Trade, FDI, and Welfare Effects from Dismantling Currency Barriers

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Abstract

A currency union eliminates two barriers to international trade and investment flows - transaction costs and exchange rate risk. In a model with internationally differentiated goods and assets, eliminating the exchange rate risk has a disproportionately large effect on asset flows. The exchange rate risk channel can be quite strong, implying that gains from adopting a single currency might be predominantly realized through FDI rather than trade, and will be magnified during times of heightened exchange rate uncertainty such as financial crises. Model predictions are consistent with the response of trade and FDI in the EU to the 2008-09 crisis.

- *Keywords*: FDI Flows, currency unions, Financial Crises
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1 Introduction

A currency union benefits its members by helping to drive down barriers to freely flowing goods, services, and assets through two channels: eliminating exchange rate risk and currency conversion costs. A rich empirical literature including Rose and van Wincoop (2001) and Petroulas (2007) among others have documented these gains, yet little theoretical work analyzes the channels through which that boost appears.[1] Theoretical models like Lama and Rabanal (2012) have looked at the welfare impacts from adopting a single currency but have focused on the monetary policy costs rather than on the various factors that drive FDI and trade gains.[2]

Our goal in this paper is to fill in this gap, and analyze how the elimination of the two distortions impacts FDI, trade, and welfare. More specifically, we want to understand what is the relative importance of the conversion channel compared to the exchange rate risk channel. If the relative importance of the risk channel is undervalued, gains from a currency union may be underestimated for two reasons. First, the more important the risk channel, the more that gains from adopting a single currency will be predominantly realized through FDI. Second, the variance of welfare gains will be understated as gains will be time varying and magnified during times of heightened exchange rate risk such as financial crises.

We develop a stylized, two-period model with internationally differentiated goods and assets. Adhering to parsimony, we avoid a monetary framework and simply model conversion costs as a within period wedge, and the exchange rate risk as an inter-temporal wedge. Our framework offers a very intuitive, yet novel insight. Trade in goods and services, as well as trade in assets between two countries not sharing a common currency, are impacted by exchange rate conversion costs. However, only asset trade is exposed heavily to exchange rate risk, given that asset returns involve the payment of a future return denominated in

[1] According to Anderson and van Wincoop (2004) within the empirical literature there seems to be a puzzle as to why currency unions raise trade by so much.

[2] Most of the existing theoretical literature on FDI flows has focused on the long-run determinants of the composition of capital inflows. Hull and Tesar (2001) see the specialization benefits of FDI and the risk-sharing benefits of portfolio equity, suggesting a composition of flows can be complementary. Smith and Valderrama (2009) explain the dynamic composition of inflows and its relation to the business cycle.

the foreign currency.[3] The extent to which the asset trade is affected by the exchange rate risk channel depends crucially on the elasticity of substitution between domestic and foreign ownership of capital stock. If that elasticity is low, FDI will be less responsive to changes in exchange rate risk, but the welfare gains from eliminating that risk will be greater.

To understand better the time-varying welfare benefits from a currency union, we engineer a recession combined with a spike in exchange rate risk in our two period model with four countries, two of which are in a currency union. This allows us to the see the differing responses over time to trade and FDI flows between countries that share a currency and those that do not in response to a shock to exchange rate uncertainty. Our simulations suggest that while intra-currency union trade and FDI flows during a recession behave in a manner similar to inter-currency union flows, exchange rate risk generates an asymmetric impact through its influence on expected investment returns to FDI in future periods. The model predicts that trade in assets remain relatively strong during a financial crisis within a currency union. We find support for this prediction of a differential impact using data from the 2008-09 financial crisis for EU countries, some of whom share a common currency.

2 Model

We consider a 2-period environment with I symmetric countries: $i = 1, 2, ..., I$. Each country produces its unique tradeable good i. Physical capital is the only factor of production. Rather than explicitly modeling nominal frictions, we consider a real economy with two distortions - an intra-temporal distortion that captures the costs of currency exchange, and an inter-temporal distortion which captures the appreciation/depreciation of the value of foreign assets in units of the domestic good. The inter-temporal distortion can be easily interpreted as an inflationary tax imposed on foreign owners of domestic assets.

[3]While all trade is exposed to some degree of exchange rate uncertainty due to payment lags, we are lumping those into conversion costs considering those are incurred in the relative short run.

2.1 Effective capital stock and aggregate production

Physical capital stock located in country j can be owned by residents of all countries:

$$K^j = \sum_{i=1}^{I} k^{i,j}, \qquad k^{i,j} \geq 0$$

where $k^{i,j}$ is the capital stock located in country j and owned by residents of country i. Capital fully depreciates at the end of each period.

Foreign and domestic ownership of capital may not be perfect substitutes. For example, Toyota may buy a car factory in Spain (i.e. a Japanese resident purchases Spanish capital), and bring different expertise and organizational, intangible capital (see e.g. McGrattan and Prescott (2010)). We model this by defining an ***effective capital stock*** — $\tilde{K}$ — a CES composite of that country's capital stocks owned by residents from different countries:

$$\tilde{K}^j := \left[\sum_{i \in I} \omega_k^{i,j} \left(k^{i,j} \right)^{\frac{\theta_k - 1}{\theta_k}} \right]^{\frac{\theta_k}{\theta_k - 1}}, \tag{2.1}$$

where θ_k is the elasticity of substitution between domestic and foreign ownership.[4] The effective capital stock $\tilde{K}^j$ is the sole input in the production of the tradeable good j:

$$Y^j = e^{z_j} \cdot \tilde{K}^j.$$

[4] In a standard international macro model, the ownership of capital stock is irrelevant, so we would implicitly assume that $\theta_k = \infty$.

2.2 Aggregate expenditures

The aggregate consumption and investment expenditures in each country i are CES composites of all I tradeable goods:

$$C^i = G^i\left(c^{i,1},...,c^{i,i},...,c^{i,I}\right) \equiv \left[\sum_{j\in I}\omega_c^{i,j}\left(c^{i,j}\right)^{\frac{\theta_c-1}{\theta_c}}\right]^{\frac{\theta_c}{\theta_c-1}}$$

$$X^i = H^i\left(x^{i,1},...,x^{i,i},...,x^{i,I}\right) \equiv \left[\sum_{j\in I}\omega_x^{i,j}\left(x^{i,j}\right)^{\frac{\theta_x-1}{\theta_x}}\right]^{\frac{\theta_x}{\theta_x-1}}$$

where $c^{i,j}$ is the consumption of good j by households in country i, $\omega^{i,j}$ is household's i bias towards good j, and $\theta_c > 0$ is the elasticity of substitution between different consumption goods. The notation for aggregate investment expenditures is similar. With full depreciation, the total amount of physical capital in country j in period 2 will be:

$$K_2^j = X_1^j, \qquad j = 1,...,I$$

2.3 Utility maximization, exchange rate risk, and conversion costs

The only source of income for a household is the return to capital stocks. Income in the second period is uncertain because of the exchange rate risk - foreign currencies may appreciate or depreciate against the domestic one. We model the depreciation of the foreign currency as an inflationary tax imposed on the return from capital held in a foreign country.

Mechanically, we proceed as follows. In period 1, the exchange rate between any two countries i and j is normalized to one. In period 2, the world can be in one of S states, indexed by s'. Each state s' corresponds to a potentially different matrix of appreciations/depreciations. We denote that matrix with $\chi(s')$. We impose two straightforward restrictions on the matrix $\chi(s')$. First, we require that, for every $s' \in S$, $e^{\chi^{i,j}(s')} = e^{-\chi^{j,i}(s')}$ — country i's appreciation against j is country j's depreciation against i. Second, we require that $e^{\chi^{i,j}(s')} = e^{\chi^{i,n}(s')} \cdot e^{\chi^{n,j}(s')}$ — there are no arbitrage opportunities. Let $\pi : S \to \Delta(S)$

denote the probability distribution over the different states. The final assumption we make is that $\sum_{s'} \pi(s') \cdot \chi^{i,j}(s') = 0$ — the expected change in the exchange rate is zero.

In each country i, a stand-in household buys domestic and foreign tradeable consumption goods $c^{i,j}$, and shares of domestic and foreign-located capital stocks $k^{i,j}$, while domestic investment firms buy domestic and foreign tradeable investment goods $x^{i,j}$. The local currency price of a tradeable good j is $p^{i,j}$, while the local currency price of a capital good j is $q^{i,j}$. The rental rate on capital stock $k^{i,j}$, expressed in the currency of the country where the capital is located (country j) is $r^{j,i}$. The price of the tradeable good 1 in country 1 in each period and each state is normalized to 1. We assume that the law of one price holds in every date and state. If i and j do not share a common currency, then the law of one price will imply that:

$$\begin{aligned} p_1^{i,j} &= (1 + \tau^{i,j}) \cdot p_1^{j,j} \\ p_2^{i,j}(s') &= (1 + \tau^{i,j}) \cdot p_2^{j,j}(s') \cdot e^{\chi^{i,j}(s')} \qquad \forall s' \in S \\ q_1^{i,j} &= (1 + \tau^{i,j}) \cdot q_1^{j,j} \end{aligned}$$

where $\tau^{i,j}$ is the costs of currency conversion and $e^{\chi^{i,j}(s')}$ is the price of country j currency in units of country i currency.

The household has time-separable preferences over current and future aggregate consumption expenditures:

$$V(C_1^i, C_2^i(s')_{s' \in S}) = \frac{{C_1^i}^{1-\sigma}}{1-\sigma} + \sum_{s' \in S} \pi(s') \frac{C_2^i(s')^{1-\sigma}}{1-\sigma}$$

where σ is the coefficient of relative risk aversion. Using the notation described above, we

can write the budget constraints in period 1, and in state s' in period 2 as:

$$\sum_{j=1}^{4} p_1^{i,j} c_1^{i,j} + \sum_{j=1}^{4} q_1^{i,j} k_2^{i,j} = \sum_{j=1}^{4} r_1^{j,i} k_1^{i,j} \tag{2.2}$$

$$\sum_{j=1}^{4} p_2^{i,j}(s') c_2^{i,j}(s') = \sum_{j=1}^{4} \frac{1}{1+\tau^{i,j}} r_2^{j,i}(s') e^{\chi^{i,j}(s')} k_2^{i,j} + \zeta_2^i(s'), \quad s' \in S \tag{2.3}$$

Since we model the change in the exchange rate as an inflationary tax imposed on foreign investors, we assume that $\zeta_2^i(s') = \sum_j (e^{\chi^{i,j}(s')} - 1) \cdot r_2^{i,j}(s') k_2^{j,i}$ is a lump-sum transfer of the proceeds from that tax (of course $\zeta^i(s')$ can be negative if country i's currency appreciates).

Intra-temporal and inter-temporal distortions The model outlined above features two distortions. The intra-temporal (within period) distortion, $\tau^{i,j}$, captures the transaction costs associated with the currency conversion between countries i and j. The inter-temporal (between periods) distortion, $\chi^{i,j}(s')$, captures the exchange rate risk between countries i and j.

3 Currency union

We can now analyze how eliminating the two distortions will affect trade and FDI flows between countries using a numerical comparative statics exercise. We consider the world consisting of two symmetric countries. We assume the set of future states has three elements, $S = \{s_1, s_2, s_3\}$, with $\pi(s') = \frac{1}{3}$ for all s'. In state s_1 the exchange rate of country 1 appreciates, in state s_2 the opposite happens, while in state s_3 exchange rate remains constant. In our benchmark simulations we impose the following parameter values:

- $\omega_c^{i,i} = \omega_k^{i,i} = \omega_x^{i,i} = 0.5$, i.e. there is no home bias
- $\sigma = 2$ in the utility function
- $\theta_c = \theta_x = \theta_k = 1.5$

- cost of currency exchange is $\tau = 0.01$
- size of appreciation/depreciation is $\chi(s_1) = 0.20$

Elimination of intra-temporal distortion means that we set $\tau = 0$, elimination of inter-temporal distortion means that we set $\chi(s') = 0$ for all s', while creation of the currency union means we set both $\tau = 0$ and $\chi(s') = 0$. While it is not a strictly calibrated exercise, we impose reasonable parameter values. The elasticity of substitution between domestic and foreign tradeable consumption and investment goods, θ_c and θ_x are consistent with the value in Backus et al. (1994), although some studies suggest values less than one (Corsetti et al. 2008, Rothert 2020). The elasticity of substitution between domestic and foreign owned capital stock, θ_k, is not well established in the literature. In our benchmark experiments we set it to the same value as θ_c and θ_x and we will analyze in detail how its value affect our results. The cost of currency exchange is consistent with a typical fee imposed on foreign transactions by credit cards companies, based on our personal experience. Finally, the size of appreciation/depreciation before the creation of the currency union is consistent with average annual fluctuations of the exchange rate between British Pound and German Mark during the 1995-1999 period (we did not use the countries that were on the path to forming the European Monetary Union as their exchange rates were forced to be stable).

Table 1 shows the impact of currency union on trade and FDI flows, and welfare in our model. We consider a standard measure of welfare effects - % change in life-time consumption that would yield the same change in utility.

Eliminating the conversion costs We first look at the impact of eliminating the costs of currency conversion. Not surprisingly, elimination of transaction costs will boost both FDI flows and trade flows, and improve welfare. The elasticity between domestic and foreign capital ownership has a large impact on the FDI response. Not surprisingly, when that elasticity is high, FDI flows respond more strongly. The intuition is fairly straightforward - with low elasticity, the return is highly sensitive to the ratio of domestic and foreign owned capital stock and hence there are large cross-border holdings of capital even in the presence of transaction costs.

Table 1: Impact of currency union on trade and FDI flows, and welfare

	% change in FDI flows			% change in trade flows			welfare effect		
	$\tau = 0$	$\chi = 0$	Curr. union	$\tau = 0$	$\chi = 0$	Curr. union	$\tau = 0$	$\chi = 0$	Curr. union
Benchmark	0.59	2.06	2.67	0.25	0.00	0.25	0.80	1.81	2.64
$\sigma = 4$	0.47	5.54	6.05	0.25	0.00	0.25	0.80	3.96	4.83
$\theta_K = 1$	0.09	1.03	1.12	0.25	0.00	0.25	0.81	1.85	2.69
$\theta_K = 5$	4.08	8.91	13.58	0.25	0.00	0.25	0.75	1.55	2.40

Benchmark: $I = 2$, $\sigma = 2$, $\theta_k = \theta_c = \theta_x = 1.5$, $\chi(s_1) = 0.20$, $\tau = 0.01$, $\omega_c^{i,i} = \omega_k^{i,i} = \omega_x^{i,i} = 1/I$. σ is the coefficient of relative risk aversion. θ_k is the elasticity of substitution between domestic and foreign capital.τ is the costs of currency conversion. χ is the exchange rate uncertainty.

Eliminating the exchange rate risk Next, we look at the impact of eliminating the exchange rate risk. The first striking result is that exchange rate risk has no impact on trade flows in our model. This is not surprising, as the exchange rate risk is the inter-temporal distortion, and the decisions to buy domestic vs. foreign goods in the model reflect intra-temporal trade-offs.

Exchange rate risk has a clear impact on FDI flows, as the return to capital is realized in the future. Under our benchmark parameterization, the elimination of exchange rate risk increases FDI flows between the two countries. That increase is larger if the elasticity of substitution between domestic and foreign ownership is larger. This is fairly intuitive. Exchange rate risk reduces the incentive to buy foreign capital, and in a typical country i the ratio of foreign-to-domestic owned capital, $\frac{k^{j,i}}{k^{i,i}}$, falls. This would increase the return to foreign-owned capital, but if the elasticity of substitution is high, the impact of $\frac{k^{j,i}}{k^{i,i}}$ on return to $k^{j,i}$ is going to be small, and hence foreign ownership of capital will be more sensitive to exchange rate risk. The impact of exchange rate risk on FDI flows is also larger when the coefficient of relative risk aversion, σ, is larger. This result is obvious enough that we do not need to elaborate on it.

The intuition behind the results rests on three model assumptions. First, new capital stock is purchased in period 1, while the return is realized in period 2. Second, the return measured in units of domestic good is uncertain. Third, households are risk averse. The key difference between FDI and trade flows in the model is that FDI has the inter-temporal

component while trade does not.

Currency union Creation of currency union is a joint elimination of both distortions. The overall effect of the currency union is thus a combination of the two individual effects. The results in Table 1 suggests that the two effects complement each other, as the overall impact of the currency union is slightly more than just a sum of the two individual effects under some parameterizations.

3.1 Comparative Statics

The qualitative impact that elimination of exchange rate risk has on FDI, trade, and welfare depends on model parameters. The two parameters that are crucial in our analysis are the relative risk aversion parameter, σ, and elasticity of substitution between domestic and foreign ownership of physical capital stock, θ_k. In this section we focus on exchange rate risk alone, because its impact on FDI flows is the most subtle, and most affected by different values of σ and θ_k.

Elimination of exchange rate risk and FDI The top panel of Figure 1 shows the combinations of the two parameters for which the elimination of exchange rate risk (the inter-temporal distortion) would have a positive impact on FDI flows between the two countries. Part of this graph is not surprising - when exchange rate risk is eliminated, FDI flows will increase if σ is large enough (households are more risk averse) and when elasticity of substitution between domestic and foreign ownership is larger (return to foreign-owned capital is less sensitive to the ratio of domestic to foreign owned capital).

The more subtle result in the top panel of Figure 1 is that there are combinations of values of σ and θ_k for which the elimination of exchange rate risk leads to a decline in FDI flows. Why would that every be the case? Consider a German household that wants to buy a 1 EUR worth of British capital stock. To keep things simple, imagine today's exchange rate is 1, and the gross return in GBP is 1. That means, next period, that German investor will have 1 GBP. Now imagine there is 50% chance of EUR appreciating by 100% and a 50%

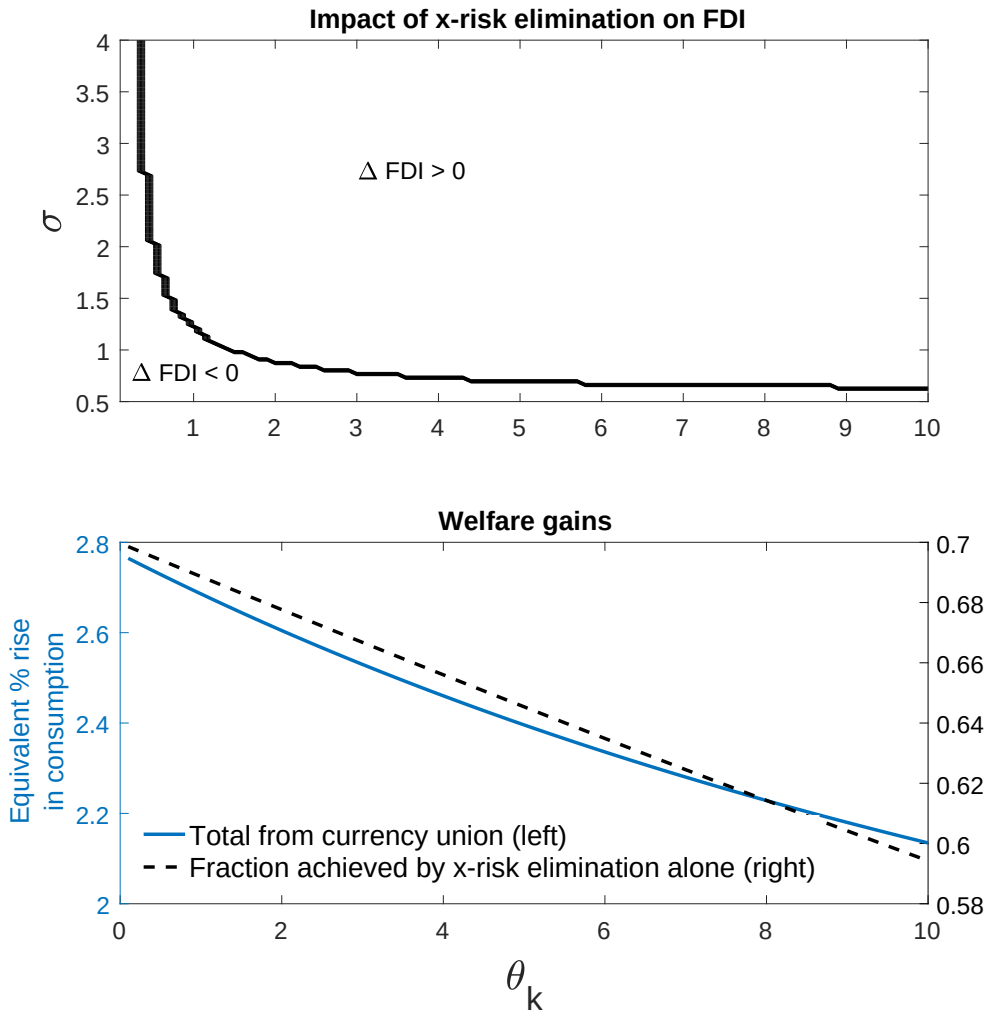

Figure 1: Impact of currency union and exchange rate risk elimination on FDI and welfare

NOTES: The top panel corresponds to the second column in Table 1, calculated over larger grids of σ and θ_k values; θ_k on the horizontal axis. The bottom panel corresponds to the last two columns in Table 1, calculated over a larger grid of θ_k values. The solid blue line corresponds to the last column, the dashed black line corresponds to the ratio of the last two columns. All other model parameters are set to the values listed at the beginning of Section 3.

chance of GBP appreciating by 100%. Then with probability 50% the German investor will end up with 2 Euros, and with probability 50%, that investor will end up with 0.5 Euros. The expected gross Euro return will be 1.25, with an expected net return of 0.25. In other words, an unbiased increase in exchange rate risk increases the expected return to FDI. If the household's risk aversion parameter is sufficiently small, that increase in expected return may be large enough for the increase in exchange rate risk to increase FDI flows.

Welfare gains from the currency union Lastly, we want to emphasize the importance of knowing the right value of θ_k for our conclusions about the welfare effects of forming a currency union. The bottom panel of Figure 1 shows just how important that is. An implicit assumption in a typical macroeconomic model is that $\theta_k = \infty$. Our stylized model suggests that the value of θ_k plays a non-trivial role for understanding welfare gains. Changing θ_k from 10 to 1 (Cobb-Douglas) raises our estimate of welfare gains by about 30%, and increases the fraction of total gains that can be achieved by the elimination of exchange rate risk alone (from 60% to 70% of total gains).

We interpret this result as an indication that properly identifying the degree of substitutability between domestic and foreign capital stock is important to accurately evaluate the welfare gains of forming the currency union in general, and eliminating the exchange rate risk in particular. Given that exchange rate risk is time varying, one would expect the welfare games of elimination of such risk should be magnified during financial crises. Furthermore, FDI's greater exposure to exchange rate volatility should create an asymmetric response between FDI and trade during times of crisis. We explore these implications in the next section by modelling the FDI and trade response among four countries- two within a currency union and two outside. We then compare these predictions to European experience during the global financial crisis.

4 Trade and FDI flows during a crisis

Our analysis thus far highlighted how the intra- and inter-temporal distortions affect trade and FDI flows in an economic area with an otherwise free movement of goods and assets. Our results have interesting implications for the behavior of these two aggregates during periods of economic crises that coincide with large uncertainty. We will now analyze these implications and provide some preliminary evidence that they are consistent with the European experience during the 2008-09 financial crisis.

4.1 Exchange rate risk, recession, and crisis - experiments

In this section we consider a world consisting of 4 countries (we set $I = 4$). Countries 1 and 2 form one currency union, countries 3 and 4 form the other. As in Section 3, we consider three states of the world — in state s_1, currency of the first union will appreciate, in state s_2 currency of the second union will appreciate (by the same %), in state s_3 exchange rate will be remain constant. We measure the exchange rate risk as $1 - \pi(s_3)$ and we set $\pi(s_1) = \pi(s_2) = \frac{1-\pi(s_3)}{2}$.

We conduct three experiments with results presented in Figure 2: (A) an increase in exchange rate risk, (B) a decrease in productivity (a recession), (C) a recession combined with larger exchange rate risk (a crisis). In each panel, the top graph shows the response of FDI flows, the bottom graph shows the response of trade flows.

The results are as follows. First, an increase in exchange rate risk reduces the size of FDI flows between currency union countries and those outside the union, but it has no impact on trade flows between them (panel A). Second, a recession, without any change in exchange rate risk, reduces both FDI and trade flows between countries. Most importantly, the impact on both is essentially the same (panel B). Finally, a crisis that combines a recession with an increase in exchange rate risk, reduces FDI flows more than it reduces trade flows. The larger is the rise in exchange risk during the crisis, the larger is the difference between the response of FDI flows and the response of trade flows(panel C).

As we discussed in Section 3, the two key parameters in the model that matter for the behavior of FDI flows are the coefficient of relative risk aversion σ and the elasticity of substitution between domestic and foreign ownership of capital θ_K. Figure 3 shows how the two parameters affect the response of FDI to a change in exchange rate risk.

Not surprisingly, an increase in exchange rate risk has a larger impact on FDI flows when households are more risk-averse. That impact is also larger when θ_K is larger. This follows from the intuition described in Section 3 — with a larger value of θ_K, the marginal product of capital stocks owned by households from different countries is less sensitive to the ratio of these capital stocks. We believe this to be a very important result of our paper — the empirical response of FDI to exchange rate risk can inform us about the degree to which

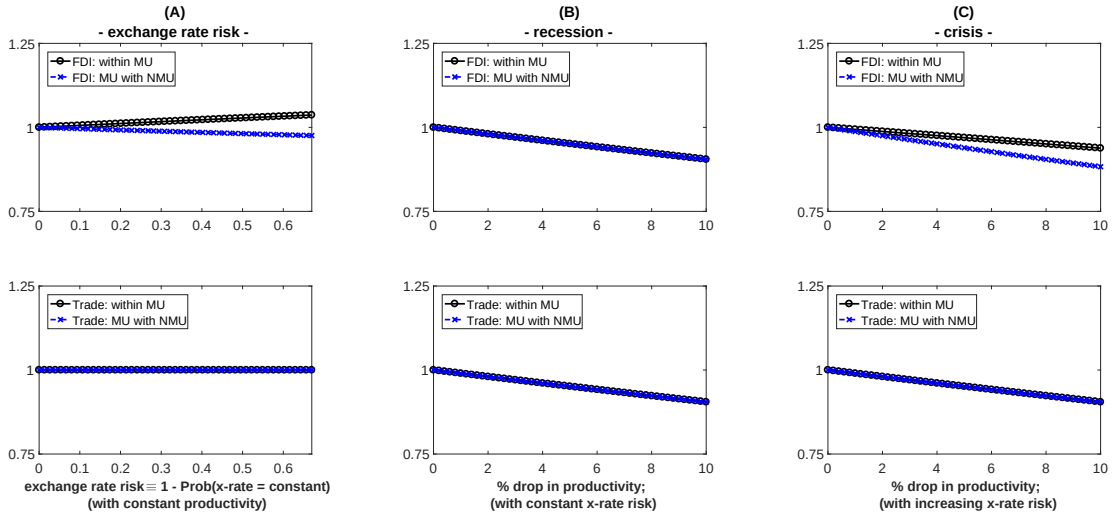

Figure 2: FDI and Trade in the model — exchange rate risk, recession, and crisis
NOTES: Four symmetric countries ($I = 4$), with two separate currency unions, each with two members. "Within MU" is the sum of flows within each of the unions. "MU with NMU" is the sum of flows between the two unions. Same parameters as in Table 1.
Panel (B): benchmark x-rate risk set to $\pi(s_1) = \pi(s_3) = 1/3$; drop in productivity happens in period 1 only.

domestic and foreign ownership of capital can be considered substitutes. As indicated in Figure 3, that parameter can have a non-trivial impact on our evaluation of the welfare effects of joining a currency union.

4.2 European trade and FDI flows during the 2008-09 Crisis

We now look at the empirical response of trade and FDI flows in the European Union during and following the 2008-09 crisis. The EU offers a great laboratory, as it is a customs union with free mobility of capital between all members. However, only a subset of countries shares a common currency, without *constant* conversion costs and *time-varying* exchange rate risk.

The top panel of Figure 4 shows aggregate FDI flows (in natural logs) between country pairs over time. FDI flows between countries that are both within the Euro Area are consistently higher than aggregate FDI flows between country pairs where one country is

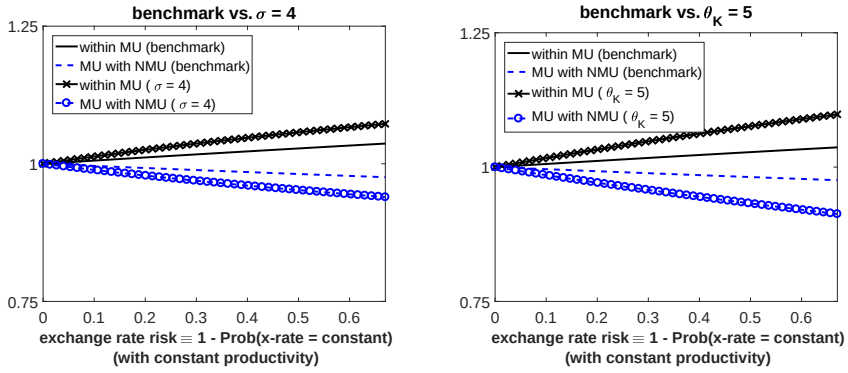

Figure 3: FDI response to higher exchange rate risk: comparative statics
NOTES: See Figure 2.

within the Euro Area and the other is outside (but within the customs union). The pre-crisis trends are mostly similar, and while both types of flows decline starting with the 2008 financial crisis, the decline is less noticeable for countries that share a common currency.

Contrast that with the middle panel of Figure 4, which shows aggregate trade flows (in natural logs) between country pairs over time. Again, currency union pairs have higher overall levels of trade, but the trend is similar between the two groups. After the global crisis, trade dips for both sets of pairs consistent with the great trade collapse, but rebounds relatively quickly for both groups. The aggregate trade dynamics for both currency union pairs and partial Euro pairs are very similar.

Our model provides a simple explanation for this dichotomy - FDI, like all investment in physical capital, takes time to build so it is exposed to intertemporal exchange rate risk to a much greater degree than trade. Exchange rate risk can be seen in the bottom panel of Figure 4, which shows the Euro / GBP one-year implied volatility rate from 1999 until 2015. One-year implied volatility is a market measure of forward-looking risk inferred from the price of currency options. There was a notable spike in implied volatility starting in late 2007 as the global financial crisis began to unfold. Implied volatility continued to stay elevated for the next few years, with additional spikes in 2009 and 2010.

While intra-currency union trade during a recession behaves in a similar manner to inter-currency union trade, exchange rate risk generates an asymmetric impact through its influence on expected returns to FDI in future periods. Thus we see trade in assets remaining relatively strong during a financial crisis within a currency union, consistent with model predictions.

5 Conclusions

This paper shows that the gains from adopting a single currency are mainly realized through FDI rather than trade and will be magnified during times of heightened exchange rate uncertainty such as financial crises. This result is driven by the fact that although the elimination of transaction costs associated with currency conversion is important to trade in assets and goods, it is the reduction in exposure to exchange rate risk, captured in FDI flows, that delivers much of the welfare gains to currency union participants. The size of these welfare gains are crucially dependent on the elasticity of substitution between domestic and foreign ownership of capital- low values of that parameter imply that elimination of exchange rate risk could have non-trivial welfare effects. The main prediction of our model is that the response of FDI flows to a spike in exchange rate risk would be stronger than the response of trade flows. It is supported by empirical evidence from the European Union during the 2008-09 financial crisis. Our results call for empirical work that would estimate the degree to which domestic and foreign-owned capital stock can be considered complements or substitutes.

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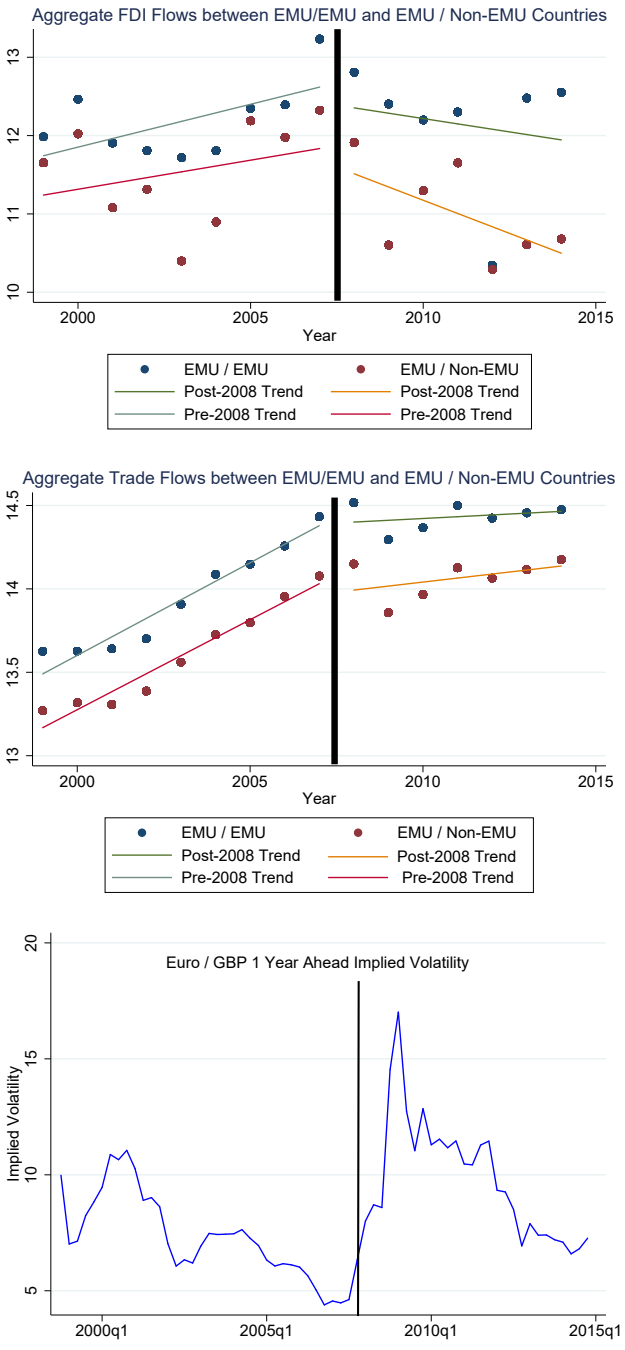

Figure 4: FDI vs. Trade flows, and Exchange Rate Risk in the European Union