

Financial Crises and International Trade: the Long Way to Recovery

Nicolas Berman*

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Abstract

Recent emerging market crises have emphasized the fluctuating character of trade's reaction after financial crises, in contradiction with the apparently simple theoretical impact of such events on trade, which is essentially described by the well-known J-curve mechanism.. We use a gravity-like equation to assess the impact of these events on bilateral sectoral trade and reveal the elements which can improve their effect and accelerate countries' recovery. We find that both currency and banking crises have a long-lasting negative impact on trade. Trade remains under its natural level during eight years after a currency crisis. The persistent negative impact of currency crises on exports is magnified by the combination of firms' foreign currency borrowing and high fixed costs, which leads to important balance-sheet problems. Post-crisis volatility explains a large part of the negative imports' reaction after currency crises. Finally, the effect of crises on exports largely depends on the country's specialization: currency crises have a more positive effect as the country exports goods associated with a high elasticity of substitution and a low financial external dependence; specialization biased toward highly differentiated, externally dependent industries magnifies the negative impact of banking crises.

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*TEAM - University Paris 1 Pantho-Sorbonne. Adress : Maison des sciences économiques, 106-112 Bd de l'Hôpital, 75647 Paris Cédex 13, France. Tel and Fax numbers: (0033) (1) 1 44 07 82 67. E-mail: Nicolas.Berman@malix.univ-paris1.fr. I am especially grateful to Thierry Mayer for providing me a large part of the data.

I Introduction

The growing number of financial crises during the nineties has generated an important economic literature. Most of it focuses on the determinants of crises, explains why financial crises happens, and tries to predict their occurrence. These papers have widely studied the role of international trade in explaining financial crises, showing in particular the significant role of trade linkages in facilitating the contagion of crises¹, or more generally testing the importance of trade links on the probability of occurrence of financial crises². A fewer number of authors have shown the implications of such events, by looking generally at the crises' impacts in terms of output variation. Among others, Gutpa and al. (2004), Noy and Neuberger (2002), Dooley (2000) and Hong and Tornell (2005) study the effects of currency, banking and twin crises on output, and describe the necessary conditions for the output cost to be minimum.

Surprisingly, very little work has been done on the impact of financial crises on international trade, the latter being usually considered as obvious or traditional. Theoretically, a currency crisis may lead to a decrease in imports, and to an increase in exports because of a J-curve effect : the nominal devaluation usually implies a real devaluation, at least to the extent that relative prices do not adjust by the same amount as the nominal exchange rate; this competitiveness gain, by leading to a switch of demand toward home produced goods, may improve the trade balance. On the other hand, a banking crisis, by decreasing the total financing capacity of the economy, may have a recessive impact; this should imply a drop of both exports and imports.

However, the few authors who tried to test the effect of crises on trade generally found unclear results, in contradiction with the apparently simple theoretical effects. A fast look to some recent stylized facts emphasizes this fluctuating character of trade's reaction after currency and banking crises. Trade patterns after crises deeply differs according to the considered country: while in Mexico, total exports increased by 32 percents in 1995, it diminished in Brazil in 1999 and in Thailand in 1998 by almost 6 percent. Since the improvement of the trade balance is one of the main ways to recover from a crisis, it seems important to understand the mechanisms that explain these variable responses.

Fischer (1999) listed strong exports, expansionary domestic policies and stable foreign financial conditions as the key determinants of recovery after a financial crisis. Nevertheless, Hong and Tornell (2005) shows that the share of the export sector was not significant in explaining recent currency crises recoveries. We attempt in this paper to explain this fact by looking more closely at the channels which can affect trade's reaction to financial crises. We argue that while the exports' reaction in an important determinant of crises recoveries, some elements may affect negatively exports after such an event, thus preventing trade from having beneficial effects on the country's recovery.

The lack of robust and general results of previous studies is probably due to missing variables or to an insufficient consideration of the different mechanisms through which crises may affect bilateral imports and exports. Campa (2000) tests the impact of currency crises on South American countries' exports. The impact appears positive or insignificant, according to the specification, but the empirical methodology he employed suffers from a problem of omitted variables which prevents us to take its results for granted. In particular, it seems that control variables that should capture the effect of

¹See for example, Kaminsky and Reinhart (2000), Glick and Rose (1998) and Camarazza and al. (2004).

²See, among others, Frankel and Carvalho (2005).

demand or prices are missing. In a more recent paper, Ma and Cheng (2003), using a gravity-like equation, test the impact of financial crises - both currency and banking crises - on international trade. Their results are even less clear-cut: currency crises do not seem to have any impact in the short run (or a slightly negative impact), and the sign of the long run impact depends on the considered period. The present paper brings a number of innovations which allow us to find clearer results.

More precisely, the question we address is twofold : is the theoretical impact of crises on trade so simple? And, if not, how can we test empirically the relevance of the different theoretical channels? To answer this question, the present work builds on the recently growing literature on the links between finance and international trade. Since its first introduction by Kletzer and Bardan (1987), the important role of financial development for international trade's growth has been widely studied (Beck (2002, 2003), Manova (2005)). More particularly, a special attention has been given to the interactions between financial market imperfections, exchange rate movements and international trade. Finance is especially important for international trade because of the existence of high fixed costs of entry on the export market. If financial imperfections are observed, like foreign currency borrowing or credit constraints, the impact of exchange rate movements on international trade and exports decisions can be modified. On the first hand, Chaney (2005) has shown within a monopolistic competition model with heterogeneous firms à la Melitz (2003) that when firms are liquidity constrained, an appreciation of the exchange rate, by facilitating the entry on the export market (because of the increase of the value of firms' wealth, denominated in home currency), can lead to new firms' entry, and to an increase in total exports. On the other hand, Berman and Berthou (2005) have studied the impact of exchange rate movements on international trade in presence of foreign currency borrowing. They show that if firms borrow in foreign currency in order to finance their fixed cost of entry, a devaluation of the home currency can lead to a decrease of the number of exporters (the extensive margin of trade), and to a drop of the export volume of the country. Moreover, they show that the impact of exchange rate movements may be non-linear: while little depreciations lead to the positive, traditional competitiveness effect, large swings have a reversed impact. This last result underlines the specificity of the impact of currency crises in comparison with smaller exchange rate variations.

We build on these various theoretical results to show that the impact of banking and currency crises on trade are likely to be more complex than one can suppose. More precisely, we show that while the effect of currency crises on imports is theoretically negative, the reaction of trade after a banking crisis and the reaction of exports after a currency crisis are not well-defined. To assess the impact of crises, we use a gravity-like equation in which we introduce crises dummies. We use a sectoral database in order to reveal, through sectoral characteristics, the different channels through which trade is affected by financial crises. We are thus able to determine different elements which can improve or worsen the crises' effect on trade and accelerate countries' recovery. First, we show that both kinds of events - currency and banking crises - have a negative impact on both imports and exports. Trade remains under its natural level during the eight years that follow a currency crisis. Second, the persistent effect of crises on exports is likely to be magnified by the combination of firms' foreign currency borrowing and high fixed costs of entry, which leads to important balance-sheet problems. Post-crisis volatility explains a large part of the negative imports' reaction after currency crises. Finally, we find that the effect of both types of crises on exports depends on the country's specialization: currency crises

have a more positive effect as the country exports goods that are associated with a larger elasticity of substitution, and is specialized in industries that use less external capital in their financing; the impact of banking crises is harder when the country is specialized in industries associated with higher fixed costs of export and larger financial external dependence.

This paper contributes to the existing literature at various levels. First, it provides a theoretical framework which allows a better understanding of the interactions between financial crises and international trade. Second, our results emphasize the specificity of large exchange rate shocks, in comparison with smaller exchange rate movements. Finally, our conclusions have important policy implications, since we define some elements that should be able to improve the impact of crises on international trade, thus facilitating the crisis' recovery.

The remainder of this paper is organized as follow. In the next section, we present the different channels which connect financial crises to international trade. In section 3, we present our methodology, while in section 4 we review the data used in the regressions. In section 5 we present the overall and the sectoral results, before drawing some conclusions and policy implications in section 6.

II Theoretical links between financial crises and international trade

Financial crises may affect trade in a number of different ways. Currency and banking crises lead to distinct impacts. Their total effect on imports and exports is far from being trivial, and, in most of cases, is theoretically unspecified.

1 Currency crises and international trade

The main reason of a potential non-traditional reaction of exports to a currency devaluation relies on the existence of balance-sheet effects. Recent literature have underlined the important role of foreign currency debt and credit constraints in explaining the occurrence of crises and modifying their impact. In the aftermath of a currency crisis, the increase of the amount of foreign currency denominated debt and the decrease of the amount of home currency denominated cash flow can dampen the positive impact of the devaluation through a diminution of investment capacity³. Empirically, studies have shown that the tradable sector is more likely to face this negative effect, exporting firms being typically more prone to borrow in foreign currency (Aghiar (2005), Kawai et al. (2003)) because of their better access to foreign financial markets. An important point is that, despite the obvious risk of such a behavior, emerging markets' firms seldom hedge themselves against exchange rate fluctuations⁴. Moreover, it is interesting to notice that an increase in devaluation's expectations does not

³See among others Krugman (1998), Aghion, Bacchetta and Banerjee (2004), Bacchetta (2000), Cespedes and al. (2002), Chang and Velasco (2000). Calvo et al. (2003a,b) provide empirical evidence of the importance of liability dollarization as a predictor of sudden stops in capital flows for a sample of 32 emerging market countries. If foreign currency borrowing is used as a larger part of total borrowing in countries which experienced financial crises, balance-sheet effects are more likely to be larger after crises.

⁴A number of theoretical reasons have been exposed to explain this fact. See among others Eichengreen and Hausmann (2000), Chinoy (2001). It seems that the problem of the absence of hedging directly comes from the 'original sin' one, i.e. the impossibility for developing countries' agents to borrow in their own currency. According to Eichengreen and Hausmann (2000) "these mismatches exist not because banks and firms lack the prudence to hedge their exposures;

seems to have any impact on firms' borrowing and investment behavior (Galvani et al. (2003)). More generally, based of firm-level data, studies have found significantly negative balance-sheet effects of currency crisis on investment or profitability for Mexico (Patrap et al. (2003), Patrap and Urrutia (2004)), Colombia (Echeverry and al. (2003)), Peru (Carranza et al. (2003)) and Chile (Benavente et al. (2003)). However, these studies do not look precisely at the effect of currency crises on trade flows nor on firms' export decisions, so that we cannot say anything about the relative size of the two mechanisms, namely the positive competitiveness and the negative balance-sheet effects.

In this section, we present a very simple framework through which we try to explain the impact of exchange rate devaluations on firms' export decisions. Let us consider two countries, home and foreign (denoted by a *), each of them composed by an only firm. Each firm produces to serve its own market, and is confronted to an export decision. We study the determinants of the export decision of the home firm which wants to enter the foreign market. To do so, it has to pay a fixed cost F . The firm owns an exogenous amount of liquidity which can serve to pay the fixed cost. If that liquidity is not sufficient to cover the whole cost, the firm can borrow, but it doesn't have any access to home currency loans - so that it has to borrow in foreign currency. This is a simplified view of the "original sin" problem of emerging countries, i.e. the incapacity of those countries to borrow in their own currency⁵. Thus, the firm's end-of-period fixed cost (which include the loan's repayment) can be written as:

$$F_h = \omega F + (1 - \omega)F(1 + r^*)e \quad (1)$$

where ω is the share of the fixed cost financed by firm's liquidity, r^* is the international interest rate and e the exchange rate (an increase in e means a depreciation of the domestic currency). The firm's export decision depends on the relative sizes of fixed cost and foreign demand for its good. We consider a very simple function of foreign demand, which can be written as:

$$D^* \equiv d_{hf} + d_{ff} \equiv L^*(p_h^*)^{-\sigma} + L^*(p_f^*)^{-\sigma} = L^* \left[\left(\frac{p_h}{e} \right)^{-\sigma} + (p_f^*)^{-\sigma} \right] \quad (2)$$

where d_{ij} denotes the demand of country j for the variety produced by country i , L^* is the foreign number of households (wage is normalized to 1), p_h and p_h^* are respectively the home and the foreign prices of the home produced variety, p_f^* the foreign price of the foreign variety. σ represents both the elasticity of substitution between home and foreign varieties and the elasticity of demand to prices variations. The firm's export decision depends on the relative size of fixed cost of entry and foreign demand, which determines the volume exported by the firm. The home price of a domestic variety equals the marginal cost multiplied by an equilibrium margin:

the problem rather is that a country whose external liabilities are necessarily denominated in foreign currency is, by definition, unable to hedge". Indeed, assuming that someone on the other side of the market for foreign currency hedges is strictly equivalent to assuming that the country can borrow abroad in its own currency.

⁵More precisely, this is a simplified view of the 'foreign original sin', in opposition to the 'domestic original sin' as defined by Eichengreen and Hausman (1999), i.e. the incapacity of a country to borrow in the long-run in the domestic financial market. We focus here on the foreign currency borrowing and thus do not consider this other kind of financial imperfections

$$p_h = \frac{\sigma}{\sigma - 1}c \quad (3)$$

where c is the firm's marginal cost; the foreign price of a home produced variety p_h^* is simply p_h/e (we suppose that there are no trade costs). Hence, the home firm's export-related profit can be written as:

$$\Pi = p_h d_{hf} - c d_{hf} - F_h = \frac{1}{\sigma} p_h^{1-\sigma} e^\sigma L^* - \omega F - (1 - \omega)F(1 + r^*)e \quad (4)$$

The firm doesn't know the future value of the exchange rate; it makes its decision according to the initial exchange rate value $e = 1$. The devaluation occurs after the firm's entry, and leads both to an increase in foreign demand (the first member of the profit function) and in the amount of debt repayment (the last member of the profit function). The firm can either decide to stay or exit the market, depending on its profit's variation. If the devaluation leads to an increase in Π (i.e. if the increase in demand is larger than the increase in the debt repayments), the firm stays. If the profit becomes negative (i.e. if the negative balance-sheet effect is greater than the positive competitiveness one), it decides to stay if the negative profit is lower than the amount of repayment $F(1 - \omega)r^*e$, and decides to exit if the profit is more negative than this amount. Thus, the firm will exit only if:

$$\begin{aligned} \Pi &= \frac{1}{\sigma} p_h^{1-\sigma} e^\sigma L^* - \omega F - (1 - \omega)F(1 + r^*)e < F(1 - \omega)r^*e \\ \iff \Delta\Pi &= \frac{1}{\sigma} p_h^{1-\sigma} e^\sigma L^* - F[\omega - (1 - \omega)(1 + r^*)e] < 0 \end{aligned} \quad (5)$$

Differentiating $\Delta\Pi$ with respect to e , we can study the effect of an exchange rate devaluation on the firm profit, and on its export decision. More precisely, we find the following expression:

$$\frac{\partial\Delta\Pi}{\partial e} = \frac{1}{\sigma} p_h^{1-\sigma} e^\sigma L^* - F[\omega - (1 - \omega)(1 + r^*)e] \quad (6)$$

which is increasing with σ , L^* and ω , and decreasing with F . Thus, a devaluation have a more negative effect (leads some firms to exit the market) as:

- *Elasticity of substitution between varieties is low, i.e. competition is soft (low σ)*
- *Fixed cost of entry is high (high F)*
- *The share of foreign currency borrowing over total financing is large (low ω)*
- *The firm belongs to an externally dependent industry, i.e. use more external finance than cash flows from operations to finance its capital expenditures. (low ω)*
- *Foreign country is small (low L^*)*

Of course, this model is very simple and imperfect. It only tries to explain how high fixed costs of export and foreign currency borrowing can interact with exchange rate movements to create non

conventional effects on international trade. For a more complete version of the same theoretical mechanisms, see Berman and Berthou (2005). The main conclusion of these theoretical intuitions is the importance of the extensive margin adjustment: here, it is the firms' entries and exit from the export market that determines total exports' variations after an exchange rate shock. Indeed, these mechanisms could easily be applied to a dynamic framework, and generalized to a continuum of firms: if we suppose that the fixed cost of export has to be paid at the beginning of each period, then exchange rate movements can lead to firms' entry-exit behaviors, which in turn can lead to modification of the level of trade.

This simple model does not take into account all the elements that can affect international trade through exchange rate movements. The first reason is that it only considers the impact of exchange rate movements on exports, without studying the imports' reaction. The effect of foreign currency borrowing on imports should be smaller because the fixed costs associated with this activity are lower. Nevertheless, as shown by Deardorff (2000), negative balance-sheet effects can be observed on imports after a devaluation as foreign currency denominated borrowing can be used in order to finance imports operations. This behavior can lead firms to default on their loan after a crisis, thus increasing the cost of financing trade in the subsequent periods.

Moreover, our model omits two important channels, respectively related to exchange rate volatility and imported inputs, that can affect the way in which exchange rate shocks may be transmitted to international trade.

First, post-crisis exchange rate level is often characterized by an important uncertainty. The impact of volatility on international trade has been widely studied, but the results are mitigated, both empirically and theoretically. Clark et al. (2004) explain this lack of robustness by the fact that the exchange rate variability is the result of shocks which can themselves affect trade. For example, exchange rate volatility can come from measures of trade liberalization that can increase the total volume of trade flows. Klaassen (2004) argues that the true effect of exchange rate risk on trade is difficult to find because export decisions are mostly affected by the probability distribution of the about one-year rate, which appears fairly constant over time. However, it seems necessary to take into account the exchange rate riskiness in an empirical treatment of the impact of currency crises because the volatility associated with such events is somewhat different and larger, and could well cause more important effects.

Second, a currency depreciation, by making imported inputs relatively more expensive, may decrease the volume of imports. If intrafirm trade is important, this should lead to a decrease of exports in sectors that use an important share of imported inputs. Evidence of this channel has been found by Nucci and Pozzolo (2001) : according to their results, the effect of exchange rate fluctuations is stronger for firms characterized by a high degree of import penetration.

Finally, all these effects suppose that the currency crises indeed lead to a currency devaluation, and most of them implicitly suppose that the nominal devaluation transforms itself into a real devaluation. The first assumption is not systematically true in reality, because the currency can be successfully defended after a speculative attack by a variation of interest rate or international reserves. However,

empirically, most of currency crises leads to a currency devaluation⁶. In the same way, empirical evidence shows that only a small part of nominal devaluations after currency crises is transmitted to prices⁷.

2 Banking Crises and International Trade

The importance of financial development for international trade has been pointed out by several authors (Beck (2002, 2003), Becker and Greenberg (2004), Manova (2005)). Since a banking crisis diminishes the amount of liquidity available in the economy, decreases the level of financial development, it should have an important effect on international trade. After a banking crisis, domestic borrowing can be more difficult to contract, and the firms can be forced to use their own liquidity or to borrow in the foreign markets. If the firm belongs to an externally dependent industry, the impact of the crisis will be magnified. On the other hand, if the firm faces an important fixed cost to enter the export market, the need for financing it through borrowing will be larger, and the negative impact of the banking crisis too. If imports operations require an important amount of financing, the banking crisis, by making more difficult for firms to borrow, may have a negative impact on imports. Nevertheless, the impact should be larger for exports since banking crises prevent some firms to enter the export market, or force them to exit from it, which is not the case for importing firms.

Moreover, as pointed out by Aghion and Howitt (2005), a Schumpeterian view of business cycles and growth emphasizes the fact that a recession has cleansing properties, correcting organizational inefficiencies and encouraging the firms to reorganize and innovate. In that context, a banking crisis may have a mitigated effect. It often leads to important recessions which could in turn induce the previously mentioned cleansing effects. On the other hand, the tightening of credit constraints that follows the crisis may prevent firms from borrowing in order to do their reallocating operations.

Finally, on the long run, a banking crisis, by forcing the less efficient banks to exit the market, may increase the mean level of banking system efficiency. Indeed, if inefficiency has played a role in the occurrence of the banking crisis, an efficiency recovery should be observed in the post-crisis period. As pointed out by Bertrand, Schoar and Thesmar (2004), a larger banking system's efficiency may lead to an improvement in firms' efficiency and productivity; this can generate a higher share of exporting firms and an increase of total exports - which should be larger when the country is specialized in more financially dependent industries. Imports can increase too, because of the diminution of credit constraints generated by the improvement of banking system efficiency. While this improvement has not been observed for some recent crises in Turkey and Indonesia (Reynaud and Rokhim (2004)), it seems however necessary to consider it in a more global study like the present one.

To sum up, the reaction of trade to financial crises may be affected by various elements. Table 1 reports the different channels through which trade may be affected by financial crises and the financial or sectoral elements that may magnify or reduce their impact. Only the impact of currency crises on

⁶According to Eichengreen and Bordo (2002), only 11% of the 128 crises they registered between 1980 and 1998 didn't lead to a devaluation. Our own computations lead to an even smaller percentage.

⁷Godfajn and Werlang (2000) have shown that less than 20% of the currency devaluation was reflected in the rate of inflation 12 months after the 1997 asian crisis.

Table 1: Crises and Trade: channels of transmission

	Exports	Imports		Exports	Imports
Currency Crisis			Banking Crisis		
<i>Competitiveness</i>	+	-	<i>Financing Capacity</i>	-	-
<i>Balance-Sheets</i>	-	-	<i>Efficiency</i>	+	+
<i>Volatility</i>	-	-			
<i>Imported Inputs</i>	-	-			
<i>Total Effect</i>	?	-	<i>Total Effect</i>	?	?
Magnification			Magnification		
<i>Fixed Costs</i>	-		<i>Fixed Costs</i>	-	
<i>Elasticity of Substitution</i>	+	-	<i>External Financial Dependence</i>	-	
<i>External Financial Dependence</i>	-				
<i>Foreign Currency Borrowing</i>	-	-			

imports is unambiguously predicted to be negative. Exports can either increase or decrease after a currency crisis; both imports and exports can increase after a banking crisis because of the improvement of the financial system efficiency. To test the different channels, it seems useful to take into account firms' borrowing behavior and the sectoral specialization - because of differences in the levels of fixed costs, external dependance and elasticities of substitution which can modify the effect of crises. All these elements interact with each other: the amount of fixed cost influence the impact of crises in more externally dependent industries ; the level of foreign currency borrowing and credit constraints have a different impact on exports' reaction of industries using a large amount of external finance. Thus, a sectoral differentiation of trade flows allows us to discriminate among the different channels through which financial crises may be transmitted to international trade.

Another important point is the difference between the short and the long run effects of crises. Indeed, while currency crises are likely to have an expansionary impact on exports in the medium run because of a traditional competitiveness effect, the negative balance-sheet effect may durably decrease the investment capacity. Hence, it seems particularly important to know whether the Mundell-Fleming effect overcomes other effects in the long run or not. Recently, Cespedes (2005) found that financial crises lead to important output losses in the short-run because of a negative balance-sheet effect of foreign currency borrowing. Nevertheless, according to his results, the real devaluation finally generates positive effects on output because of the existence of the competitiveness effect. However, it is not obvious that the effects on trade are the same: while the competitiveness effect is certainly larger when considering only exports instead of the whole output, trade is equally more likely to be associated with larger balance-sheet problems, due to the existence of higher levels of fixed costs that requires important amounts of borrowing.

III Empirical Methodology

We follow the previous work of Ma and Cheng (2003) and introduce crises dummies in a gravity-like equation of bilateral trade. The basic estimated equation takes the form:

$$\begin{aligned} \log(m_{ijk,t}) = & \alpha_1 + \alpha_2 \log(v_{jk,t}) + \alpha_3 \log(v_{ik,t}) + \alpha_4 \log(1 + t_{ijk,t}) + \alpha_5 \log(1 + nt_{ijk,t}) \\ & + \alpha_6 \log(d_{ij,t}) + \alpha_7 \text{Contig}_{ij,t} + \alpha_8 \text{FTA}_{ij,t} + \alpha_9 \text{Comcol}_{ij,t} + \alpha_{10} \text{Landl}_{ij,t} + \alpha_{11} \text{Comlang}_{ij,t} + \alpha_{12} \text{ER}_{ij,t} \\ & \alpha_{13} \text{CC}_i + \alpha_{14} \text{BC}_i + \alpha_{15} \text{CC}_j + \alpha_{16} \text{BC}_j + \text{FE}_i + \text{FM}_i + \text{FS}_k + \epsilon_{ij,t} \end{aligned}$$

where :

- $m_{ijk,t}$ are bilateral exports from country i to country j in sector k
- v_{ik} is the value of production of country i in sector k
- $t_{ijk,t}$ is bilateral tariff between countries i and j in sector k
- $nt_{ijk,t}$ represents non-tariff barriers between countries i and j in sector k
- $d_{ij,t}$ represents the distance between major cities of countries i and j
- $\text{Comlang}_{ij,t}$ is a binary variable which is unity if countries i and j share a common language
- $\text{Contig}_{ij,t}$ is a binary variable which is unity if countries i and j share a land border
- $\text{FTA}_{ij,t}$ is a binary variable which is unity if countries i and j belong to the same regional trade agreement
- $\text{Comcol}_{ij,t}$ is a binary variable which is unity if countries i and j are ever in colonial relationship
- $\text{Landl}_{ij,t}$ is the number of landlocked countries in the pair (0, 1 or 2)
- $\text{ER}_{ij,t}$ is the bilateral exchange rate between i and j (an increase of ER means an appreciation of the currency of country i)
- CC and BC are crises dummies, respectively representing currency and banking crises
- FE , FM and FS are respectively exporter, importer and sector fixed effects

According to the gravity equation literature, we expect the signs of the coefficients α_2 , α_3 , α_7 , α_8 , α_9 , α_{11} to be positive, and the signs of α_4 , α_5 , α_6 , α_{10} , α_{12} to be negative. The latter coefficient relies on exchange rate effect on bilateral trade. We introduce it despite the presence of the currency crisis dummy for the following reasons: first, it allows us to take into consideration (at least partly) the possible contagion of the crisis to trade partners because of its bilateral character; second, the coefficient of this variable may be considered as an element that explains the *competitiveness effect* of the crisis. By introducing separately bilateral exchange rate and a crisis dummy, we are able to take into account the other effects of the currency crisis through the estimated coefficient of the latter.

As mentioned above, the estimated coefficients of crises dummies can be either positive or negative - excepted for α_{15} , which is theoretically negative. Moreover, we introduce debt crises as a control variable. This seems necessary because recent work have underlined the potential correlation between currency crises and default⁸. As the effects of these two events on international trade are likely to be different, it seems necessary to control our results by introducing this dummy. Theoretically, a debt crisis should have a negative impact on bilateral trade - both imports and exports - because of a sanction from the creditor: as Rose (2005) shown, the latter can set up a penalty against the debtor in order to discourage future defaults.

The above specification only considers the year of the occurrence of the event. As we want to study the long-run effect of financial crises, we will introduce lagged variables in the regressions in order to determine the degree of persistence of such shocks on trade. Finally, we introduce importer, exporter and sectors fixed effects to control for unobserved characteristics.

Finally, to test the separate impacts of each theoretical channels exposed below, we will introduce in the basic equation interacted terms between financial crises and financial imperfections, and between crises and sectoral characteristics. More precisely, we will take into account the firms' foreign currency borrowing behavior, and the sectoral elasticity of substitution, fixed costs and financial external dependence. We will expose in details our methodology below.

IV Data

Gravity Variables

We use a large sectoral database of bilateral trade which combines COMTRADE and CEPII data for bilateral trade and UNIDO data for production, for 26 ISIC 3-digit industries between 1975 and 2003⁹. Distance and bilateral exchange rate data comes from CEPII, and geographical data comes from Rose's (2005) work.

Financial Crises

The larger part of our work on data comes from the construction of the financial crises indexes. A large literature have already focused on the identification of financial crises, without conducing to clear conclusions. A number of different methods have been proposed to compute indexes of currency, banking and debt crises. Each method presents advantages and and disadvantages; it seems necessary to control our results by using different definitions of these events.

The simplest way to identify currency crises has been proposed by Frankel and Rose (1996): they define a currency crash as a large change of the nominal exchange rate (25 percent) that is also a substantial increase in the rate of change of the nominal depreciation (10 percent). As we already mentioned, most often, speculative attacks have been resolved through a devaluation of the currency or its flotation. Nevertheless, it seems necessary to take into account the possibility of currency defenses by central banks through contractionary monetary policies or the selling of foreign exchange

⁸Including Dreher, Herz and Karb (2005), Herz and Tong (2003), Reinhart (2002) and Corsetti and Mackowiak (2001).

⁹The trade and production database is available at <http://team.univ-paris1.fr/teamperso/mayer/data/data.htm>. We are extremely grateful to Thierry Mayer for sharing this database.

reserves. High interest rate defenses were not uncommon in the wake of the Asian and Russian crises, while Argentina lost 20 percent of its foreign exchange reserves in a few weeks following the Mexican peso crisis of 1994. Thus, an index of currency crises should capture these different manifestations of speculative attacks. The most common way to put together these elements is to compute an "foreign exchange market pressure" index. This is the method used in most of studies that deal with currency crises. The computed index takes into account both exchange rate and international reserves variations¹⁰: the index is a weighted average of these two indicators with weights such that the two components have equal sample volatility¹¹. Large positive readings of this index indicate speculative attacks¹². The problem of this approach is the definition of the threshold from which we consider that the index indicates a crisis. Kaminsky and Reinhart (2000) use a value of three standard deviations above the mean; for Eichengreen and Bordo (2000), a crisis is said to occur when this index exceeds one and a half standard deviations above its mean. The identification of crises is quite dependent from this choice, so it seems necessary to control empirical results by using different thresholds. Finally, a recent paper by Pozo and Amuedo-Dorantes (2003) proposes an alternative method of identification that uses extreme value theory. This method requires fewer parametric assumptions and seems to be less subjective.

We have constructed different indexes of currency crises using the different methods: Frankel and Rose (1996)'s method, the "foreign exchange market pressure" one, with two different thresholds, and the extreme value method. In addition with the need of controlling our results, this allows us to identify different categories of currency crises that can be classified according to their magnitude. We are thus able to determine whether the impact of a currency crisis on trade is linear or depends on the magnitude of the event. In the first regressions, we only introduce an index of currency crisis computed as an exchange rate market pressure as in Eichengreen and Bordo (2002). We run robustness checks at the end of the paper to control our results with other indexes.

The identification of banking crisis is even more complicated since the concept of banking crisis is highly subjective. According to Eichengreen and Bordo (2000), to qualify an event as a banking crisis, we must observe either "bank runs, widespread bank failures and the suspension of convertibility of deposits into currency such that the latter circulates at a premium relative to deposits, or significant banking sector problems, resulting in the erosion of most or all of banking system collateral that are resolved by a fiscally underwritten bank restructuring". More generally, it seems that the only way to identify banking crises is to stress events. The main reason for relying exclusively on events has to do with the lack of high frequency data that consistently signals that a financial crisis is underway. Thus, most of studies, like Eichengreen and Bordo (2000), defines different characteristics of a financial crisis and qualifies an event as being a banking crisis if one or more of these characteristics are observed. We use Caprio and Klingebiel (2003) data in our study. Their results on banking crises are highly consistent with the previous studies, and include an important number of countries and years. Moreover, Caprio and Klingebiel (2003) provide a description of each crisis and a distinction between small - "borderline" - and large - "systemic" - crises.

¹⁰It is often difficult to introduce interest rates because of lack of data. Moreover, using a large sample of developed and developing countries, Kraay (2003) shown that interest rates have been most of time ineffective in defending currencies during speculative attacks.

¹¹This weighting scheme prevents the much greater volatility in the exchange rate to dominate the crisis measure.

¹²See for example Kaminsky and Reinhart (2000), Hong and Tornell (2005), Eichengreen and Bordo (2000) or Eichengreen, Rose and Wyplosz (1996) for details about the computation.

Finally, we use two different definitions of debt crises to control our results. Following the work of Detragiache and Spilimbergo (2001), we classify an observation as a debt crisis if either of both of the following conditions occur: there are arrears of principal or interest on external obligations towards commercial creditors of more than 5 percent of total commercial debt outstanding; there is a rescheduling or debt restructuring agreement with commercial creditors as listed in the Global Development Finance (GDF) of the WorldBank. Moreover, we use a second definition by Rose (2005): default occurs if there is a renegotiation of bilateral debt on Paris Club. Clearly, these two definitions are conceptually different; the first relies on global debt, while the latter deals with bilateral debt. Since we use a bilateral database of international trade, we expect the second type of crisis to have a more significant impact on trade.

Put together, we are able to compute indexes for the different kinds of crises for nearly 80 countries between 1975 and 2003¹³. This represents a significant improvement in comparison with earlier works on this subject, in particular with Ma and Cheng's (2003) work, which uses the Eichengreen and Bordo (2000) database, thus considering about 50 countries, with a single definition of each type of crisis. As we already mentioned, this large database allows us both to control for potential biases due to the subjective definitions of events and to classify currency and banking crises according to their magnitude - and, thus, to consider the potential non-linear impacts of such events on international trade.

Transmission Channels

To assess the impact of foreign currency borrowing, we use data from the WBES (WorldBank), a firm level survey which covers more than 10,000 firms in 80 countries. For each country, we compute an average index of firms' currency borrowing. The results of our computations are reported in appendix. As the WBES contains information on small and medium firms that have a restricted access to foreign borrowing, it seems logical to find small shares of foreign borrowing. Nevertheless, the orders of magnitude of the different countries are found to be consistent with empirical observations (the level of foreign borrowing in Argentina, a very "dollarized" economy, is by far higher than the share of industrialized countries).

Besides, we use different sectoral data to test the interaction between financial crises, countries' specialization and international trade. We first consider the role of elasticity of substitution by using estimations from Broda and Weinstein (2004). We use Rauch (1999) classification of international trade to assess the impact of fixed costs. In this classification, Rauch separates goods into three categories: organized exchange, reference prices and differentiated. One can expect a larger fixed cost of export for differentiated goods¹⁴. Finally, we use data on external financial dependence from Rajan and Zingales (1998)¹⁵; according to these authors, external dependence is defined as the "share of

¹³See appendix for a table that summarize the obtained results for two chosen indicators of financial crises.

¹⁴Indeed, an exporter specialized in very differentiated goods may at least face larger costs linked to the research of trading partners, marketing or publicity. This variable only represents a proxy, but the lack of available data on the level of fixed costs constrains us to use these data.

¹⁵Data of elasticity of substitution, external financial dependence and Rauch's classification are given in Table 6

capital expenditures that are not financed by cash flow from operations”. Broda and Weinstein (2004) and Rajan and Zingales (1998) have made their computations using american data. We apply their results to all the countries of our sample; this is an important approximation but the lack of data for developing countries constrains us to do so. However, as explained by Rajan and Zingales (1998), the american industries’ external dependence can be considered as an optimal one, given the high level of financial development in the US and the low probability of firms to be financially constrained.

V Results

1 Overall Impact

Table 2 summarizes the impact of financial crises on trade during the year of the crisis and the following one. We use in these estimations a broad definition for currency crises¹⁶ and we consider only systemic banking crises listed by Caprio and Klingebiel (2003)¹⁷. The detailed list of these events are given in appendix. In the last part of the paper we run robustness checks and control our results by using others definitions of crises. Gravity variables are significant and have the expected signs. The second part of the table relies on the impact of financial crises.

The coefficient on bilateral exchange rate is significant and negative as expected. This term represents the competitiveness effect of the devaluation after a currency crisis. Its negativeness signifies that a currency depreciation leads to an increase of bilateral trade. Columns (A) to (C) present the impact during the year of the crisis; columns (D) to (F) show the effect in the year of the crisis and the following year. As we control for the specific competitiveness effect of currency crisis by including this term, we are able to capt with our currency crisis dummy the other effects of such events on trade. As these previously mentioned effects are often negative¹⁸, it is not surprising to observe a negative coefficient on both exports and imports after crises. In the next part of the paper we will study more precisely the relevance of the different channels. The impact of banking crisis is more puzzling. Indeed, the effect of this kind of event is positive on exports during both the year of occurrence of the crisis and the following one, and on imports during the year of occurrence of the event. Their impact of imports during the year that follows the crisis is positive when we include the currency crisis dummy, and negative when this dummy is omitted, suggesting an important correlation between the two kinds of crises.

In Figures 1 and 2 are represented the long-run impacts of financial crises on trade. 95% confidence intervals are colored in grey. More precisely, we run regressions that includes ten lags and four leads of each crisis dummy, and plot graphs with respect to the estimated coefficient of these variables and to their confidence interval.

The first interesting point is the ”anticipation” of financial crises by trade flows. They are signifi-

(Appendix).

¹⁶More precisely, a currency crisis is said to occur when the exchange market pressure index exceeds 1.5 standard deviations above its mean.

¹⁷These authors separate banking crises into two categories: systemic and borderline banking crises. We only use the first kind of crises in the first part of our work.

¹⁸The volatility channel, as the cost and the balance-sheet channels, have negative theoretical impacts on both exports and imports.

Table 2: Overall Impact during the year of the crisis

	(A)	(B)	(C)	(D)	(E)	(F)
	m_{ij}	m_{ij}	m_{ij}	m_{ij}	m_{ij}	m_{ij}
<i>Production exporter</i>	0.43 ^a	0.43 ^a	0.43 ^a	0.43 ^a	0.43 ^a	0.43 ^a
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<i>Production Importer</i>	0.34 ^a	0.34 ^a	0.34 ^a	0.35 ^a	0.35 ^a	0.34 ^a
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<i>Bilateral Distance</i>	-0.77 ^a	-0.77 ^a	-0.77 ^a	-0.75 ^a	-0.75 ^a	-0.75 ^a
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Landlocked</i>	-0.83 ^a	-0.83 ^a	-0.83 ^a	-0.81 ^a	-0.80 ^a	-0.81 ^a
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Contiguity</i>	1.03 ^a	1.03 ^a	1.03 ^a	0.91 ^a	0.90 ^a	0.91 ^a
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
<i>Free Trade Agreement</i>	0.77 ^a	0.78 ^a	0.77 ^a	0.69 ^a	0.71 ^a	0.69 ^a
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Common Colonizer</i>	0.80 ^a	0.80 ^a	0.80 ^a	0.62 ^b	0.63 ^a	0.62 ^a
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
<i>Colonial Relationship</i>	0.78 ^a	0.78 ^a	0.78 ^a	0.77 ^a	0.77 ^a	0.77 ^a
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
<i>Common Language</i>	0.03	0.03	0.03	0.02	0.02	0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
<i>Bilateral Exchange Rate</i>	-0.02 ^a	-0.02 ^a	-0.02 ^a	-0.02 ^a	-0.02 ^a	-0.02 ^a
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<i>Currency crisis, exporter</i>	-0.11 ^a		-0.11 ^a	-0.11 ^a		-0.12 ^a
	(0.00)		(0.00)	(0.00)		(0.00)
<i>Currency cr. in t-1, exporter</i>				-0.03 ^a		-0.03 ^a
				(0.00)		(0.00)
<i>Currency crisis, importer</i>	-0.07 ^a		-0.07 ^a	-0.09 ^a		-0.09 ^a
	(0.00)		(0.00)	(0.00)		(0.00)
<i>Currency cr. in t-1, importer</i>				-0.11 ^a		-0.11 ^a
				(0.00)		(0.00)
<i>Banking crisis, exporter</i>		0.01	0.03 ^a		0.00	0.02 ^a
		(0.01)	(0.01)		(0.01)	(0.01)
<i>Banking cr. in t-1, exporter</i>					0.06 ^a	0.09 ^a
					(0.01)	(0.01)
<i>Banking crisis, importer</i>		0.14 ^a	0.15 ^a		0.13 ^a	0.15 ^a
		(0.01)	(0.01)		(0.01)	(0.01)
<i>Banking cr. in t-1, importer</i>					-0.01 ^c	0.02 ^a
					(0.01)	(0.01)
Observations	942172	942172	942172	823162	823162	823162
Groups	79816	79816	79816	69138	69138	69138
R ²	0.66	0.66	0.66	0.67	0.66	0.66

OLS regressions with importer, exporter and sector fixed effects. Significance levels: ^c 10%, ^b 5%, ^a 1%. Robust Standard Errors into parentheses. Intercept not reported.

cantly below their natural level during the years that precede a currency crisis. This can be explained by the loss of competitiveness and the activity slowdown that often precede the currency devaluation. In the case of banking crises, trade flows are, on the contrary, above their natural level. A possible explanation for this result is the increase in credit level which is often observed before banking crises: if credit skyrockets before the crisis, firms are less credit constrained, and thus - as suggested by Chaney (2005) - more firms are able to enter the export market, or to use credit to finance their import operations.

The impact of the crisis deeply differs according to the considered case. Currency crises have a slightly positive impact on exports in the year of the event, and a more positive impact during the year that follows the event. More precisely, exports stay under their natural level but increase in comparison with their pre-crisis' level. Then, they stay under their natural level during the eight years that follow the crisis. These results are consistent with Cespedes (2005) who finds a negative effect of currency crashes on output in the year following the devaluation, but a positive one during the second year. We can connect these results to the previously mentioned mechanisms: if the competitiveness effect is observed in the short-run, the negative balance-sheets effect overcomes it in the long-run. Exports stay down again after two years of devaluation. It is only after nine years that they will come back to this level. This result underlines the persistence of large exchange rate shocks on international trade. Contrary to Baldwin and Krugman (1989), this persistence may not be only due to the sunk character of fixed costs of exports, but rather to negative interactions between fixed costs and financial imperfections, that lead to important balance-sheet effects which in turn increase the cost of trade in the following year. We corroborate this idea in the next section.

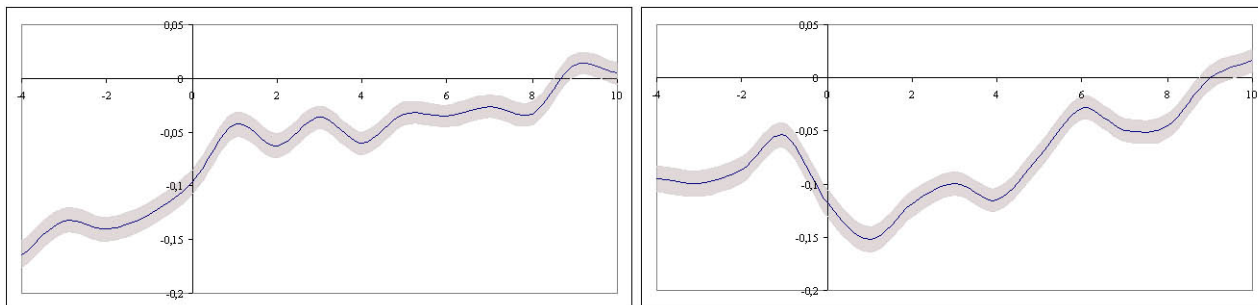


Figure 1: Long Run Exports (left) and Imports (right) reaction to a Currency Crisis

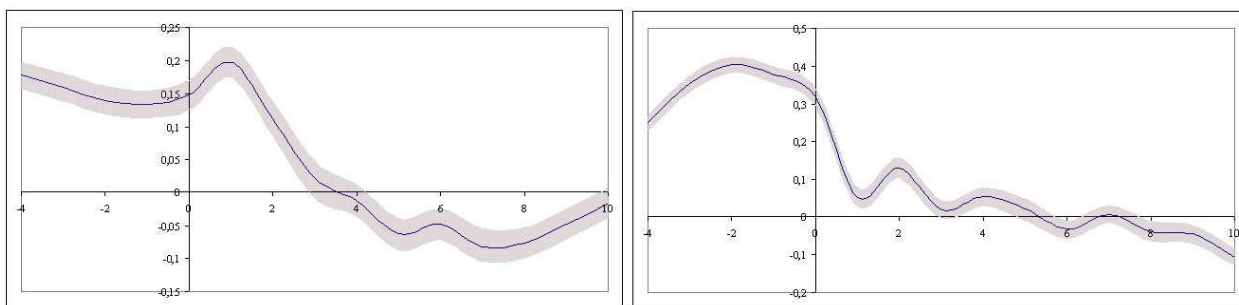


Figure 2: Long Run Exports (left) and Imports (right) reaction to a Banking Crisis

The impact of currency crises on imports is persistent too, but this may be due to different reasons. Imports plummet in the short run by more than 10%, and stay statistically below their natural level during the nine years which follow the crisis. This persistence may be due to the competitiveness effect: foreign goods become relatively more expensive, and consumers modify their consumption basket toward home produced goods. As the results of the next section suggest, negative balance-sheet effects can be observed, but may be less important as fixed costs associated with the activity of imports are lower. Moreover, the negative impact of currency crises on imports may be due to the recession that often follow financial crises, and which can involve a fall in demand of both home and foreign goods. We introduce in the specification the sectoral production of the country, which is only an imperfect measure of home demand.

The impact of banking crises is somewhat different; the long-run results shed light on the previous puzzling results, according to which banking crises have a positive impact on trade in the short-run. Indeed, both imports and exports actually *decrease* after the crisis, in comparison with their pre-crisis level. Exports remain above their natural level during two years, and imports during four years. After four years, exports are below their natural level, and only return to equilibrium after ten years. Imports are not statistically different from their natural level after five years. These trends may be explained by the different mechanisms we mentioned above. The credit crunch that follows the crisis should lead to a drop in both imports and exports, but it is possible that the increase in banking system efficiency generates reallocations which in turn permit international trade to recover its natural level in the long-run. Banking crises are not found to have a real negative effect on trade, but rather "cleansing properties": trade was above its natural level before the event, and the crisis, by leading to credit reallocation, force the level of trade to return to its natural level. Finally, the increase in exports that occurs in the year that follow the event may be due to the credit boom that occurred just before the crisis: a number of firms borrow to pay their fixed cost, enter the export market, exports increase; but when the crisis diminishes the amount of liquidity, improves the system efficiency, and forces the less efficient firms to exit the market, thus leading to a return of trade to its natural level.

We now turn to more precise empirical tests, through which we aim to show that the negative long-run impact of financial crises on exports is principally due to the interactions between large fixed costs and financial imperfections.

2 Financial Imperfections, countries' specialization and Trade reaction to Financial Crises

Balance-sheet effects of Currency Crises

We first study the impact of foreign currency borrowing on the reaction of trade to a currency crisis. As we explained in the simple framework presented before, if firms use an important share of foreign currency borrowing on their total financing, negative balance-sheet effects should arise after an exchange rate shocks because of the increase of the debt burden. We introduce in our estimation an interacted term between currency crisis and foreign currency borrowing. We expect the sign of this variable to be negative; the sign of the currency variable can be either positive or negative; if it becomes positive, we can conclude that the negative effect of currency crises found previously principally

Table 3: Currency Crises, Foreign Currency Borrowing and International Trade

Est.	Trade	Currency crisis					Foreign Borrowing*Currency crisis					Volatility*Currency Crisis				
		T	T-1	T-2	T-3	T-4	T	T-1	T-2	T-3	T-4	T	T-1	T-2	T-3	T-4
(A)	Exports	-0.20 ^a (0.01)	0.05 ^a (0.01)	0.10 ^a (0.01)	0.09 ^a (0.01)	0.12 ^a (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.09 ^a (0.01)	-0.09 ^a (0.01)	-0.14 ^a (0.01)					
	Imports	-0.15 ^a (0.01)	-0.11 ^a (0.01)	-0.13 ^a (0.01)	-0.08 ^a (0.01)	-0.06 ^a (0.01)	0.01 (0.01)	-0.02 ^b (0.01)	-0.02 (0.01)	0.01 (0.01)	0.00 (0.01)					
(B)	Exports	-0.19 ^a (0.01)	-0.01 (0.01)	0.15 ^a (0.01)	0.15 ^a (0.01)	0.14 ^a (0.01)	0.01 (0.01)	-0.01 (0.01)	-0.11 ^a (0.01)	-0.09 ^a (0.01)	-0.14 ^a (0.01)	0.22 (0.16)	-0.33 ^b (0.16)	-1.05 ^a (0.17)	-2.14 ^a (0.19)	0.17 (0.15)
	Imports	-0.08 ^a (0.01)	-0.06 ^a (0.01)	-0.14 ^a (0.01)	-0.07 ^a (0.01)	-0.07 ^a (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)	-1.67 ^a (0.13)	-1.14 ^a (0.13)	0.16 (0.15)	0.15 (0.15)	0.10 (0.12)

Number of observations: 325899; Number of Groups: 29625; R^2 : 0.62

OLS regressions with importer, exporter and sector fixed effects. Intercept, gravity equation variables and banking crises dummies not reported. Significance levels: ^c 10%, ^b 5%, ^a 1%. Robust Standard Errors into parentheses.

comes from this balance-sheet problem; if the coefficient on the currency crisis dummy stays negative, we can suppose that the other mechanisms (volatility, cost channels) are relevant and important in explaining the negative reaction of trade flows after currency crises.

Our results are reported on Table 3, in estimation (A). To allow a clearer reading, we didn't report neither the coefficients of the gravity variables, nor the banking crises ones. The results stress an important, negative and persistent impact of foreign currency borrowing on the impact of currency crises on exports. The coefficient of the currency crisis dummy becomes positive, suggesting that the balance-sheet effect of the currency crisis account for a a large part of the total effect of the event on exports. An interesting point is that the effect on exports is only observed two years after the crisis. During year of the crisis, the impact on exports stays negative but this is not because of foreign currency borrowing. Then we can suppose that the other channels, in particular the volatility one, are more relevant in explaining exports' variations right after a devaluation. Besides, the fact that the estimated coefficients on the currency crises dummies become positive suggest that the bilateral exchange rate term does not capture the entire competitiveness effect. This can be explained by the bilateral character of this variable, which doesn't take into account the possible currency depreciation of the import country's partners.

The reaction of imports is somewhat different. Balance-sheet effects are lower or insignificant. This seems logical since imports are less associated with important fixed costs, and requires less financing. Once again, this results are in line with the hypothesis according to which the adjustment of the extensive margin of trade explains principally the post-crisis trade reaction.

Estimation (B) includes, in addition with the currency crisis dummy and the interacted term with foreign currency borrowing, a volatility effect. We have computed for each country and year of our sample an index of volatility based on the monthly exchange rate of each currency against the SDR¹⁹, and we introduce in the estimated equation an interacted term between currency crisis and the level of volatility. As we can see, the introduction of this term does not really modify the results, except

¹⁹We used data from the International Financial Statistics (IFS).

for the effect on foreign currency borrowing on imports, which is no longer significant. Post-crisis volatility is found to have an important negative effect on bilateral trade flows, both imports and exports. It explains a important share of the negative reaction of imports in the short run. Nevertheless, the impact of currency crisis in the year of the event stays negative even after we take into account volatility. This can be due to various elements. First, we do not include any variable to capture the cost channel mentioned above. As this channel describes a negative effect of currency crises on exports, its omission can logically lead to this result. Second, we do not take into account the precise month of occurrence of the crisis. If our sample is biased toward end-of-year crises, the crisis dummy will not capture the proper effect of the crisis but rather the loss of competitiveness due to the pre-crisis overvaluation. Then it will be more logical to find a negative effect of the crisis in its year of occurrence. Nevertheless, it stay possible that our results reflect the significance of the cost channel.

Countries specialization, Financial Crises and International Trade

We now turn to study the role of countries' specialization. As we explained before, three different sectoral elements can modify the way exports react to a currency crisis, namely the elasticity of substitution, the amount of fixed costs and the degree of external dependence. We only consider the role of specialization on the reaction of exports without studying its effect on imports because the latter are less likely to endure negative balance-sheets effects. As those 'specialization effects' may not be observe without balance-sheets effects, it doesn't seem necessary to test their impact on imports. We use as a proxy for fixed costs the classification of Rauch (1999) and create a variable which is equal to 1 if the sector contains principally homogenous goods, 2 if it contains reference priced goods, and 3 if it contains more differentiated goods. We expect the estimated coefficient of the interaction of this variable with the currency crisis dummy to be negative because differentiated goods are associated with larger fixed costs. On the other hand, we interact the currency crisis dummy with the level of elasticity of substitution from Broda and Weinstein (2004) and of external dependence from Rajan and Zingales (1998). We expect a positive coefficient on the first interaction variable, and a negative one on the second.

Our results are presented in Table 4. To allow for a clearer reading, we only reports the estimated coefficients of the variables linked to currency crises and exports. The effect of foreign currency borrowing is always negative, as the impact of volatility. The coefficient on the specialization variables, when they are significant, have the right sign. Products' differentiation is found to have an important impact on the reaction of exports to a currency crisis. On the first hand, it leads to a negative effect through a lower elasticity of substitution. This effect is observed in the short and medium run: a larger elasticity improves the reaction of exports during the year of the crisis, and during the two following years. On the other hand, differentiation has a negative impact through larger fixed costs: the coefficient on the interaction variable between currency crisis and Rauch classification indicates that countries specialized in industries associated with important fixed costs are more prone to endure sluggish reactions of exports after a devaluation. The effect is significant during the year of the crisis and the following one. We can interpret these results as an adjustment of the number of firms related to a balance-sheet effect: the devaluation, by increasing the firms' debt burden of foreign currency borrowers, forces them to exit the export market, and lead to a decrease of the extensive margin of

trade.

Table 4: Specialization and the impact of currency crises on exports

Estimation	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Dep. Var: Exports							
<i>Currency Crisis</i>	-0.23 ^a (0.02)	-0.10 ^a (0.03)	-0.16 ^a (0.02)	-0.20 ^a (0.02)	-0.15 ^a (0.02)	-0.09 ^a (0.02)	-0.12 ^a (0.02)
<i>T-1</i>	-0.09 ^a (0.02)	0.05 ^a (0.03)	0.00 (0.02)	-0.04 ^c (0.03)	-0.03 (0.03)	0.07 ^a (0.03)	0.02 (0.04)
<i>T-2</i>	0.09 ^a (0.02)	0.18 ^a (0.03)	0.17 ^a (0.02)	0.14 ^a (0.03)	0.05 (0.04)	0.20 ^a (0.03)	0.08 ^c (0.05)
<i>T-3</i>	0.09 ^a (0.02)	0.14 ^a (0.03)	0.16 ^a (0.02)	0.16 ^a (0.03)	0.10 ^a (0.04)	0.17 ^a (0.03)	0.16 ^a (0.05)
<i>Foreign Borrowing*Currency Crisis</i>	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
<i>T-1</i>	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)
<i>T-2</i>	-0.09 ^a (0.01)	-0.09 ^a (0.01)	-0.09 ^a (0.01)	-0.09 ^a (0.01)	-0.09 ^a (0.01)	-0.09 ^a (0.01)	-0.09 ^a (0.01)
<i>T-3</i>	-0.06 ^a (0.01)	-0.06 ^a (0.01)	-0.06 ^a (0.01)	-0.06 ^a (0.01)	-0.06 ^a (0.01)	-0.06 ^a (0.01)	-0.09 ^a (0.01)
<i>Volatility*Currency Crisis</i>	0.12 (0.15)	0.12 (0.15)	0.11 (0.16)	0.12 (0.15)	0.11 (0.16)	0.12 (0.15)	0.12 (0.15)
<i>T-1</i>	-0.45 ^a (0.15)	-0.45 ^a (0.15)	-0.45 ^a (0.17)	-0.45 ^a (0.15)	-0.45 ^a (0.15)	-0.46 ^a (0.15)	-0.45 ^a (0.15)
<i>T-2</i>	-1.25 ^a (0.17)	-1.25 ^a (0.17)	-1.25 ^a (0.17)	-1.25 ^a (0.17)	-1.25 ^a (0.17)	-1.25 ^a (0.17)	-1.26 ^a (0.17)
<i>T-3</i>	-2.26 ^a (0.18)	-2.26 ^a (0.18)	-2.25 ^a (0.18)	-2.26 ^a (0.18)	-2.27 ^a (0.18)	-2.26 ^a (0.18)	-2.26 ^a (0.18)
<i>Elasticity*Currency Crisis</i>	0.04 ^a (0.01)			0.03 ^b (0.01)	0.02 (0.02)		0.01 (0.02)
<i>T-1</i>	0.06 ^a (0.01)			0.04 ^a (0.01)	0.04 ^b (0.02)		0.02 (0.02)
<i>T-2</i>	0.05 ^a (0.01)			0.03 ^b (0.01)	0.06 ^a (0.02)		0.04 ^b (0.02)
<i>T-3</i>	0.02 (0.01)			0.00 (0.01)	0.02 (0.02)		0.00 (0.02)
<i>Fixed Cost*Currency Crisis</i>		-0.03 ^a (0.01)			-0.02 ^c (0.01)	-0.03 ^a (0.01)	-0.03 ^b (0.01)
<i>T-1</i>		-0.03 ^a (0.01)			-0.02 (0.01)	-0.03 ^a (0.01)	-0.02 ^c (0.01)
<i>T-2</i>		-0.01 ^c (0.01)			0.01 (0.01)	-0.01 (0.01)	0.00 (0.01)
<i>T-3</i>		-0.00 (0.01)			0.00 (0.01)	-0.00 (0.01)	0.00 (0.01)
<i>External Dependence*Currency Crisis</i>			-0.08 ^a (0.02)	-0.07 ^a (0.02)		-0.08 ^a (0.02)	-0.07 ^a (0.02)
<i>T-1</i>			-0.12 ^a (0.02)	-0.11 ^a (0.02)		-0.12 ^a (0.02)	-0.11 ^a (0.02)
<i>T-2</i>			-0.11 ^a (0.02)	-0.11 ^a (0.02)		-0.12 ^a (0.02)	-0.11 ^a (0.02)
<i>T-3</i>			-0.13 ^a (0.02)	-0.13 ^a (0.02)		-0.13 ^a (0.02)	-0.13 ^a (0.02)
Observations	318715	318715	318715	318715	318715	318715	318715
Number of groups	29506	29506	29506	29506	29506	29506	29506
R-Squared	0.61	0.61	0.61	0.61	0.62	0.62	0.62

OLS regressions with importer, exporter and sector fixed effects. Intercept, gravity equation variables, banking dummies. Significance levels: ^c 10%, ^b 5%, ^a 1%. Standard Deviations into parentheses.

Finally, a higher financial external dependence is found to have a significant negative impact on exports. Taken as a whole, our results stress the importance of countries' specialization in international trade reaction to currency crises. More generally, one can argue that the adjustment of trade to exchange rate movements is partly correlated to countries' specialization. While this general result is far from being a real innovation - according to the Marshall-Lerner condition, sectors with a higher price-to-demand elasticity will better react to a currency devaluation -, the interesting point is that the importance of specialization principally comes from the existence of important fixed costs, combined to the financial imperfections, in particular to the foreign currency borrowing behavior.

Exports' reaction to Banking Crises : the importance of Fixed Costs

Table 5 summarizes the existing links between countries' specialization, bilateral exports and banking crises. We introduce in the basic specification two interacted terms - respectively between banking crisis and sectoral fixed costs and between banking crisis and sectoral external financial dependence - to account for the effects of countries specialization in industries that should require a larger amount of external financing.

Clearly, countries specialized in highly differentiated goods - thus more exposed to an important level of fixed costs - will react more negatively to a banking crisis. The estimated coefficients on the interaction variable between banking crisis and Rauch's classification - is significant after two years of crisis. The effect of external dependence is less easy to understand; its impact is found to be positive in the short run, and negative in the long run (after three years of crisis).

These results emphasize the persistent negative effect of banking crises in financially dependent industries. Moreover, we can understand these estimations in terms of banking system efficiency; if we admit that an improvement in the banking system efficiency should lead to an increase of the average productivity of the country, and thus to an increase in the extensive margin of trade - the number of exporters -, then exports should increase in the long-run after a crisis, especially in externally dependent industries. However, according to the previously mentioned results, banking crises are not found to be able to enhance the banking system efficiency - if the banking system efficiency was improved after a banking crisis, one should observe an increase in trade flows, especially in exports. These results are in line with Reynaud and Rokhim (2005) who find that recent banking crises in Indonesia and Turkey have actually deteriorated the global efficiency of the system.

Table 5: Specialization and the impact of banking crises on exports

Estimation Dep. Var	(A) Exports	(B) Exports	(C) Exports
<i>Banking Crisis</i>	0.06 ^c (0.03)	0.03 ^b (0.01)	0.05 (0.03)
<i>T-1</i>	0.10 ^a (0.03)	0.08 ^a (0.01)	0.10 ^a (0.03)
<i>T-2</i>	0.02 (0.03)	-0.06 ^a (0.01)	0.02 ^a (0.03)
<i>T-3</i>	-0.07 ^a (0.03)	-0.16 ^a (0.01)	-0.06 ^a (0.03)
<i>T-4</i>	-0.09 ^a (0.03)	-0.14 ^a (0.01)	-0.13 ^a (0.03)
<i>Fixed Cost*Banking Crisis</i>	-0.01 (0.01)		-0.01 (0.01)
<i>T-1</i>	-0.02 (0.01)		-0.02 ^b (0.01)
<i>T-2</i>	-0.04 ^a (0.01)		-0.04 ^a (0.01)
<i>T-3</i>	-0.04 ^a (0.01)		-0.04 ^a (0.01)
<i>T-4</i>	-0.03 ^b (0.01)		-0.02 ^b (0.01)
<i>External Dependence*Banking Crisis</i>		0.16 ^a (0.04)	0.16 ^a (0.04)
<i>T-1</i>		0.06 (0.04)	0.06 (0.04)
<i>T-2</i>		-0.02 (0.04)	-0.01 (0.04)
<i>T-3</i>		-0.07 ^b (0.04)	-0.05 (0.04)
<i>T-4</i>		-0.10 ^a (0.04)	-0.9 ^b (0.04)
Observations	914675	914675	914675
Number of groups	85081	85081	85081
R-Squared	0.66	0.67	0.67

OLS regressions with importer, exporter and sector fixed effects. Intercept, gravity equation variables, currency dummies not reported. Significance levels: ^c 10%, ^b 5%, ^a 1%. Standard Deviations into parentheses.

3 Robustness Tests

This last section is devoted to some robustness tests and comparison of our results using the different kinds of definitions of financial crises we computed. Up to now, we used a single definition of currency and banking crises²⁰. We run test with the other indicators of crises for two reasons: first, it allow us to check that our results are not too dependent of the used definition; second, it allow us to emphasize potential non-linearities in trade reaction to financial crises, and thus to determine wether the impact of the crisis depends on its magnitude. The data of these definitions of crises are given in Table 5

²⁰We use the broad definition of currency crises: an event is qualify as currency crisis when the "exchange market pressure index", which take into account exchange rate and international reserves variations exceeds 1.5 standard deviations above its mean. For banking crises, we only use the events described as "systemic" by Caprio and Klingebiel (2003).

(Appendix).

We have estimated the reaction of sectoral trade after currency and banking crises using the other definitions of these events. These impacts are represented in Figures 5 and 6²¹ (TO BE COMPLETED). These figures show that the impact of crises does not really depend on the definition of the events. The global pattern of sectoral trade flows is similar with the different definitions of currency crises. However, the impact is magnified when we consider only the larger crises: imports decrease more after both banking and currency crises. The impact of currency crises on exports is magnified both in the short and long run: if larger currency crises seem to lead to a larger competitiveness effect in the three years that follow the devaluation, their long-run impact is more negative too. Trade does not return to its initial level in the ten years that follow the devaluation. This last result emphasizes the non-linearity of the effect of exchange rate movements on international trade.

As our sample includes an important number of bilateral trade flows equal to zero (about 15 percent of the sample), a left-censored tobit estimation may be performed in order to take into account the potential bias due to the existence of these zeros. We chose to show the OLS results in this paper, because the estimated coefficient can be more easily interpreted. However, we ran tobit regression which lead to the same results.

TO BE COMPLETED: Endogeneity problems, Developing / Developed Countries subsamples, Debt Crises.

VI Conclusions and Directions for Further Research

We have investigated in this paper the impact of financial crises on international trade, and determined the elements that improve or worsen this impact. We attempted to fill the gap left by the previous literature, which mostly worked on trade as a cause of the crisis.

We first show that financial crises has long-lasting negative effects on the level of trade flows. Trade stays below its natural level during almost 8 years after a currency crisis. These durations are even higher when we consider only the larger events.

Moreover, we have studied in this paper the relevance of the different channels through which international trade may be affected after a financial crisis. We have shown that the negative and persistent impact of currency crises on exports is mostly due to negative balance-sheets effects that comes from the important level of firms' foreign currency borrowing in a number of countries. The sectoral specialization of countries affects, too, their reaction to a crisis. Specialization on sectors characterized by important fixed costs, high product differentiation (low elasticity of substitution between goods) and high externally dependent industries are more prone to endure important drops of exports after a currency crisis. The impact of a banking crisis on exports is magnified by a specialization biased towards financially dependent, high fixed costs of export sectors. Besides, more than allowing a better understanding of trade reaction after crises, our work has important policy implications since we define elements that should improve or worsen the impact of crises on trade, thus facilitating or making more difficult the crisis recovery.

²¹The presented curves are obtained using the same methodology that for Figures 1 and 2.

More generally, our paper contributes to the increasingly large literature that focuses on the links between financial imperfections and international trade. The above results suggest that most of the adjustments of international trade to exchange rate or financial shocks comes from variations of the extensive margin of trade, i.e. from variations in the the number of exporting firms. The main area of future research on this subject relies on a more precise study of the interactions between exchange rate movements, financial imperfections and firms' export decisions. Unfortunately, an empirical treatment of this question may use firm-level databases that include balance-sheets data for emerging markets firms. The lack of availability of such a database constrained us to study these mechanisms at a sectoral level. Equally interesting is the reaction of trade structure to exchange rate or financial shocks. Currency and banking crises seem to modify the number of trade partners and exporting sectors. This suggest that a crisis - or more generally an exchange rate or a financial shock - may have an impact on a country's comparative advantage. As the reason for such an adjustment is for from being trivial, this should probably be an important area for future works.

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VII Appendix

1 Long-Run impact of financial crises on trade with different definitions of crises

Table 6: Financial Crises and Foreign Currency Borrowing

Country	Currency Crises	Banking Crises	Foreign Borrowing
Algeria	1991, 1994	1990	-
Argentina	1982, 1986, 1989, 1990, 1995, 2002	1980, 1989, 2001	14.4
Australia	1976, 1985, 1986, 1995	1989	-
Austria	0	0	-
Bangladesh	1975	1987	5.78
Belgium	1982	0	-
Benin	1994	1988	-
Bolivia	1982, 1983, 1985	1986	2.52
Brazil	1986, 1989, 1990, 1991, 1999	1994	3.92
Burkina Faso	1978, 1982, 1994	1988	-
Cameroun	0	1995	-
Canada	1978, 1985	0	1.97
Cent. Afr. Rep.	0	1976, 1988	-
Chile	1976, 1982, 1984	1981	6.82
China	1980, 1986, 1989, 1993	1998	0.36
Colombia	1983, 1985, 1999, 2002	1982	6.11
Costa Rica	1980, 1981	1987	4.88
Cote d'Ivoire	1993	1988	-
Denmark	1980, 1993	0	-
Egypt	1979, 1989, 1990	1981	-
El Salvador	1986, 1990	1989	1.73
Ecuador	1983, 1985, 1988, 1992, 2000	1981, 1998	3.21
Equatorial Guinea	1991	1983	-
Ethiopia	1992	1994	-
Finland	1986, 1991, 1992	1991	-
France	1992	0	1.56
Germany	0	0	2.15
Ghana	1983, 1987	1982	-
Greece	1983, 1987	0	-
Hong Kong	2002	1998	-
Iceland	1978, 1982	0	-
India	1991, 1993	0	1.83
Indonesia	1978, 1983, 1986, 1997, 1998	1997	4.04
Israel	1977, 1983, 1984, 1985	1977, 1983	-
Italia	1976, 1992, 1995	0	2.36
Jamaica	1978, 1983, 1988, 1991, 1993	1994	-
Japan	1979, 1989, 1995	1991	-
Kenya	1992, 1993, 1995	1993	-

Source: Author's calculations from IMF data for currency crises; Caprio and Klingebiel (2003) for banking crises; authors calculations from WBES (Worldbank) data for foreign borrowing. In this table we have listed our results with a broad definition of currency crises - 1.5 standard deviations above the mean of the computed exchange market pressure index. For banking crises, the table presents the larger crises as listed by Caprio and Klingebiel.

Country	Currency Crises	Banking Crises	Foreign Borrowing
Korea	1979, 1997	1997	-
Lebanon	1984, 1986, 1987, 1992	1988	-
Madagascar	1987, 1994	1988	-
Malaysia	1997, 1998	1985, 1998	2.58
Mali	1993	1987	-
Mauritania	1978, 1992	1984	-
Mexico	1976, 1982, 1994	1981, 1994	1.14
Morocco	1980, 1983, 1985, 1990	0	-
Nepal	1985, 1991, 1992	1988	-
Netherlands	1992	0	-
New Zealand	1984, 1986	0	-
Nigeria	1986, 1992, 1998	1993	-
Norway	1982, 1986, 1991, 1992, 1993	1987	-
Pakistan	1979, 1988, 1990, 1993, 1996, 2000	0	2.91
Panama	1985, 1987, 1994	1988	6.05
Paraguay	1984, 1989, 1992	1995	3.6
Peru	1976, 1987, 1990	1983	5.54
Philippines	1983, 1984, 1986, 1990, 1997	1981, 1998	2.8
Portugal	1976, 1978, 1983	1986	0.35
Senegal	1994	1988	-
Singapore	1986, 1997, 1998	1982	7.11
South Africa	1984, 1985, 1986, 1998, 2001	1977, 1985	-
Spain	1976, 1982, 1992, 1993	1977	2.09
Sri Lanka	1997, 1998	1989	-
Sweden	1977, 1982, 1992	1991	0.92
Switzerland	1996	0	-
Taiwan	0	1997	-
Thailand	1984, 1997	1983, 1997	5.03
Togo	1993	1993	-
Tunisia	1981, 1986, 1992	1991	-
Turkey	1977, 1980, 1984, 1991, 1994, 2001	1982, 1994, 2000	3.31
United Kingdom	1976, 1981, 1981, 1992	0	1.02
Uruguay	1983, 2002	1981, 2002	5.15
United States	1987	0	0.98
Venezuela	1984, 1987, 1989, 1994, 1995, 2002	1980, 1993	5.42
Yemen	1995	1996	-
Zambia	1986, 1994	1995	-
Zimbabwe	1991, 1994, 1998, 2000	1981	-

Source: Author's calculations from IMF data for currency crises; Caprio and Klingebiel (2003) for banking crises; authors calculations from WBES (Worldbank) data for foreign borrowing. In this table we have listed our results with a broad definition of currency crises - 1.5 standard deviations above the mean of the computed exchange market pressure index. For banking crises, the table presents the larger crises as listed by Caprio and Klingebiel.

ISIC Number	Description	Elasticity of Substitution	External Dependence	Rauch Class.
311	Food products	6,81	0,14	H
313	Beverages	2,65	0,08	R
314	Tobacco	3,73	0	R
321	Textiles	2,7	0,4	D
322	Wearing apparel, except footwear	2,82	0,03	D
323	Leather products	1,82	0	D
324	Footwear, except rubber or plastic	2,41	0	D
331	Wood products, except furniture	2,54	0,28	D
332	Furniture, except metal	2,04	0,24	D
341	Paper and products	3,28	0,18	R
342	Printing and publishing	2,53	0,2	D
351	Industrial chemicals	4,83	0,2	R
352	Other chemicals	1,76	0,22	D
353	Petroleum refineries	8,37	0,04	H
354	Miscellaneous petroleum and coal products	2,88	0,33	R
355	Rubber products	2,82	0,23	D
356	Plastic Products	3,54	1,14	R
361	Pottery, china, earthenware	1,34	0	D
362	Glass and products	1,91	0,53	R
369	Other non-metallic mineral products	2,89	0,06	D
371	Iron and steel	5,03	0,09	D
372	Non-ferrous metals	3,25	0,01	H
381	Fabricated metal products	3,73	0,24	D
382	Machinery, except electrical	2,16	0,45	D
383	Machinery, electric	1,98	0,45	D
384	Transport equipment	3,63	0,31	D
385	Professional and scientific equipment	1,58	0,96	D
390	Other manufactured products	1,76	0,47	D

Broda and Weinstein (2005) for elasticity of substitution; Rajan and Zingales (1998) for financial external dependence; Rauch's (1999) data for goods classification.