical strategy

Following our theoretical model, we propose two identification strategies to test equation (2).

- **Specification (a)**

First, we estimate the following equation using only country i fixed-effects (α_i). We use the GDP of country j (GDP_j) for the market size (n_j) of the "destination" country (the country that sells the asset and imports capital). We also proxy the financial sophistication of market (j) by the ratio of stock market capitalization over GDP ($\frac{MktCap}{GDP}$)$_j$. We do not have to proxy the market size ($L_i y_i$) for the "source" country (the country that buys the assets and exports capital) since it is included in the fixed-effect (α_i). Expected returns in country j are approximated by the log of the average gross equity return in US$ over the period 1990-2001 ($\log r_j$).

$$\log(Asset_{ij}) = \alpha_i + \beta \log(GDP_j) + \gamma(\frac{MktCap}{GDP})_j + (\varepsilon - 1)\log Z_{ij} + (\varepsilon - 1)\log r_j$$

where Z_{ij} are the transaction costs on international financial markets. We assume the specific functional form:

$$Z_{ij} = Distance_{ij}^{\delta_1} exp(\delta_2 euro_{ij} + \delta_3 commonlang_{ij} + \delta_4 legal_{ij} ...)$$

where $Distance_{ij}$ is the bilateral distance, $euro_{ij}$, $commonlang_{ij}$, $legal_{ij}$ are dummies that indicate that both countries belong to the euro zone, share a common language and a common legal system. We describe these in more detail in the next section.

To analyze the impact of the euro on the elasticity of substitution between assets inside the euro zone, we will add an interaction term between the euro dummy and the identity of the legal system.

The use of fixed-effects in the source country dimension (i) allow us to control for the financial price index Q_i. Indeed, as shown by Anderson and Van Wincoop (2004) (see also Baldwin and Taglioni (2006)), this strategy allows to control for the "multilateral resistance term" (Q_i). Since transaction costs affect the financial price index, the omission of source country fixed-effects might bias the estimated coefficient on our transaction cost variables. This specification has the main advantage to keep variability in two dimensions (country j and bilateral dimension). Strictly speaking, this equation is the exact counterpart of equation (2). This is our preferred specification since we control for the financial remoteness of country (i) and we keep a reasonable number of parameters to estimate. However, without fixed-effect in the country (j) dimension, we might not control perfectly for some unobservable country-specific factors that can affect international asset holdings. In order to deal with this issue, we will add a large set of control and dummy variables in the country (j) dimension (financial sophistication, corruption index, presence of tax havens and financial centers in the sample and some regional dummies).

In the second specification, we control for fixed-effects in both dimensions.

- **Specification (b)**

We add fixed-effects in the destination country (j) dimension:

$$\log(Asset_{ij}) = \alpha_i + \alpha_j + (\varepsilon - 1)\log Z_{ij}$$

In this case, only the impact of the dyadic variables Z_{ij} can be estimated.

3.2 Data description

3.3 Cross country data

Our data set concerns the year 2001 and our sample contains 27 "source" countries (j) and 61 "destination" countries (j)[4]. Using panel data in order to estimate the impact of the euro both across time and across countries would have been more appropriate but we are restricted by our data set on international financial claims: indeed, data on bonds and equity holdings exist only for one year before 1999 and for a very restricted number of countries while data on banking assets are full of zeroes for most countries before 1999.

To estimate the "gravity equation" of bilateral international asset holdings, we use two different data sources for asset holdings: first, we use the Coordinated Portfolio Investment Survey (CPIS) in 2001[5] provided by the IMF which geographically breaks down securities holdings (bonds[6] and equities). The associated dependant variables are (Equity_{ij}) which is the log- of aggregate equity holdings in country (j) of investors in country (i) (in US dollars) and (Bond_{ij}) which is the log- of aggregate bond holdings in country (j) of investors in country (i) (in US dollars). Second, we use data on bilateral banking financial assets in 2001 provided by the Bank of International Settlements (BIS)[7]: the BIS reports quarterly the international claims of its reporting banks on individual countries, geographically broken down by nationality of reporting banks. Unfortunately, this dataset includes only 19 "source" countries (j) among the 27 countries used from the CPIS data. The dependant variable (BankAsset_{ij}) is the log of banking claims in country (j) held by banks of country (i) (expressed in US dollars). These data partially overlaps data on negotiable securities since around one third of banking assets are bonds and equities but include a large part of bank lending (around two thirds) which are excluded from the CPIS dataset.

We use the log- of "destination" countries GDP (GDP_j) to control for market size[8]. The GDP is

[4] We restricted our sample according to missing values on bilateral asset holdings and data availability for control variables. See appendix for a country list.

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

[6] Bond holdings include Long–Term Debt Securities and Short–Term Debt Securities

[7] See http://www.bis.org/statistics/histstats10.htm. To get more robust results, we averaged quarterly data for portfolio stocks in 2001. See appendix for a more precise description of the BIS dataset.

[8] It may be argued that market capitalization is a better proxy for the Gravity Model of Equity Holdings but none of our results is affected by this choice. Moreover we control for the ratio of stock market capitalization over GDP. We experimented with GDP/Capita in the regressions to better control for the development of financial markets but the results were mixed because of interaction with the corruption variable.

expressed in current US dollars. We also control for the financial sophistication of the destination country using the stock market capitalization over GDP[9].

We use stock market data (monthly stock prices in US $ from 1990 to 2001 of the main stock market index of the country[10]) to compute the log of the average gross stock returns of country j (Ret_j) over the period. We will not use these series of returns to explain bilateral bond holdings since bond holdings are mainly public bonds but unfortunately we do not have data on bond prices for a large sample of countries[11].

Our focus is on the determinants of the bilateral transaction costs. Since variables related to the flows of information between markets, bilateral trade intensity and the quality of institutions have been shown to perform well in gravity equations for asset trade, we include the following determinants of the geographical allocation of asset holdings (see Portes and Rey (2005), Aviat and Coeurdacier (2007), Lane and Milesi-Ferretti (2004)):

We use the log of distance between the two main cities of country pairs (Distance_{ij}) since it might proxy for some information related transaction costs between markets (Portes and Rey (2005)).

We use a "Common Language" dummy (CommonLang_{ij}) if country i and country j share the same language[12].

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 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.

We also control for bilateral goods trade between countries. The variable (Trade_{ij}) is the log of bilateral imports from country (j) to country (i) that is not due to market sizes. In other word, this is the residual of the regression of bilateral imports on GDP_i and GDP_j[13]. The data on international trade flows come from the dataset Chelem (Cepii, Paris).

We use an index of corruption for the "destination" country (Corruption_j) since it is likely that hidden bribes reduce transactions in international markets. This index is developed by *Transparency International*[14] and gives some insights on the degree of corruption as judged by business people, academics and risk analysts.

[9] We use past data (from 2000) to reduce endogeneity issues.

[10] Data on stock returns are from Martin and Rey (2002) and Global Financial Data.

[11] However this is less an issue than for equity returns since there is much less variability in bond returns across countries. One could also argue that equity returns might not be the relevant variable for banking assets given that a large share of cross-border banking assets is made of bank loans but we cannot provide better data on banking portfolios returns.

[12] We also constructed a "Colonial Link" dummy which was equal to one if country (j) was a former colony of country (i) (or vice-versa) but this variable was almost never significant so we drop it from our regressions.

[13] We normalize trade by market size in order to have a correct estimate of the impact of countries GDPs on bilateral asset holdings. In non-reported regressions, we used exports from (i) to (j) or the average of imports and exports but none of the results were affected.

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

To control for the impact of the euro on bilateral asset holdings, we construct the following dummies: euro_{ij} is equal to one when both countries belong to the euro zone and zero otherwise, and euro_j is equal to one when the destination country (j) belongs to the euro zone but not the source country (i)[15]. We will also make some robustness checks by controlling for the impact of the European Union: Eurcom_{ij} is equal to one when both countries belong to the European Union.

We add a variable TaxHaven_j to control for destination countries with very favorable fiscal treatment and FinCenter_j to control for the presence of financial centers in our data. The variable (TaxHaven_j) equals one if the destination country is considered as a tax haven and zero otherwise[16]. Similarly, the variable FinCenter_j equals one if the country is considered as a financial center. Financial centers are Luxembourg, Hong-Kong, United Kingdom and Singapore.

Finally, to control for unobservable regional variables that might affect bilateral asset holdings, we add some regional dummies in the "destination country" dimension. We have five such dummies: Europe, North America, Central and South America, Africa, Asia and Oceania[17].

3.4 Results

The results of the two specifications are shown in table 1 and 2. The impact of the usual gravity variables is consistent with those of Portes and Rey (2005), Aviat and Coeurdacier (2007) and Lane and Milesi-Ferretti (2004). The estimated coefficients on Distance_{ij}, Trade_{ij}, CommonLang_{ij} and Legal_{ij} all show up with the expected sign and for most regressions are significant.

A novel feature of these regressions is that we make comparisons across types of assets. The variables related to information or legal asymmetries (CommonLang_{ij} and Legal_{ij}) matter more for equity holdings and banking assets. This is somehow consistent with the idea that equities and banking assets are more information intensive assets than bonds. This is especially so because most bonds are public bonds and not corporate bonds. In both specifications, bilateral equity holdings and banking asset holdings are more affected by the trade intensity between countries than bond holdings. This is consistent with two competitive explanations that have been brought by the theoretical literature: it is likely that trade in goods proxies for some information flows between countries and this is not surprising that it mainly affects the allocation of information intensive assets. A second explanation suggested by Coeurdacier (2005), is that buying assets of firms that compete with local firms (firms that export towards market (i)) are a good hedge against fluctuations in the performance of local firms in the presence of portfolio home bias.

[15] Note that due to the presence of fixed-effects in the dimension (i), we cannot use a variable that is equal to one when the country (i) is in the euro but not the country (j).

[16] Countries are considered as tax havens according to the classification of GAFI (Groupe d'Action Financière). We consider five Tax Havens in our sample, namely Netherlands, Switzerland, Luxembourg, Panama and Ireland.

[17] see country list in appendix.

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
GDP_j	1.134***	.875***	.821***
	(.080)	(.083)	(.063)
Mktcap-gdp_j	.878***	.043	.374**
	(.233)	(.326)	(.183)
Ret_j	2.750		-.540
	(2.142)		(1.487)
Trade_{ij}	.491***	.185**	.376***
	(.086)	(.090)	(.073)
Distance_{ij}	-.243**	-.592***	-.354***
	(.101)	(.130)	(.117)
Legal_{ij}	.222**	.167	.475***
	(.122)	(.134)	(.112)
CommonLang_{ij}	.437***	.271	.368**
	(.156)	(.225)	(.174)
Corruption_j	-.155***	-.184**	-.040
	(.053)	(.075)	(.063)
TaxHaven_j	1.192***	.195	.608**
	(.422)	(.331)	(.333)
FinCenter_j	-.025	.747	1.294***
	(.293)	(.524)	(.293)
euro_{ij}	.957***	1.849***	.861***
	(.303)	(.338)	(.299)
euro_j	.509**	.759**	.761***
	(.269)	(.307)	(.286)
e(N)	1034	1031	897
e(r2)	.766	.678	.703
e(F)	120.437	65.308	96.096

Table 1: Gravity Models on world asset holdings with source country fixed-effects.
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. Regional dummies of destination are included but not reported.

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
Trade_{ij}	.393***	.123	.344***
	(.067)	(.079)	(.070)
Distance_{ij}	-.420***	-.747***	-.490***
	(.095)	(.116)	(.123)
Legal_{ij}	.189*	.183	.447***
	(.104)	(.122)	(.111)
CommonLang_{ij}	.497***	.378**	.424***
	(.129)	(.190)	(.162)
euro_{ij}	.372**	.917***	.044
	(.183)	(.196)	(.156)
e(N)	1034	1031	897
e(r2)	.787	.716	.717
e(F)	744.994	312.073	227.545

Table 2: Gravity Models on world asset holdings with source and destination country fixed-effects.
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country.

The effect of distance on bond holdings is almost twice the effect it has for equity and bank assets. According to the first specification, when distance between two markets doubles, bilateral bond holdings are reduced by 60%, 35% for banking assets and only 25% for bilateral equity holdings. This might be surprising since according to Portes and Rey (2005) and Portes, Oh and Rey (2001), distance proxy some informational costs and then should affect to a lower extent trade in public bonds, which is the largest part of international bond holdings. However, distance may also proxy for transaction costs (costs of phone calls, of trading assets outside the local financial markets, different opening hours of markets...). In this case it would square well with the theoretical framework developed in the first section. Indeed, if bonds of different countries are better substitutes than are equities of different countries (because of risk idiosyncratic to the firm), then we would indeed expect that the coefficient on transactions costs is higher (in absolute value) for bonds than for equity. In the theoretical framework, this would translate into a higher elasticity of demand (ε). This interpretation is strengthened by the fact that other variables that proxy for financial transaction costs (financial center, corruption and the euro effect) have (in absolute term) a larger effect on asset holdings in the case of bonds than in the case of equity.

The euro effect

In the first specification we only include country dummies in the source country dimension which allows us to analyze the impact of the euro on financial trade not only in the euro zone (through the variable euro_{ij}) but also between the rest of the world and the euro zone (euro_j).

Table 1 and 2 provide two important regularities in the data related to the impact of the euro on international asset portfolios.

First, the euro works like a unilateral financial liberalization: the positive and significant coefficient on the euro_j dummy in Table 1 means that countries **outside of the euro-zone** hold more assets supplied in the euro zone than predicted by the usual variables. This is true for both bonds and bank assets and to a lesser extent for equity. The portfolio bias towards the euro-zone is large: for equities, investors hold around 60% more euro assets than predicted by the usual gravity variables and this number goes up to around 100% for bonds and banking assets. These are very large numbers and one may think that, as for the early Rose effects of the single currency on trade, they are too large to be true. However, first remember that this number is not driven by the fact that euro countries are more financially developed, have better institutions, are closer to the other main financial markets (or more integrated in product markets). We control for these observable characteristics of euro countries. One could also argue that this result is not due to the euro but to some empirical regularity among European countries: Europe is for some unobservable reasons more attractive for investors than other regions in the world. However, we control for regional dummies of destination and in particular a dummy for "broad" Europe. This variable

equals one for a significant number of Central and Eastern European countries but creating two different dummies, one for Western Europe and the other for Central and Eastern Europe did not change any of the result. Both dummies were very similar in absolute terms and non-significant[18].

Second, the euro works like a preferential financial agreement. The average country exhibits a euro bias but this bias is significantly larger when the two countries are in the euro zone. Quantitatively this effect is also very large but varies across specifications and across assets. We choose to select the one in Table 2. It should be the best specification to measure the impact of bilateral variables since we control for dummies in both the source and destination dimensions. In this case, the euro increases by 150% bilateral bond holdings between two euro countries while equity holdings rise by around 45%. The impact on bank assets is not significant. Again, these results hold once we control for a relatively large set of variables that might be correlated with membership in the euro zone (trade linkages, geography...). Although the value of the estimates of the euro effect looks different in the two specifications (Table 1 and 2), the two specifications provide very similar quantitative results: the reason is that the estimates of table 1 also include the impact of the euro as an unilateral financial liberalization (which also affects euro countries). Hence, the measure of the euro bias within the euro zone (on top of the unilateral financial liberalization) is the difference between the estimates of euro_{ij} and euro_j. This yields very comparable estimates to table 2.

The results confirm those of Lane (2006) on the positive role of the euro on bond holdings between countries of the euro zone. Quantitatively, our estimated effect on bond holdings is however smaller (150% versus around 230%). We also find that the euro effect does not hold only for bonds but also for equity although with a smaller coefficient. This is not surprising since bonds of different countries are expected to be closer substitutes than equities, which magnifies the impact of a decrease in transaction costs due the introduction of the euro. As we argued in the theoretical model we interpret this result as coming from a higher elasticity of demand (ε) for bonds than for equities and therefore a larger response of bond holdings to transaction costs.

Interestingly, these two regularities resemble the results obtained in the recent literature (see Baldwin (2006), Flam and Nordstrom (2003)) on the impact of the euro on trade in goods: the euro acted as a decrease in transaction costs between euro countries but also between euro countries and the rest of the world. The former effect is especially true for bonds and to a lesser extent for equity while the latter is true whatever the type of asset.

We then perform robustness checks on the euro effect. Controlling for a European Union dummy

[18] We also estimated the model dropping randomly three European countries from the sample of source country since one might argue that European countries are over-represented in the sample and our estimates might suffer from some selection bias. The estimates were identical. Actually, even when we drop all euro countries as source countries, the same bias towards the euro zone exists.

(which equals one when both countries belong the European Union and zero otherwise) does not affect our results and the estimated euro effect is actually even larger for equities and not significantly different for bonds (see appendix, tables 11 and 12). However given the collinearity between these two variables, one should interpret these results with caution.

One interesting question is also whether the euro effect is simply driven by the absence of exchange rate risk between members of euro. We test this hypothesis by controlling for bilateral exchange rate volatility (ExchRateVol_{ij}) where ExchRateVol_{ij} is the log- of (empirical) bilateral nominal exchange rate volatility computed using monthly data over a five years window before 2001. Controlling for nominal exchange rate volatility does not modify our results regarding the effect of the euro, our estimates are essentially unaffected (see appendix, tables 14 and 15). Surprisingly, bilateral nominal exchange rate volatility is not a significant obstacle to cross-border investment in equities and bank lending. For bond holdings, we do find that exchange rate risk reduces cross-border bond holdings when we control for fixed-effects in both dimension (although the coefficient is only significant at the 10% level, see table 15). This result makes sense since bond returns are much more affected by exchange rate risk than equity returns[19].

We also test whether the euro effect is due to the existence of deeper agreements on the taxation of cross-border capital incomes between euro countries. We use data from Aviat and Coeurdacier (2007) about the international taxation of capital available for a restricted number of countries[20]. Indeed, 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 (which makes them on average lower between euro countries). We use two different variables that describe bilateral withholding taxes on dividends (and capital gains) and on interests (from loans, deposits or debt securities), resp. DividendTax_{ij} and InterestTax_{ij}, in percents. The former should discourage bilateral equity holdings while the latter should discourage bilateral bond holdings and banking assets[21]. Although significant (at the 10% level), these variables do not change any of the results on the euro effects (see table 16 in appendix) .

– Quantifying the euro effect: the equivalent variation in transaction costs

We can now provide quantitative estimates of the fall in transaction costs associated with the euro. Remember that transaction costs are lower for all countries (the unilateral liberalization effect) and also for countries within the euro (the preferential liberalization effect). We call the unilateral variation (decrease) in transaction costs ($\frac{\Delta\tau_j}{\tau_j}$) and the preferential one ($\frac{\Delta\tau_{ij}}{\tau_{ij}}$). The estimated fall depends on our

[19] The Swedish data will confirm this result with much more robust estimates
[20] Data from bilateral tax treaties; http://www.ibfd.org.
[21] Those taxes are far from being negligible, ranging from 0% for some agreements to 40%.

assumed elasticity of demand (ε) which may be different for bonds, equities and banking assets.
We use data on bilateral taxation of equity dividends and interests on bonds and banking assets to estimate this elasticity. According to equation (2), the coefficient estimated for the bilateral rate of taxation should be equal to $(\varepsilon - 1)$. According to our estimates of this coefficient[22] (table 16 in appendix), we use the following values: $\varepsilon^{equity} = \varepsilon^{bankasset} = 4$ and $\varepsilon^{bond} = 6.5$. As expected, estimates of this elasticity is higher for bonds than for other assets. These numbers are a bit lower than other estimates in the literature which found values between 6 and 12 for equities (see Loderer *et al.* (1991), Wurgler and Zhuravskaya (2002) and Martin and Rey (2006) for a short survey of those elasticities). However, the elasticity we estimate is for assets from different countries whereas the literature has focused on the elasticity between assets of the same country.

This implies that for equities we obtain:

$$\frac{\Delta\tau_j}{\tau_j} = \frac{0.509}{\varepsilon^{equity} - 1} = 17\% \text{ and } \frac{\Delta\tau_{ij}}{\tau_{ij}} = \frac{0.372}{\varepsilon^{equity} - 1} = 10\%$$

While for bonds, we get: $\frac{\Delta\tau_j}{\tau_j} = 14\%$ and $\frac{\Delta\tau_{ij}}{\tau_{ij}} = 17\%$. For banking assets[23], $\frac{\Delta\tau_j}{\tau_j} = 25\%$ and $\frac{\Delta\tau_{ij}}{\tau_{ij}} = 1.5\%$. Note that despite apparently larger estimates of the euro effect for bonds than for equities, the associated fall in transaction costs is of the same order of magnitude since bonds are closer substitutes than equities. If we use higher values for the elasticity of substitution, we obtain smaller estimates for the fall of transaction costs due to the euro[24].

– Quantifying the impact of the euro on the elasticity of substitution between assets

Up to now, we have assumed that the elasticity of substitution between the assets is not affected by the euro. However, as noted by Lane (2006), the euro can be interpreted as both a decrease in transaction costs and potentially a factor that increases the substitutability of assets of the euro zone. Can we disentangle these two effects? One way is to introduce interaction terms between the euro and other transaction costs than the euro itself[25]. If the euro increases the substitutability of assets we should then find that the effect of any remaining transaction costs is larger inside the euro-zone. We perform this exercise for the dividend tax (for equity), the interest tax (for bonds and banking assets) and for the common legal system. Only the interaction term for the legal system turns out to be significant and of the expected positive sign. This holds for bonds and banking assets but not for equity (see table 3). The reason why the most natural transaction costs to analyze this question (dividend and interest taxes) do

[22] Note that we could also estimate this elasticity for equities by using the coefficient estimated for returns. The estimated coefficient is similar (see table 1) even though not significant.

[23] For banking assets $\frac{\Delta\tau_{ij}}{\tau_{ij}}$ is not significantly different from 0.

[24] If we double the value of the elasticity (roughly two standard deviations above the estimated one using international tax data), we divide by two the estimated decrease in transaction costs.

[25] An alternative root would be to introduce interaction terms with the returns of the assets. However, two issues make this difficult. First, these returns are endogenous and second there is very little variation inside the euro zone.

not yield any result is that they exhibit extremely little variation inside the euro zone. This is not the case for the legal system for which cross-country variation exists inside the euro zone. Our interpretation is that remaining financial frictions (such as legal differences) are amplified within the euro zone because euro assets are closer substitutes. This evidence suggests that indeed assets from the euro zone have a higher elasticity of substitution[26].

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
euro_{ij}	.367**	.892***	.017
	(.184)	(.197)	(.161)
Legal_{ij}-x-euro_{ij}	.244	.422***	.782***
	(.212)	(.161)	(.157)
Legal_{ij}-x-Noneuro_{ij}	.181	.146	.397***
	(.111)	(.133)	(.120)
e(N)	1034	1031	897
e(r2)	.787	.716	.718
e(F)	725.473	301.683	208.128

Table 3: Gravity Models on world asset holdings with source and destination countries fixed-effects. Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. Control variables are included but not reported.

The estimates of table 3 provide a way to compare elasticities of substitution between two euro bonds ($\varepsilon_{euro}^{bonds}$) with respect to the average elasticity (ε^{bonds}) between two bonds which are not both issued in the euro zone (respectively for banking assets). We get the following rough estimates:

$$\frac{\varepsilon_{euro}^{bond}-1}{\varepsilon^{bond}-1}=\frac{0.422}{0.146}=2.9 \text{ and } \frac{\varepsilon_{euro}^{bankasset}-1}{\varepsilon^{bankasset}-1}=\frac{0.782}{0.392}=2$$

This suggests that the elasticity of substitution between two euro bonds (banking assets) is three (twice) times larger than for other bonds (banking assets). Such a difference implies that the fall of transaction costs within the euro zone ($\frac{\Delta\tau_{ij}}{\tau_{ij}}$) is actually biased downwards for bonds (and to a lesser extent for banking assets). On the one hand, the introduction of the euro can be associated with lower transaction costs between euro countries (direct effect) but on the other hand, a higher elasticity of substitution amplifies the effect of any remaining friction (indirect effect). Note that the direct effect enhances asset trade between euro countries while the indirect effect plays in the opposite direction. Since we found a positive euro effect, clearly the direct channel dominates the indirect one. Our empirical strategy does not allow us to disentangle properly these two effects (in particular because we do not observe all frictions between markets) and our measure of the variation of transaction costs inside the euro zone is somehow the sum of these two effects. However, at least for the legal costs, we can measure the amplitude of this indirect effect. Given our assumed (ε^{bond}), we estimate that differences in the legal system act like a 2.5%

[26] Again, it is possible that assets within the euro zone were already closer substitutes before the introduction of the euro due to the convergence of monetary policies for instance. Strictly speaking, with our cross-sectional data, we evaluate the difference between elasticities of substitution inside the euro zone versus outside the euro zone but not their variation over time.

transaction cost. Due to an higher elasticity of substitution between euro bonds, the effect of these legal transaction costs is multiplied by 3 inside the euro zone.

Asset trade diversion and the euro? The example of Scandinavian countries

The previous section provided new results on the euro effect for countries buying assets but not for countries selling assets. A natural question is whether the introduction of the euro is detrimental for countries close to the euro zone but not part of it. Note that according to the theoretical model, we should expect such a diversion effect since EMU decreases the "financial" price index of euro countries, which reduces their demand for assets outside the euro zone.

In other words, do euro countries invest less in countries which have similar characteristics than the euro countries (geographically close to the euro zone, with similar transaction costs, similar level of developments, similar diversification opportunities...) but which decided to stay outside of the euro zone?

The group of Scandinavian countries (namely Denmark, Sweden and Norway) is an interesting group to test such an hypothesis. This is especially true because Finland joined the euro while the other nordic countries did not. Of course, one could argue that these countries did not join the euro because they were less integrated *ex-ante* to the euro countries. We should, in this case, perform double-differences using data before and after the introduction of the euro to test such an hypothesis. However, given that we do not have time-series data, we will restrict our analysis to simple-difference estimates. This can be done by adding in the regression an interaction term $\text{euro}_i\text{-Scand}_j$ which equals one when the source country belongs to the euro and the destination is either Denmark, Sweden or Norway. We also add a dummy Scand_j to control for some specific characteristics of the Scandinavian countries for the specification without destination country fixed-effects[27]. Finally, we also add a variable Scand_{ij}, which equals one when both countries are Scandinavian countries and zero otherwise to test some specific linkages among Scandinavian countries. For this variable, Finland is considered as a Scandinavian country since we do not want our results regarding the euro to be driven by the presence of Finland among the euro countries.

The results are shown table 4 and 5. First, the variable Scand_j is large, positive and significant (the same order of magnitude than euro_j), so on average, countries exhibit a bias towards Scandinavian countries for all classes of assets. We do not investigate this question but the existence of publicly traded large multinationals is a likely reason. However, for equity investment, everything else equal, euro countries invest less in Scandinavia than the average country. This effect is significantly different from zero and large: according to table 4 (which should give the most precise estimate), euro countries invest in equities around 65% less towards these countries than predicted by the country specific factors and

[27]In particular, these countries have been historically more integrated to the rest of the world, so we can expect this coefficient to be positive.

the usual gravity variables. This "asset trade diversion" seems to hold only for equity investment, the estimated coefficients for bonds and banking assets being very close to zero and non significant. This may be because a significant portion of bonds in these countries are issued in euro.

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
euro_j	.802***	1.187***	1.205***
	(.264)	(.435)	(.338)
euro_{ij}	1.222***	2.296***	1.335***
	(.299)	(.424)	(.337)
euroi-Scandj	-.375**	.130	-.064
	(.162)	(.264)	(.136)
Scand_j	.906**	1.135**	1.156***
	(.387)	(.552)	(.432)
Scand_{ij}	.339	.666**	1.822***
	(.359)	(.308)	(.296)
e(N)	1034	1031	897
e(r2)	.769	.686	.723
e(F)	128.78	62.076	111.105

Table 4: Gravity Models on world asset holdings: the case of Scandinavian countries.
Estimation with source country fixed effects. Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. The control variables of table 1 and regional dummies of destination are included but not reported.

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
euro_{ij}	.297*	.966***	.070
	(.167)	(.212)	(.155)
euro_i-Scand_j	-.521***	.056	-.080
	(.163)	(.249)	(.134)
Scand_{ij}	-.159	.733**	1.892***
	(.363)	(.293)	(.295)
e(N)	1034	1031	897
e(r2)	.788	.717	.725
e(F)	863.301	344.616	329.235

Table 5: Gravity Models on world asset holdings: the case of Scandinavian countries.
Estimation with source and destination country fixed effects. Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. The control variables of table 2 are included but not reported.

As a robustness check, we test whether this lower level of bilateral equity investment from euro countries towards Scandinavian countries is also observed in Finland. We add an interaction term euro_i-Fin_j in the previous regression. Indeed, it is possible that the euro bias inside the euro zone does not apply to Finland, which would suggest that Nordic countries are for some unobservable reasons unattractive for euro investors. As shown in table 6, this is not the case, the euro bias for equities is actually larger for Finland than for the other euro countries (although not significantly different). This suggests that

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
euro_{ij}	.236	.972***	.058
	(.202)	(.224)	(.165)
euro_i-Scand_j	-.518***	.056	-.077
	(.163)	(.249)	(.135)
euro_i-Fin_j	.611***	-.065	.124
	(.142)	(.162)	(.138)
Scand_{ij}	-.100	.725**	1.910***
	(.348)	(.288)	(.299)
e(N)	1034	1031	897
e(r2)	.788	.717	.725
e(F)	909.446	355.928	282.779

Table 6: Gravity Models on world asset holdings: the case of Scandinavian countries.
Estimation with source and destination country fixed effects. Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. The control variables of table 2 and regional dummies of destination are included but not reported.

for equity holdings some trade diversion due to the introduction of the euro exists. But this does not apply to the other types of assets. We could even speculate that equity investment from the euro zone in Scandinavia is diverted towards Finland, a country with similar characteristics but inside the euro zone. Of course, this result must be taken with caution and this hypothesis should be tested with time-series data.

These results suggest that the European monetary union makes Scandinavian countries which do not belong to the euro zone less attractive for equity holders of euro countries. However, we cannot really say whether this comes from the elimination of the currency risk or from the creation of an unified stock market where the largest firms of the euro zone are quoted.

Finally, if we argue that euro countries attract relatively more inward portfolio investment from countries outside the euro zone and invest relatively less in European countries outside the euro zone, these results do not imply that euro countries should have moved into substantial capital account surplus following the introduction of the euro. Indeed, our identification strategy relies on the variability of portfolio holdings across countries **relative** to the average country of our sample in 2001 and does not pretend to shed light on the evolution of global imbalances over time[28].

[28]For instance, it is possible that euro countries have on average increased their outward portfolio investment while attracting more inward investment (keeping their capital account relatively stable around 1999) but this increase must have been less pronounced in countries similar to euro countries to be consistent with our view. Similarly, a decrease in inward investment in the euro area around 1999 would not contradict our view as long as this decrease is less pronounced in the euro area than in a "similar" country outside the euro area.

3.5 Swedish data

To test the robustness of some of these results, we now turn to Swedish data on bilateral asset holdings and bilateral capital flows. These data are available for a larger number of countries and for more than one cross sectional year. However, we loose some information since we have data on outward investment from Sweden but not on inward investment (moreover we have only one source country, namely Sweden).

3.5.1 Swedish asset holdings

- **Data description**

The Riksbank provides data on Swedish asset holdings for a very large sample of countries (68 destination countries[29]). This data partially overlap our data on international asset holdings but includes are larger number of countries and is available for four consecutive years (2001-2004). Like the CPIS database, we have a disaggregation by types of securities (bonds or equities). Finally, for comparison purposes, we also include banking asset holdings from the BIS for the same sample of countries and the same years. For stock returns, we use the annual return (in Swedish krona) over the year considered. Since data on stock returns are not available for the whole set of countries, we also present the regression without stock returns (column (2) of futures tables).

We keep the same control variables as in the previous section but we had to drop the market capitalization over GDP variable since this variable is not available for this larger set of countries over the period 2001-2004. We also had to choose between the common language variable, the legal variable and the Scandinavian dummy given the large overlap between these variables[30]. We decided to keep the legal one. Note that all variables are now time varying except for distance and the euro, financial center, legal and tax haven dummies.

We also add an additional control variable that might affect bilateral asset holdings: (ExchRateVol_{ijt}) is the log- of bilateral nominal exchange rate volatility , between Sweden (country (i)) with country (j), calculated with monthly data over a five-year window before time (t).

- **Results**

The results are shown in table 7.

Looking only at Swedish foreign asset holdings confirm most of the results presented in the previous section. The impact of bilateral variables (Trade_{ijt} or Distance_{ij}) gives qualitatively very similar estimates than found using data on world asset holdings. These variables are estimated with the expected sign

[29]The original database was even larger but due to data availability for some of the control variables, we restrict our sample to 68 countries.

[30]Indeed, countries with a legal system considered as similar to the Swedish one are Norway, Denmark, Finland and Iceland, while countries considered as having the same language as Sweden are Denmark and Norway.

	equity_{ijt}	equity_{ijt}	bond_{ijt}	bankasset_{ijt}
	(1)	(2)	(3)	(4)
GDP_{ijt}	1.275***	1.076***	.920***	.766***
	(.106)	(.121)	(.102)	(.108)
Ret_{jt}	1.248			
	(1.375)			
Distance_{ij}	.362	-.091	-.893**	.026
	(.313)	(.330)	(.424)	(.273)
Trade_{ijt}	.862***	.494**	.082	1.085***
	(.295)	(.272)	(.359)	(.246)
ExchRateVol_{ijt}	.143	.057	-.864**	-.403
	(.411)	(.591)	(.479)	(.336)
Corruption_{jt}	-.201**	-.310***	-.566***	-.107
	(.084)	(.106)	(.172)	(.103)
euro_{j}	.833**	.905*	1.257**	-.032
	(.439)	(.532)	(.575)	(.508)
Legal_{ij}	1.273	1.095	.301	.713
	(.790)	(.689)	(1.027)	(.825)
FinCenter_{j}	1.401**	1.590**	.342	.450
	(.652)	(.635)	(.808)	(.877)
TaxHaven_{j}	1.143**	.946**	-1.346**	.244
	(.536)	(.451)	(.566)	(.587)
e(N)	150	265	176	255
e(r2)	.884	.732	.832	.727
e(F)	31.313	39.5	74.303	45.431

Table 7: Gravity Models on Swedish foreign asset holdings.
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors and time fixed-effects. Observations are clustered within destination country.

when significant and quantitatively the estimates are not significantly different from the ones found in the previous section. We also confirm that the euro worked like an unilateral liberalization for Swedish investors: the portfolio bias towards the euro zone is found quantitatively large for equity and bond holdings. In particular, the bias of Swedish investors towards euro bonds is larger than for the average country. The Swedish and the euro bonds markets also seem to be particularly well integrated.

The variable (ExchRateVol_{ijt}) shows up significantly *only* for bond holdings. Again, this makes sense since exchange rate risk is a much larger part of the risk in foreign bond returns than in equity returns. Quantitatively, this effect is non negligible and larger than what has been estimated using cross-country data: raising the bilateral nominal exchange rate volatility by 10% lowers bilateral bond holdings by 8%. Moreover, as we just said, only a small part of the euro effect seems due to the stability of euro-krona exchange rate.

3.5.2 Swedish capital outflows

- **Data description**

The data on Swedish outflows come from the Balance of Payments statistics which provides data on aggregate asset purchases in international financial markets broken down by countries of destination and by types of assets over the period 1998-2005 (on a quarterly basis). Note that this data are on capital flows (and not asset holdings) and the comparison with results on holdings is *per-se* interesting. Unfortunately, we cannot analyze the determinants of Swedish capital inflows and we must focus our attention on asset purchases by Swedish investors since we do not have the nationality of Swedish assets buyers. Due to missing data in the beginning of the period for some countries, we had to restrict the sample to 56 destination countries which are the largest markets. These 56 countries account for about 99% of total Swedish asset purchases. This dataset gives the nationality of the counter-party which might be different from the nationality of the asset involved in the transaction, however we will make the assumption that assets bought by Swedish investors to an investor in a country have been issued in the same country. This is less an issue for bank loans but might introduce some measurement errors in the series of equities and bonds purchases. We will partly control for this with our "FinCenter$_j$" dummies.

The dependant variables "purchaseequity$_{ijt}$", "purchasebond$_{ijt}$" and "loan$_{ijt}$" are respectively the aggregate purchases by Swedish investors (country (i)) of equities and bonds in country (j) and the aggregate loans towards country (j) over the quarter.

Note that this data start in 1998, before the introduction of the euro and before Greece joined after the other countries (in 2001) so that the dummy euro$_t$ is now time varying although with little time variation.

We use the same control variables as in the previous section: GDP$_{ijt}$ which is the log of the product of Swedish and country (j)' GDP, Trade$_{ijt}$[31] and Ret$_{jt}$. Ret$_{jt}$ is the averaged equity return over the last four quarters in Swedish krona[32].

Like for asset holdings, we also add a measure of bilateral exchange rate risk: (ExchRateVol$_{ijt}$) is the bilateral nominal exchange rate volatility. At a given time (t), (ExchRateVol$_{ijt}$) is the log- of the volatility of bilateral nominal exchange rates calculated with monthly data over a five-year window before time (t).

We also control for foreign direct investment flows (FDI$_{ijt}$) to see whether asset purchases and FDI are complementary or substitutes. Similarly to the trade variable, FDI$_{ijt}$ is the log- of bilateral foreign direct investment outflows that are not due to market sizes[33].

[31] As in the previous section, Trade$_{ijt}$ is the part of bilateral trade orthogonal to market sizes. Data on bilateral Swedish trade were provided by Statistics Sweden and include a larger sample of countries than the CHELEM dataset.

[32] We used annual returns rather than quarterly returns to reduce the importance of extreme events like currency or stock market crashes. Moreover, given data availability on stock markets returns, we also run regressions without this variable to reduce data attrition (column (2)).

[33] The residual of the regression of bilateral FDI flows on countries GDPs.

- **Results**

The results are shown in table 8. Looking at capital outflows does not modify qualitatively our results. The gravity variables (Trade_{ijt} or Distance_{ij}) shows up with the expected sign (when significant). Compared to the previous section, only bilateral loans gives very different quantitative estimates. Indeed, they are much more related to the geographical distance (and not so much affected by trade linkages) compared to the bilateral banking assets. They are also the only bilateral flows to be weakly (positively) affected by foreign direct investment.

	$\text{purchaseequity}_{ijt}$	$\text{purchaseequity}_{ijt}$	$\text{purchasebond}_{ijt}$	loan_{ijt}
	(1)	(2)	(3)	(4)
GDP_{ijt}	1.162***	1.180***	.975***	1.343***
	(.139)	(.102)	(.107)	(.136)
Ret_{jt}	1.085**			
	(.493)			
Distance_{ij}	-.471	-.646*	.039	-1.580***
	(.422)	(.330)	(.400)	(.390)
Trade_{ijt}	.635***	.488**	.498*	-.054
	(.235)	(.217)	(.284)	(.233)
FDI_{ijt}	-.100	-.101	-.033	.272*
	(.117)	(.108)	(.097)	(.144)
ExchRateVol_{ijt}	.199	.360	-2.676***	-.217
	(.530)	(.438)	(.521)	(.564)
Corruption_{ijt}	-.341***	-.352***	-.101	-.097
	(.129)	(.117)	(.135)	(.150)
euro_{jt}	1.146**	1.312***	1.002***	3.451***
	(.528)	(.410)	(.376)	(.528)
Legal_{ij}	2.429***	2.462***	2.538***	2.162**
	(.876)	(.582)	(.699)	(1.102)
FinCenter_{j}	2.358***	2.236***	1.253***	2.490***
	(.544)	(.493)	(.485)	(.937)
TaxHaven_{j}	1.163***	1.377***	-1.143***	.793
	(.402)	(.400)	(.323)	(.821)
e(N)	766	1105	686	1442
e(r2)	.776	.753	.738	.7
e(F)	65.808	62.18	258.859	61.488

Table 8: Gravity Models on outflows from Sweden.
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. Time fixed-effects are included but not reported.

With respect to the euro, not surprisingly, we also find that Sweden trade in assets much more with euro countries[34] but interestingly, if we compare table 7 and 8, this euro bias tends to be larger for flows than for holdings (at least for equities and loans). This suggests that the fall in transaction costs due to the euro is partly due to an increase in the liquidity of euro assets which in turn has increased the turnover on euro assets. We also confirm the impact of bilateral exchange rate volatility on bilateral bonds flows (but not equity and loans). Finally, we also find that bilateral exchange rate volatility reduces only

[34] Again see table 12 in appendix, for robustness checks with respect to the European Union.

trading in bonds market but with an higher elasticity for bonds flows than for bonds holdings.

The euro bias: estimation in the time-dimension

It could be argued that Sweden larger trade in assets with euro countries reflects some unobservable variables which make these countries especially attractive for Swedish investors and which have nothing to do with the euro. Given the time dimension of this database on capital outflows, we can partly deal with this issue.

	$\text{purchaseequity}_{ijt}$	$\text{purchaseequity}_{ijt}$	$\text{purchasebond}_{ijt}$	loan_{ijt}
	(1)	(2)	(3)	(4)
euro_{jt}	-.121	.112	1.035***	3.097***
	(.610)	(.563)	(.324)	(.413)
e(N)	766	1105	686	1442
e(r2)	.095	.061	.155	.077
e(F)	10.3	4.674	15.869	15.626

Table 9: Gravity models on outflows from Sweden.
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. Destination country fixed-effects and control variables of table 9 are included but not reported.

As a consequence, we can estimate the euro effect across time as well as across countries, comparing Sweden's asset trade with a euro country with respect to a non-euro country before and after the introduction of the euro. This can be done by looking at the estimate of our euro dummy once we control for destination countries fixed-effects[35]. In other words, with this strategy, we control for unobservable specific factors of euro countries and estimate the change of asset purchases towards these countries before and after the introduction of the euro. This is however a very restrictive test since we have very little variability in the time dimension: one year of data just before the introduction of the euro and Greece joining in 2001. The results are shown in table 9. This confirms that the euro had a very strong effect on bonds trading as well as on bilateral loans (with comparable estimates), while the effect on equity purchases is no more significant. We see these results as a confirmation of one of the main message of the paper. The euro acted as a decrease of transaction costs for non-euro countries (like Sweden). This effect is more robust for bonds purchases and loans than for equities.

4 Conclusion

Can we draw some welfare implications from these empirical results for countries that are outside of the euro zone? They suggest that the euro has three main effects: 1) a unilateral financial liberalization which makes it cheaper to buy euro zone assets; 2) a diversion effect due to the fact that lower transaction

[35]The country fixed-effects are assumed to be constant over the period considered. In a non-reported regression, we also interacted the euro dummy with a time-trend; it did not affect our estimates.

costs inside the euro zone lead the countries of the zone to purchase less non euro assets; 3) an increase in cross-border asset holding inside the euro zone which is the counterpart of the diversion effect and corresponds to a preferential financial liberalization. The first effect should be beneficial to non-euro countries as it implies that it pays less to diversify risk when purchasing euro assets. This could be readily demonstrated in the model of our theoretical section. The second and third effects are the two faces of the same mechanism. The second is clearly detrimental to non euro countries. If assets are imperfect substitutes (which our analysis confirms), the lower demand for non euro equity (the only asset for which some diversion is suggested by our empirical analysis) implies a lower price of non-euro assets relative to euro assets. This implies an increase in the cost of capital for firms outside the euro zone. The increase in cross-border financial trade inside the euro-zone affects non euro countries in different ways. First, it is at the origin of the diversion effect already discussed. Second, it constitutes an opportunity cost of not joining the euro zone. A third effect is not present in our framework but would appear in a model like Martin and Rey (2000) where the number of assets is endogenous. In such a model, the increase in cross-border demand and price leads to the creation of new assets and an increase in the possibilities of risk diversification (markets become less incomplete). Another way to say this is that, above the transaction cost effect, non euro countries should benefit from the fact that financial markets in the euro zone become larger and more diversified. However, the price of those assets should also increase due to the increased demand coupled to imperfect substitution and transaction costs. Overall, non euro countries should benefit from more and cheaper (in terms of transaction costs) opportunities to diversify financial risk but with a deterioration of their financial terms of trade.

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5 Appendix

5.1 Data Description

- **International Data on Bilateral Securities Holdings**:

  Aggregate bilateral bonds and equities holdings in US dollars, in 2001, from the Coordinated Portfolio Investment Survey. http://www.imf.org/external/np/sta/pi/datarsl.htm

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

  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 types 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[36]).

  See table 10 for a more precise description.

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

- **Gdp**: 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)

- **Corruption**: "Corruption Perception Index" from *Transparency International*[37] 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 [38].

- **Stock Market Returns**: monthly data from 1990 to 2000 in UDS Dollars from Martin and Rey [2002] (World Bank and Bloomberg) and *Global Financial Data*.

- **Market Capitalization over GDP**: Market capitalization over GDP in 2000 are from the Financial Structure database of the Worldbank.

[36] For some countries, namely France and UK, we know that around half of total securities are equities.
[37] http://www.transparency.org
[38] http://www.llrx.com

- **Bilateral Nominal Exchange Rates:** from the International Financial Statistics. Bilateral Nominal Exchange Rate Volatility is calculated using monthly data over five years window.
- **Fiscal Variables:** IBFD online products (http://www.ibfd.org); Latin American Taxation Database, European Taxation Database, Asia–Pacific Taxation Database, Tax Treaties Database.
- **Swedish data on bilateral asset holdings and capital outflows**: Sveriges Riksbank (Balance of Payments Statistics)
- **Swedish data on bilateral trade**: Statistics Sweden.

5.2 Country list for data on world asset holdings

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

Table 10: 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.

5.3 Robustness Checks with "European Union" Dummies

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
euro_j	.586*	.656*	.705**
	(.367)	(.373)	(.322)
euro_{ij}	1.292***	1.486***	.819**
	(.438)	(.421)	(.366)
Eurcom_{ij}	-.335*	.631**	.168
	(.209)	(.264)	(.177)
SWE-DNK-UK_j	.431	.683*	.579*
	(.330)	(.391)	(.353)
e(N)	1034	1031	897
e(r2)	.766	.681	.701
e(F)	113.194	96.702	62.658

Table 11: Gravity Models on world asset holdings with source country fixed-effects
Robustness Check with a EU dummy (Eurcom_{ij}) and a dummy for countries inside the EU but outside the euro. Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. Regional dummies of destination and control variables are included but not reported.

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
Trade_{ij}	.396***	.123	.346***
	(.067)	(.079)	(.071)
Distance_{ij}	-.496***	-.722***	-.497***
	(.094)	(.119)	(.127)
Legal_{ij}	.185*	.184	.445***
	(.103)	(.123)	(.112)
CommonLang_{ij}	.435***	.397**	.416**
	(.129)	(.188)	(.164)
euro_{ij}	.748***	.800***	.103
	(.199)	(.222)	(.174)
Eurcom_{ij}	-.668***	.219	-.109
	(.206)	(.232)	(.160)
e(N)	1034	1031	897
e(r2)	.789	.716	.717
e(F)	663.111	292.182	220.488

Table 12: Gravity Models on world asset holdings with source and destination country fixed-effects
Robustness Check with an EU dummy (Eurcom_{ij})).
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Robust standard errors. Observations are clustered within destination country.

	$\text{purchaseequity}_{ijt}$	$\text{purchaseequity}_{ijt}$	$\text{purchasebond}_{ijt}$	loan_{ijt}
	(1)	(2)	(3)	(4)
GDP_{ijt}	1.160***	1.180***	.978***	1.331***
	(.138)	(.101)	(.109)	(.147)
Ret_{jt}	1.089**			
	(.496)			
Distance_{ij}	-.482	-.654**	.034	-1.493***
	(.408)	(.328)	(.400)	(.380)
Trade_{ijt}	.636***	.493**	.491*	-.125
	(.237)	(.219)	(.288)	(.221)
FDI_{ijt}	-.099	-.099	-.033	.255*
	(.118)	(.110)	(.097)	(.130)
$\text{ExchRateVolatility}_{ijt}$	.192	.342	-2.661***	-.007
	(.527)	(.439)	(.519)	(.552)
Corruption_{jt}	-.341***	-.352***	-.102	-.074
	(.130)	(.117)	(.135)	(.146)
euro_{jt}	1.201*	1.461***	.964***	2.222***
	(.627)	(.414)	(.352)	(.529)
Eurcom_{ij}	-.095	-.214	.068	2.020***
	(.470)	(.357)	(.216)	(.571)
Legal_{ij}	2.416***	2.470***	2.542***	2.212**
	(.869)	(.581)	(.701)	(1.043)
FinCenter_{j}	2.386***	2.308***	1.228**	2.137***
	(.559)	(.492)	(.478)	(.564)
TaxHaven_{j}	1.125**	1.308***	-1.116***	1.158**
	(.446)	(.418)	(.325)	(.538)
e(N)	766	1105	686	1442
e(r2)	.776	.754	.738	.716
e(F)	71.379	56.146	134.794	58.837

Table 13: Gravity Models on outflows from Sweden: Robustness Check with EU dummy (Eurcom). Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country.

5.4 Robustness checks with bilateral nominal exchange rate volatility

	Equityij	Bondij	BankAssetij
	(1)	(2)	(3)
$euro_j$	.521*	.822**	.726**
	(.270)	(.333)	(.291)
$euro_{ij}$	.980***	1.903***	.780**
	(.300)	(.382)	(.306)
$ExchRateVol_{ij}$	.287	-.024	-.041
	(.162)	(.168)	(.116)
e(N)	920	885	755
e(r2)	.775	.685	.714
e(F)	149.109	69.425	91.762

Table 14: Gravity Models on world asset holdings with source country fixed-effects
Robustness Check with Bilateral Nominal Exchange rate Volatility (in log-) ($ExchRateVol_{ij}$).
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. Regional dummies of destination and control variables are included but not reported.

	Equityij	Bondij	BankAssetij
	(1)	(2)	(3)
$euro_{ij}$	.296*	.857***	.077
	(.170)	(.207)	(.147)
$ExchRateVol_{ij}$	-.058	-.257*	.018
	(.117)	(.135)	(.100)
e(N)	920	885	755
e(r2)	.802	.727	.754
e(F)	815.858	386.762	309.243

Table 15: Gravity Models on world asset holdings with source and destination country fixed-effects
Robustness Check with Bilateral Nominal Exchange rate Volatility (in log-) ($ExchRateVol_{ij}$).
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Robust standard errors. Observations are clustered within destination country.

5.5 Robustness checks with data on international taxation

	Equity_{ij}	Bond_{ij}	BankAsset_{ij}
	(1)	(2)	(3)
DividendTax_{ij}	-2.959*		
	(1.757)		
InterestTax_{ij}		-5.352*	-3.365
		(2.981)	(2.306)
euro_{ij}	.925***	1.919***	.771**
	(.291)	(.354)	(.318)
euro_{j}	.661**	1.087***	.692**
	(.283)	(.365)	(.305)
e(N)	793	835	863
e(r2)	.805	.707	.703
e(F)	70.571	59.585	92.004

Table 16: Gravity Models on world asset holdings with source country fixed-effects.
Standard errors in parentheses. Statistical significance at the 10% (resp. 5% and 1%) level are denoted by * (resp. ** and ***). Estimation with robust standard errors. Observations are clustered within destination country. Regional dummies of destination are included but not reported.