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Financial Market Imperfections and the impact of exchange rate movements on exports

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Abstract: This paper analyzes empirically the role of financial market imperfections in the way countries' exports react to a currency depreciation. Using quarterly data for 27 developed and developing countries over the period 1990-2005, we find that the impact of a depreciation on exports will be less positive - or even negative - for a country if: (i) firms borrow in foreign currency ; (ii) they are credit constrained ; (iii) they are specialized in industries that require more external capital; (iv) the magnitude of depreciation or devaluation is large. This last result emphasizes the existence of a non-linear relationship between an exchange rate depreciation and the reaction of a country's exports when financial imperfections are observed. This offers a new explanation for the consequences of recent currency crises in middle income countries.

Keywords: International Trade, Exchange Rate Movements, Balance-sheets effects, Financial Market Imperfections.

Résumé: Cet article s'intéresse à la manière dont les imperfections de marché financier peuvent modifier la réaction des exportations d'un pays lors d'une dépréciation du taux de change. Nous montrons, à l'aide de données trimestrielles pour 27 pays durant la période 1990-2005, que la réaction du volume d'exportation consécutive à une dépréciation sera d'autant moins positive que (i) les firmes domestiques empruntent en monnaie étrangère, (ii) il existe des contraintes de crédit, (ii) les exportateurs sont spécialisés dans des productions nécessitant l'utilisation de davantage de capital externe, (iv) l'ampleur de la dépréciation est importante. Ce dernier élément nous permet de confirmer l'existence d'une relation non linéaire entre dépréciation de la monnaie domestique et réaction des exportations, compte tenu des imperfections de marché financier. Ce travail propose en particulier une nouvelle approche permettant de mieux comprendre la faible réaction des exportations dans les économies émergentes.

Mots clés : Commerce international, Mouvements de taux de change, Effets de Bilan, Imperfections Financières.

JEL Classification: F10, F32, F37

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1 Introduction

According to the standard international macroeconomic theory, an exchange rate depreciation usually implies a real currency depreciation which increases the volume of exports. At least four conditions have to be verified so that this effect can be verified observed: (1) the depreciation is not transmitted to domestic prices, (2) export prices are set in the exporter's currency, (3) the foreign demand is sufficiently elastic (Marshall-Lerner condition), and (4) the exporter's supply is also sufficiently elastic.

This paper does not study the existence of these conditions, since previous studies have shown that they are likely to be observed[1]. Nevertheless, several recent papers have underlined the non-systematic character of the existence of a J-Curve or competitiveness effect[2]. Duttagupta and Spilimbergo (2004) study the Asian 1997-1998 currency crises and show that exports did not increase during this period. More generally, recent crisis events (Argentina and Uruguay, 2002, Brazil 1999) point to the lack of reaction of exports to exchange rate shocks. Our paper attempts to explain these stylized facts by studying the existing interactions between financial imperfections, exchange rate movements and the volume of exports. Our empirical results suggest that, even if the four previous conditions are verified, a depreciation will have a less positive - or even a negative - impact on exports if financial market imperfections are present in the economy. Moreover, we also show that countries' specialization and the magnitude of the depreciation have to be taken into account in order to explain why the traditional competitiveness effect is not always observed.

The literature exploring the link between exchange rate and trade usually focuses on the exchange rate *volatility*[3], but very few papers concentrate on the impact of exchange rate movements, the latter usually being considered as trivial or traditional. Ma and Cheng (2003) test the influence of financial crises on international trade, by introducing crisis dummies in a gravity-like equation. Their findings are not clear-cut: currency crises dot no seem to have any effect in the short run - or they have only a slightly negative one - and the long run impact depends on the period considered. Campa (2000) tests the impact of exchange rate movements on South American countries' exports. The impact appears to be positive or non-significant, according to the specification. However, the author does not take into account control variables to capture demand and prices; the results should therefore be interpreted with great caution.

When studying the link between exchange rate movements and exports, it seems very important to well take into account the sunk and fixed costs, that largely explains the entry decision of potential exporters. Economists agree that it is more costly to sell abroad than on one's domestic market. Using firm level data, several papers like Bernard and Wagner (1998) or Bernard and Jensen (2001) have attested to the presence of a fixed exporting cost, that has to be paid each period. Melitz (2003) incorporates this additional fixed cost for export in his model with heterogenous firms to show that only more productive firms will be able to export. Within a similar framework, Chaney (2005) shows that if firms receive an exogenous dotation in capital, some firms, although productive enough but financially constrained, will not be able to enter the export market. Given the existence of the fixed cost, exporting firms are likely to borrow if they cannot use their own resources, which makes them more dependent on the financial market. This last point makes especially relevant the study of financial factors when considering the impact of exchange rate movements on trade.

Tornell and Westermann (2003) list three main financial market imperfections affecting middle income countries: the foreign currency borrowing associated with the issue of the currency mismatch, credit constraints, and

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[1]See for example Goldfajn and Werlang (2000).

[2]See Bahmami-Oskooe and Ratha (2004) for a literature review on the empirical existence of the J-curve.

[3]See Clark et al. (2004) for an exhaustive survey on the subject.

systemic guarantees generating incentives to borrow in the foreign currency; this paper concentrates on the first two kinds of imperfections. Financial market imperfections are frequently observed in emerging and developing countries. In 2004, the Bank of Thailand published the results of a survey concerning the use of foreign sources of finance by 2,568 Thai non-financial firms. For this panel, foreign currency loans represented 68,9% of the total external debt. Different theoretical foundations have been proposed by several authors to explain this kind of behavior, and to explain why firms in emerging market countries do not hedge to absorb exchange rate shocks[4]. Eichengreen and Hausmann (2000) suggest that the absence of hedging is likely to be a consequence of the "original sin: if a country's liabilities are denominated in foreign currency, this country is by definition unable to hedge. Note that we only consider here the "domestic" side of the well-known concept of "original sin", i.e. the incapacity, for a country, to borrow abroad in its own currency. Credit constraints are even more widespread. Numerous studies point out the existence of this problem in most developing and emerging market economies, especially for small firms[5]. Financial market imperfections are thus likely to concern a large share of a developing country's productive sector.

In this paper, we put forward the hypothesis that financial market imperfections can affect the way in which a country reacts to exchange rate movements through different channels. It is straightforward that an exchange rate depreciation will increase the amount of firms' debt that is denominated in the foreign currency. We argue that some firms having trouble servicing their debt will exit the export market, whereas others, observing the increase in the cost of borrowing in the foreign currency, will decide not to enter, or will be forced to decrease their level of exports[6]. This second point should be especially relevant for economies in which firms are highly credit constraints, because a decrease in the value of collateral consecutive to the depreciation and the reduction of the cash flow should reduce domestic firms' borrowing capacities, and this would lead to further firms exits. Our approach therefore sees foreign currency borrowing and credit constraint mechanisms as highly complementary, as in Aghion et al. (2001, 2004), Bachetta (2000), Krugman (1999a, 1999b), Chang et al. (2004).

Beyond the issue of financial market imperfections, other factors may also induce a *more negative* reaction of exports to a currency depreciation; we list these factors as *magnification* elements. The literature on the links between finance and the real sector has recently focused on the role of local financial development on growth or trade, especially for industries that are more financially dependent, i.e. industries that need an extended access to credit suppliers for technological reasons. Rajan and Zingales (1998) show that financial development reduces the fixed cost of acquiring capital from financial intermediaries, and hence improves growth, especially in industries that are more financially dependent. Beck (2002, 2003) and Becker and Greenberg (2004) find a similar result for international trade. Given this asymmetry in financial dependence between industries, specialization may influence the extent to which a country is sensitive to financial market imperfections at a time of a depreciation. Consequently, a country exporting goods that require a high level of external finance will be more likely to suffer from financial imperfections when the exchange rate depreciates. Moreover, we argue that the magnitude of the exchange rate variation is equally important, and consider a potentially non-linear impact of exchange rate movements on exports, which is consistent with Berman and Berthou (2006): for larger shocks, the negative financial impact of the depreciation may be larger than the positive competitiveness effect. By contrast, smaller depreciations should have a positive influence, especially if firms are not financially constrained.

According to the theory, trade adjustments consecutive to an exchange rate shock relies heavily on the concept of *extensive margin*, i.e. the number of firms exporting to a given market. Using French firm-level data, Eaton

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[4]See, among others, Rajan and Zingales (1998) , McKinnon and Pill (1999), Burnside et al. (2001), Schneider and Tornell (2000) or Jeanne (2000).

[5]See Gelos and Werner (1999) and Terra (2003).

[6]See for example Deardorff (2000), Berman and Berthou (2006).

et al. (2004) show that most of the variation in the aggregate volume of exports across destinations comes from the number of firms exporting to that market; they also show that 60% of the variation in market size is reflected by firm entry. Our paper presents empirical evidence that is consistent with the view that dynamic variations in the extensive margin - i.e. variations in the number of firms exporting to a given market - explain a large part of the dynamic variations in bilateral trade flows. If financial market imperfections are especially widespread in the economy, exchange rate movements can have a large impact on the extensive margin of trade. Consequently, the overall effect of the exchange rate variation will depend on the comparison between the pro-competitiveness effect and the financial effect on the two margins of trade. If the financial effect is too large, firms will not be able to service their debt or to borrow anymore, and they will exit from the export market. The large negative variations in the aggregate volume of exports should therefore be seen as an extensive margin phenomenon: if firms are able to stay on the export market, the increase in the debt service will be at least partially balanced by an increase in the demand for home produced goods abroad and exports could even increase; however, large firms exits will not be balanced by a competition effect, and the reduction in the extensive margin should therefore lead to a large reduction in the aggregate volume of exports.

To the best of our knowledge, no empirical study considers the interaction between financial market imperfections, exchange rate movements and international trade[7], and no other work uses countries' specialization and the depreciation magnitude as magnification channels. Our work attempts to fill this gap. Using quarterly data for 27 developed and developing countries over the period 1990-2005, we confirm that the impact of a depreciation on exports will be less positive - or even negative - for a country if: (i) firms borrow in the foreign currency ; (ii) they are credit constrained ; (iii) they are specialized in industries that require more external capital; (iv) the magnitude of depreciation or devaluation is large. This last result confirms the existence of a non-linear relationship between an exchange rate depreciation and the reaction of a country's exports. This work offers a new explanation for the consequences of recent currency crises on trade flows in middle income countries.

The remainder of this paper is organized as follows. In the next section, we present the empirical methodology and the data used in our estimations. In section 3, we study the impact of financial market imperfections on the reaction of exports to exchange rate movements. In section 4 we show that specialization and the magnitude of the depreciation might amplify the shock. Section 5 concludes and draws some policy implications.

2 Theory and Empirical Methodology

2.1 Theoretical Underpinnings

Financial Market Imperfections

There is an extensive literature that evaluates the influence of the local financial market development on emerging economies' macroeconomic performances. Economists have shown that a better access to credit improves countries' growth path ; however, financial development and financial opening could also generate weaknesses in the economy. According to Tornell and Westermann (2003), financial market imperfections are responsible for "boom-bust cycles as well as other macroeconomic patterns observed at higher frequencies across middle income

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[7]Becker and Greenberg (2004) devote a short section of their paper to the study of the influence of financial development on the reaction of a country's exports to an exchange rate depreciation, but their empirical work does not consider foreign currency borrowing or the potential non-linearity of the exchange rate impact.

countries". They also emphasize the fact that these *boom-busts* are not observed in countries with developed financial markets.

Financial market imperfections are likely to hit exporting firms, which have to pay a large fixed cost at the beginning of each period, in order to stay on the export market. In the meanwhile, firms wishing to enter have to pay a sunk cost, which is larger than the fixed cost paid by incumbent firms. The payment of a sunk or fixed cost forces the firm to borrow from external lenders, and this can contribute to the occurrence of boom-bust cycles in the economy if firms borrow in a foreign currency. Several studies have shown that exporting firms are characterized by a higher share of foreign currency debt. Using data on publicly listed firms for Mexico between 1992 and 2000, Martinez and Werner (2002), show that the Mexican exporters have always a USD debt share that is higher than 43%, whereas non-exporting firms' USD debt share is always less than 12%. Other authors, like Echeverry et al. (2003) for Chile and Kawai et al. (2003) for Korea, report similar behaviors. Hence, taking financial market imperfections into account is particularly relevant for the analysis of the relationship between exchange rate and trade flows. Theoretical papers like Deardorff (2000) and Berman and Berthou (2006) show that when the currency depreciates, countries in which firms borrow in a foreign currency are more exposed to "balance-sheet effect" phenomena: if domestic firms' assets are denominated in the domestic currency and their debt in a foreign currency, a depreciation will reduce their solvability; repayment problems will occur and the next period's output will be reduced if firms are unable to invest; some of them could be forced to exit the market if they cannot service their debt. In the periods following the depreciation, it is also likely that a proportion of firms wishing to enter or remain on the export market will not be able to do so because of an increase in the borrowing cost in the foreign currency. This financial mechanism help us understand why some countries did not experience an increase in their aggregate volume of exports after the depreciation of their currency.

Note that the balance sheet effect will only be observed if (i) firms borrow in a foreign currency, and (ii) the export price expressed in the domestic currency remains unchanged, which means that there is a weak pass through of the depreciation to domestic prices. We have seen that the first point is likely to be observed for exporters located in middle income countries. The second point means that relative prices do not adjust by the same amount as the nominal exchange rate, at least in the short run. Campa and Goldberg (2005) find strong evidence of a partial exchange rate pass-through in the short run for 25 OECD countries. For Goldfajn and Werlang (2000), large exchange rate devaluations are associated to an even lower pass-through: according to these authors, less than 20% of the currency devaluation was reflected in South-Asian rates of inflation 12 months after the 1997 crisis. The lack of pass through implies that firms' export revenues - expressed in the domestic currency - are unchanged, while repayment obligations increase. Otherwise, firms' export revenues - expressed in the foreign currency - decrease, while repayment obligations in the foreign currency remain unchanged. Consequently, the increasing gap between exporting firms revenues and their debt service implies that some of them will not be able to service their debt and will be forced to exit.

Beyond to the pure foreign currency borrowing effect, several papers have shown that credit constraints limit firms' borrowing capacity after a negative exogenous shock on their cash flow. Among others, Aghion et al. (2001, 2005) define credit constraints as a relative independence between firm's borrowing capacity and the project's return, the former being more linked to the level of firm's assets or cash flow that can be used as collateral. The scarcity of capital is a different concept, since it implies that no firm is able to borrow if their is no capital available, even if it can provide a high level of collateral. We mentioned above that a depreciation of the domestic currency could lead firms to exit the export market if they were unable to service their debt contracted in a foreign currency. But even if they could, they would probably suffer from a reduction in their cash flow, because of an increase in the value of repayments. In addition, the depreciation of the exchange will

lead to a reduction in the value of firms' fixed assets in the foreign currency. In an environment where firms have to face credit constraints, borrowing opportunities are associated to the value of their collateral, which is often referred as the value of firms' assets and cash flow in the finance literature. The depreciation of the exchange rate will therefore reduce the value of firm's collateral as well as their borrowing opportunities in the foreign currency; this will lead to higher firms exits in the subsequent periods, while other firms will not be able to enter. Remaining firms should also face a reduction in their borrowing capacity during the period, which should also reduce their production and export capacities. Consequently, we anticipate that the association of a high level of foreign currency borrowing and credit constraints in the economy will deteriorate the aggregate's reaction of exports to a currency depreciation; the more negative reaction of exports should be mainly due to firms exits and to a lack of firms entry in the periods following the crisis.

Magnification Effects

We saw above that a depreciation of the exchange rate can lead to firms exists because of balance sheet effects. We further list two kind of mechanisms, which are likely to magnify the financial effects of the depreciation. First, a country's specialization may have an effect through the degree of its firms' level of dependence on external finance. Indeed, Rajan and Zingales (1998) show that firms operating in some industries use more external finance. If the currency depreciates, the financial market imperfection mechanisms listed above will therefore be especially relevant for countries that are specialized in more financially dependent industries. Consequently, the reaction of export in those countries could be especially low, or even negative, because of a reduction in the number of exporting firms or a reduction in exports by firm.

On the other hand, we evaluate whether there should be a non-linear effect of an exchange rate depreciation on the volume of exports. A larger depreciation should have a more negative impact on the number of firms operating on the export market, because it increases the value of repayments for loans contracted in a foreign currency, which can lead to more firms exits. In addition, a larger depreciation should decrease the number of exporting firms as well as the volume of exports by incumbent firms, because it increases the cost of borrowing in a foreign currency, while it decreases the value of the collateral. We therefore put forward the hypothesis that, if the economy is weaken by a high level of financial market imperfections, a small depreciation could lead to a pro-competitive effect, while a larger shock should magnify the financial effect and thus lower the reaction of a country's aggregate volume of exports.

This non-linear effect should especially be true if we assume that firms' borrowings are mainly dedicated to the payment of the sunk and fixed costs, while usual operations are self-financed. If this is the case, a depreciation should always contribute to an increase in the intensive margin - i.e. an increase in the volume of exports by remaining firms - and to some extent to a reduction in the extensive margin. For a little depreciation, few firms will be forced to exit because of repayment issues, while most of them will continue to operate on the export market or will even enter. These firms will therefore benefit from the increased competitiveness of their products abroad, which will in turn increase the aggregate level of exports. On the contrary, a large depreciation will force a large number of firms to exit because of the balance sheet effect, and the reaction of the aggregate level of exports will be lower positive or even negative. We can see here that the final effect will depend on the differentiate effect of the depreciation on the intensive and the extensive margins of trade: for a little depreciation, the increase in exports by firm compensates the reduction in the extensive margin due to few firms exists. For very large levels of depreciation, it is possible however that too many firms exit, so that the increase in exports by incumbent firms does not overcomes the large reduction in the extensive margin.

2.2 The Econometric Model

We make use of the methodology provided by Goldstein and Kahn (1978, 1985) to estimate demand and supply export equations for a group of developing and developed countries. Whereas the traditional pro-competitive effect of a depreciation of the exchange rate is specifically associated with the demand side of the export equation, we provide an explanation of the non-response of exports to a currency depreciation through the supply side.

A depreciation involves a positive competitiveness effect on the demand side because it induces an increase in world demand for domestic goods, following a decrease in domestic relative prices. However, the same depreciation leads to a negative supply effect: our hypothesis developed above says that, if firms borrow in a foreign currency or are subject to credit constraints, a depreciation will induce a balance-sheet effect which can in turn reduce firms' production capacities or their ability to remain on the export market. Theoretically, the demand for home-produced goods should increase ; however, their is some risk that home supply decreases after the depreciation. The following equation stands for the demand side of the export equation:

$$logX_{it} = \alpha_0 + \alpha_1 log(PX_{it}) + \alpha_2 logPC_{it} + \alpha_3 logE_{it} + \alpha_4 logYW_{it} + \mu_{it} \qquad (1)$$

where X_{it}^d is the demand for exports from country i, PX_{it} is country i's export price, PC_{it} is the competitors' price, E_{it} is the exchange rate - an increase of E means a depreciation of the local currency - and YW_{it} is the revenue of all i's trade partner countries. We describe in details in Appendix the construction of each country's competitor price and trade partner revenue variables. We expect the sign of the coefficient on the exchange rate to be positive, i.e. a depreciation should lead to a decrease of the export price in the foreign currency. The export supply of country i can be expressed as follows :

$$logX_{it} = \beta_0 + \beta_1 logPX_{it} + \beta_2 logP_{it} + \beta_3 logY_{it} + \beta_4 logE_{it} * FMI + \beta_5 logE_{it}ME_{it} + \varepsilon_{it} \qquad (2)$$

where X_{it}^s is the export supply from country i, PX_{it} its export price, P_{it} the domestic producer price, Y_{it} the domestic production, and FMI the measure of financial market imperfections, i.e. foreign currency borrowing and credit constraints, as defined above. This last interaction term between financial market imperfections and the exchange rate enables us to take into account the way in which financial imperfections will modify the export supply conditions when the currency depreciates. Finally, the variable ME represents the magnification effects previously mentioned. We expect $\beta_1 > 0$, $\beta_2 < 0$ and $\beta_3 > 0$. Note that the coefficients on prices could be biased because of problems of aggregation, as discussed in Goldstein and Kahn (1985). However the study of the sign and value of price coefficients remains beyond the scope of our study. In addition, our hypothesis requires a negative effect of financial market imperfections when the currency depreciates ($\beta_4 < 0$) - the depreciation will have a more negative impact on the export supply for a higher level of financial market imperfections in the economy. This negative impact may be magnified by the country's specialization and the extent of the depreciation ($\beta_5 < 0$). The equation above equivalent to :

$$logPX_{it} = b_0 + b_1 logX_{it}^s + b_2 logP_{it} + b_3 logY_{it} + b_4 logE_{it} * FMI + b_5 logE_{it}ME_{it} + \eta_{it} \qquad (3)$$

From the combination of the export demand and supply equations, we obtain the equilibrium level of exports for country i:

$$logX_{it} = \gamma_0 + \gamma_1 logP_{it} + \gamma_2 logY_{it} + \gamma_3 logE_{it}*FMI + \gamma_4 logE_{it}ME_{it} + \gamma_5 logPC_{it} + \gamma_6 logE_{it} + \gamma_7 logYW_{it} + \nu_{it} \quad (4)$$

One can show that the coefficients of this expression are expected to be of the same sign as those discussed before

: $\gamma_1, \gamma_3, \gamma_4 < 0$, and $\gamma_2, \gamma_5, \gamma_6, \gamma_7 > 0$. A depreciation of the exchange rate should lead to a pro-competitive effect through the demand side of the equation, and to a negative impact through the supply side, for a higher level of financial market imperfections in a given economy. Therefore, a depreciation should not always lead to an increase in exports, since the final effect depends on the level of firms' debt denominated in the foreign currency, and also on the influence of the level of credit constraints in the economy. This expectation is consistent with the evolution of exports in south east Asia after the 1997-98 crises.

3   Data and Econometric Issues

3.1   Measuring Financial Market Imperfections

The mechanism we have in mind requires that we find a measure of the foreign currency behavior of countries' firms as well as a proxy for the extent of credit constraints in the economy. Measuring countries' share of firms' debt denominated in the foreign currency is not simple. Several articles have used aggregated data; in particular, Eichengreen et al. (2003) and Burger and Warnock (2003) use the data provided by the Bank for International Settlements (BIS) to measure countries' proportion of bonds and securities that have been issued in a foreign currency. However, this kind of measure remains extremely imperfect, since it is calculated for the whole economy and does not enable us to distinguish between the public and private sectors. Jeanne (2003) uses this kind of aggregate measure as well as a direct measure of Foreign Currency Borrowing (FCB) by publicly listed firms. This last kind of data is of course much more satisfying ; however, it only covers a small range of countries in South America.

Our paper makes use of a direct measure of foreign currency borrowing, available for a wide range of countries[8]. The World Bank recently published a survey - the World Business Environment Survey (WBES, 2000) - that provides information on firms' activities in 80 countries. This comprehensive survey of over 10,000 firms covers firms' responses to multiple questions on the investment climate and business environment as shaped by domestic economic policy: governance; regulatory, infrastructural and financial impediments, as well as assessments on the quality of public services. Among other firm level data, the database indicates the origin of capital.

We use the WBES database to compute an average of the proportion of firms' debt denominated in the foreign currency, for each country in the sample. This variable is only available for the year 2000, so that we should consider it as a structural measure of firms' use of foreign currency loans. The data in our sample (see Table 5) indicates that some economies in South America and South East Asia - especially Argentina, Singapore and Indonesia - are characterized by a high degree of foreign currency borrowing, whereas this ratio is much lower in financial centers like the United Kingdom and the United States.

Several authors have worked on the credit constraints issue. Braun (2003) shows that industries with less tangible assets perform disproportionately better in terms of growth in countries with well-developed financial systems. In a related work, Manova (2005) shows that countries with better developed financial systems tend to export relatively more in sectors with fewer tangible assets that can serve as collateral. These two papers use the level of financial development as a proxy for the level of credit constraints in the economy; therefore, a better financial development should be associated with a lower level of credit constraints. In a related work,

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[8]In a first version of the paper, we also used aggregated measures of the FCB provided by the BIS and IMF statistics, but the coefficients on those variables in the regression suffered from a lack of robustness, and we decided to remove them. Such a lack of robustness is probably due to the aggregation problem suggested above.

Aghion et al. (2005) use a financial development variable to evaluate the influence of credit constraints on countries' growth volatility.

Financial development is defined as the ratio of private credit to GDP, and is available online from Thorsten Beck's website at the Worldbank. This variable is also used in Rajan and Zingales (1998), among others. We take five-year (1990-1995) averages for the financial development variable; this enables us to smooth the data and avoid short run variations and cyclical effects. Data indicate a wide range of financial development levels; South American countries like Argentina and Peru report very low ratios whereas Switzerland and Japan have the highest. In contrast to previous works, we do not assume a linear relationship between credit constraints and financial development. Indeed, this relationship might be non-linear because credit constraints - as defined in the theoretical part of the paper - should not be observed at very low levels of financial development, since no credit market is in operation. Therefore, an increase in the level of financial development should only help to reduce the credit constraints after a sufficiently high level of financial development. We thus make use of countries' level of financial development as well as its square, in order to take into account this non-linear relationship between financial development and credit constraints.

3.2 Measuring the External Financial Dependence of Exports

We introduce a variable to account for countries' specialization and financial dependence of exports. Rajan and Zingales (1998) and Beck (2003) define external financial dependence as *the fraction of capital expenditures not financed with cash flow from operations*. They show that countries with a higher level of financial development have higher growth rates and trade levels in industries that are more dependent on the use of external funds.

In these papers, the external dependence of American industries is considered as being an optimal one, given the high level of financial development in the US and the low probability of firms to be financially constrained. The level of each industry's external financial dependence in the US should therefore represent the actual demand of external finance by those industries, in each country. Consequently, we apply this measure of external dependence to other sets of countries[9].

We use the data provided by Rajan and Zingales (1998) to build a structural financial dependence of exports measure, by country. Our variable takes into account countries' export specialization in 1995, which allows us to determine the extent of external finance countries' exporters have to obtain in order to export. More precisely, we compute, for each country in the sample, the contribution of each SITC one digit industry in the total of exports. This export structure is used to calculate the financial dependence of exports, thanks to the data provided by Rajan and Zingales (1998) at a disaggregated level.

3.3 Trade Model Data

We concentrate our analysis on the impact of exchange rate fluctuations on the export *volume*, in order to evaluate the real impact of exchange rate fluctuations, and avoid all possible noise due to export price variations. Specifically, if we postulate that the export price - in the domestic currency - does not adjust when the currency depreciates, then the depreciation reduces this export price in the foreign currency. If the price elasticity of the

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[9]For more information about the optimal character of the external dependence of US industries, see Rajan and Zingales (1998).

foreign demand is low, the volume of exports will remain unchanged whereas the value of exports will be reduced in the foreign currency. Hence the use of export volumes seems to be justified and necessary. We construct our export volumes data set by taking the ratio of countries' total value of exports in USD to countries' export price index in USD. We also compute the GDP volume variable in the same way, by dividing the GDP value in the domestic currency by the GDP deflator in the domestic currency.

In addition to the variables described above, we use exchange rate data, country specific competitors' prices, producer prices and countries trading partners revenues[10]. We use domestic currency in terms of SDR for exchange rates series in order to take into account the competitiveness gains against other countries than United States. It would have been better to use effective exchange rates, but quarterly data were only available for a small number of countries, so we kept exchange rates in terms of SDR. All these variables are from the IMF International Financial Statistics (IFS) database. We also use the Direction of Trade Statistics (DOTS) data to compute the competitors' price and trading partner revenue variables. All the details about the data and their construction are provided in the appendixes.

Our panel of data covers the period 1990-2005 for 27 developed and developing countries at a quarterly frequency. Unfortunately, data availability is an impediment that constrains us in the extension of the database. In particular, the use of export volume data requires the existence of export price series, and these data are only available for few countries from the IFS, especially at a quarterly frequency. Nevertheless, it seems essential to take into account the export *volume*, since we concentrate our analysis on the real effect of the depreciation.

3.4   Econometric issues

The literature in econometrics and macroeconometrics has recently concentrated on the issue of stationarity and cointegration in panel data. According to Breitung and Pesaran (2005), using panel data increases the statistical power of these tests. This especially explains why researchers, like Pedroni (2001), have tried to use these late developments in econometrics, to test for the Purchasing Power Parity hypothesis. Given that our data set covers a long time period at high frequency for macroeconomic variables, it is likely that at least some of the variables - and in particular the exchange rate - are non-stationary. We therefore test for the stationarity of our variables in panel, using the Fisher unit-root test developed by Maddala and Wu (1999). Fisher's test assumes that all variables are non-stationary under the null hypothesis against the alternative that at least one variable in the panel is stationary. Unlike the Im-Pesaran-Shin (1997) test, Fisher's test does not require a balanced panel. Results are provided in Appendix 7.2, and indicate that all series are I(1).

These results allow us to test for a cointegration relationship among our variables of interest. Pedroni (1999) developed a cointegration residual-based test procedure for dynamic panel with multiple regressors, which provides seven normally distributed statistics. The four panel-statistics require that the auto-regressive parameter be the same for all individuals, whereas the three group-statistics authorize the auto-regressive coefficient to vary among individuals in the panel. The null of no-cointegration (non-stationarity of the residuals within the relationship between our variables of interest) is rejected if the auto-regressive parameter is less than one. Results are provided in Appendix 7.3 and indicate that all but one statistic reject the null of no cointegration; this is strong evidence for the existence of a cointegration relationship between our variables.

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[10]Competitors' price and producer price indexes are respectively denominated in SDR and in the local currency; the combination of these price indexes with the exchange rate gives us the real exchange rate.

We turn now to the estimation procedure of the long-run relationship, common to all individuals in the panel. Kao and Chiang (2000) and Mark and Sul (2002) show that the Dynamic Original Least Squares (DOLS) method of Stock and Watson (1993) outperforms both OLS and Fully Modified OLS when estimating a long run relationship between cointegrated variables. We thus estimate this long-run relationship using DOLS with one differentiated lead and one differentiated lag, which enables us to correct for serial correlation and the potential endogeneity of the regressors. We also introduce country fixed effects, and quarterly dummies to avoid seasonality bias. We therefore obtain a new specification of our model :

$$logX_{it} = \gamma_0 + \gamma_1 logP_{it} + \gamma_2 logY_{it} + \gamma_3 logE_{it} * FMI_{it} + \gamma_4 logE_{it} * ME_{it} + \gamma_5 logPC_{it} + \gamma_6 logE_{it}$$

$$+\gamma_7 logYW_{it} + \sum_{k=-1,k\neq0}^{1} [\gamma_8 \Delta logP_{i,t-k} + \gamma_9 \Delta logY_{i,t-k} + \gamma_{10}\Delta(logE * logFMI)_{i,t-k}$$

$$+\gamma_{11}\Delta logPmW_{i,t-k} + \gamma_{12}\Delta logE_{i,t-k} + \gamma_{13}\Delta logYW_{t-k}] + \sum_{j=1}^{3} \lambda_j Q_j + \sum_{i=1}^{27} \eta_i C_i + v_{it} \qquad (5)$$

Where the Δ terms indicate first differences of the independent variables, with lags at orders k=[-1;1], Q_j represents the quarterly dummies, and C_i the countries' dummies. All of the following hypotheses about financial market imperfections are tested using this specification.

4   The Role of Financial Market Imperfections

We put forward the hypothesis that a currency depreciation will have more negative consequences on exports if a country's firms have a higher foreign currency borrowing ratio, and if the firms are more credit constrained. The empirical estimation of the exports equation, therefore, contains two interaction terms that enable us to distinguish between foreign currency borrowing and credit constraint mechanisms in order to control for financial market imperfections. Our empirical methodology remains the same as in (5), but only reports our variables of interest. To allow for a clearer reading, we only report in the equation our variables of interest, without the leads, lags or quarterly and country dummies.

$$logX_{i,t} = \gamma_0 + \gamma_1 logP_{it} + \gamma_2 logY_{it} + \gamma_3 logPC_{it} + \gamma_4 logE_{it} + \gamma_5 logE_{it} * logFCB_i$$

$$+\gamma_6 logE_{it} * logFD_i + \gamma_7 logE_{it} * (logFD_{it})^2 + \gamma_8 logYW_{it} + v_{it} \qquad (6)$$

with FCB and FD respectively the foreign currency borrowing and financial development variables. We expect γ_5 to be negative: a larger level of a country's foreign currency borrowing should imply a more negative response of exports to a depreciation, since some firms will not be able to service their debt whereas others will not be willing to borrow in order to enter the export market, thus reducing the country's production and export capacity. An increase of the financial development variable is assumed to have a negative impact on exports at a low initial level ($\alpha_6 < 0$), and a positive impact beyond an intermediate level ($\alpha_7 > 0$).

Our estimation results are reported in Table 1. Column A reports the basic specification, and does not take into account the financial market imperfections. This first specification indicates that the traditional variables in the export equations have coefficients with the right sign: national production and world demand for exports influence positively and significantly the volume of exports, while the price ratio has a positive impact : an

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increase in the competitor's price relative to the producer's price increases exports. The striking result comes from the coefficient on the exchange rate: a currency depreciation leads to an insignificant impact on the volume of exports, suggesting that the traditional competitiveness effect is not observed in our sample.

This first puzzling result disappears when we include financial imperfections. In column (D) we test the role of both foreign currency borrowing and credit constraints by introducing interacted terms. Note that the number of observations is lower than in the basic specification because the WBES database does not include all the countries in our sample. The estimated coefficient of the exchange rate term becomes significant, reflecting a positive competitiveness effect. On the other hand, financial market imperfections significantly modify the impact of a depreciation on exports.

First, we find a negative impact of foreign currency borrowing: countries in which firms use a large share of foreign currency borrowing in their total financing will react more negatively to an exchange rate shock, which is consistent with the theory. This first result allows us to explain why Argentina or Singapore, which report the highest ratios of foreign currency borrowing in the sample, did not experience an increase of exports right after their respective currency crises.

Estimation (D) underlines the significant influence of the financial development as well. The coefficients on the interaction terms between the exchange rate and financial development variables confirm the existence of a non-linear relationship between credit constraints and financial development, which influences the reaction of countries to a depreciation: a better level of financial development is associated to a lower level of credit constraints, beyond an *intermediate* level of financial development. Therefore, a deeper financial market will improve the reaction of exports to a depreciation, but only if the country has a sufficiently high level of financial development. This *intermediate* level of financial development corresponds to a ratio of private credit GDP equal to 0.56 which is consistent with the data. Beyond this ratio, a marginal increase in financial development will help countries to better react to a depreciation through a lower level of credit constraints. Besides this result, we see that countries located "below the threshold" should only be able to remove credit constraints through a very high increase in their level of financial development.

The role of financial market imperfections in the way countries' exports react to an exchange rate depreciation is robust to the different specifications - columns (B) and (C). This confirms our main result : taking financial market imperfections into account enables us to remove the striking initial result on the coefficient of the exchange rate; a country characterized by few financial market imperfections should experience the theoretical - and expected - competitiveness effect. Typically, countries like Indonesia which are characterized by an intermediate level of financial development and a high level of foreign currency borrowing, will react very negatively to an exchange depreciation because of larger balance-sheets effects.

In Columns (E) and (F) we only consider developing countries. The results are still consistent with our hypotheses, even if the negative effects of financial imperfections are magnified. The interesting point comes from the significance of the interaction terms' coefficients. Indeed, one can suppose that the existence of financial market imperfections is an element that characterizes developing and emerging countries as two different homogenous groups. On the contrary, our results suggest that important differences exist *within* the group of developing countries, regarding financial markets. Indeed, if there were no significant difference between these countries, the estimated coefficient of the interacted term between financial market imperfections and the exchange rate would become insignificant. Some developing countries have a sufficiently low level of financial imperfections to obtain a positive competitiveness effect after a currency depreciation, while others do not. Thus, the negative coefficient on the interaction between financial market imperfections and exchange rate should not only be seen

Table 1: Financial Market Imperfections

Depvar: *Export Volume*	All countries				Developing countries only	
	(A)	(B)	(C)	(D)	(E)	(F)
Traditional Variables						
GDP Volume	0.50***	0.405***	0.466***	0.363***	0.287***	0.316***
	(0.052)	(0.066)	(0.044)	(0.051)	(0.071)	(0.059)
$\frac{CompetitorsPrice}{DomesticPrice}$	0.247***	0.256***	0.158**	0.191***	0.311***	0.264***
	(0.084)	(0.090)	(0.069)	(0.068)	(0.099)	(0.078)
Foreign Demand	0.632***	0.649***	0.490***	0.374**	0.323	0.098
	(0.180)	(0.236)	(0.141)	(0.169)	(0.232)	(0.155)
Exchange rate	0.027	0.243*	0.492***	1.033***	0.218	1.020***
	(0.071)	(0.146)	(0.105)	(0.168)	(0.163)	(0.188)
Financial Variables						
Exch.Rate*FCB		-5.625***		-7.183***	-6.817***	-8.061***
		(2.176)		(1.971)	(2.155)	(1.963)
exch. rate*fin.dvt			-2.761***	-4.520***		-4.637***
			(0.349)	(0.606)		(0.645)
$Exch.Rate * (Fin.Dvt)^2$			2.625***	5.050***		5.423***
			(0.375)	(0.787)		(0.874)
Observations	1308	811	1336	828	604	604
R^2	0.64	0.58	0.67	0.64	0.56	0.62
Estimation method	DOLS				DOLS	

Note: Significance levels: *10%, **5%, ***1%. All variables in logarithms. Robust Standard Errors in parentheses. All regressions include time, countries, quarterly dummies, and differentiated lags. Intercept not reported. Regressions (E) and (F) for developing countries only.

as a result of the different levels of financial market development between developing and developed countries; the data in appendix indicate that this kind of heterogeneity is also observed within the group of developing countries and is likely to explain countries' different paths of recovery following the recent currency crises.

5   The Role of Amplification Effects

Following our assumptions in the theoretical underpinnings section of the paper, we investigate the role of the financial dependence of exports and the role of the magnitude of the depreciation, in the way a country's exports react to an exchange rate shock. We already mentioned that countries characterized by a high level of financial dependence of exports should be more sensitive to financial market imperfection channels when the currency depreciates, since firms have to use a higher share of external capital. Moreover, we consider here the potential non-linear effect of the exchange rate depreciation by introducing a squared exchange rate term. Our analysis leads us to estimate the following equation[11]:

$$logX_{i,t} = \gamma_0 + \gamma_1 logP_{it} + \gamma_2 logY_{it} + \gamma_3 logPC_{it} + \gamma_4 logE_{it} + \gamma_5 logYW_{it}$$

$$+\gamma_6 logE_{it} * logFCB_i + \gamma_7 logE_{it} * logFD_{it} + \gamma_8 logE_{it} * log(FD^2)_i$$

$$+\gamma_9 logE_{it} * logED_i + \gamma_{10}[logE_{it} * logE_{it}] + v_{it} \tag{7}$$

where ED represent the degree of External financial Dependence of exports. We expect γ_9 to be negative - more financially dependent countries should react more negatively to a depreciation of the exchange rate. Moreover, we expect a positive sign on the coefficient of exchange rate and a negative sign on the coefficient of the square of the exchange rate, so that the result should report an inverted "U-shaped" curve to describe the impact of exchange rate on the volume of exports.

Our results are reported in estimations A, B and C of Table 2. These regressions indicate that, while the coefficient on the exchange rate is always positive - indicating a pro-competitive effect of the depreciation - the coefficient on the interaction term with the financial dependence is negative and highly significant, suggesting that the financial market imperfections channel is magnified when countries have a more financially dependent structure of exports. We can see from table 5 that Singapore, Thailand and Malaysia are more financially dependent than Brazil, Argentina and Colombia; this would be an explanation for the low degree of response of the South-East Asian volume of exports, after the currency crises that occurred in the region in 1997-98, as described in Duttagupta and Spilimbergo (2004).

Moreover, the coefficient on the exchange rate is always positive and significant while the square of the exchange rate has always a significantly negative influence. This confirms the negative impact of large depreciations, that contribute to amplify the financial market imperfections channel. This result contributes to the literature on the specificity of large exchange rate swings in comparison to smaller shocks. In particular, Baldwin and Krugman (1989) show that, given that firms have to pay a sunk cost to enter the export market and another fixed cost at the beginning of each period in order to stay, only large exchange rate movements will be likely to modify significantly the profitability of the export activity, and thus the entry and exit behavior of firms that will stay durably in or out. Our empirical estimation provide results consistent with a new mechanism regarding this theory. Since the export activity is associated with a fixed cost paid at the beginning of each period, firms have

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[11]Once again, to facilitate clearer reading, we do not report in this equation the lead / lagged variables, nor the dummies.

Table 2: Magnification effects

Depvar: *Export Volume*	(A)	(B)	(C)	*Robustness checks* (D)	(E)	(F)
Traditional Variables						
GDP Volume	0.405***	0.353***	0.281***	0.372***	0.298***	0.286***
	(0.067)	(0.059)	(0.052)	(0.058)	(0.072)	(0.051)
$\frac{CompetitorsPrice}{DomesticPrice}$	0.308***	0.135*	-0.006	0.311***	0.049	0.024
	(0.070)	(0.076)	(0.083)	(0.083)	(0.081)	(0.066)
Foreign Demand	0.163	0.417**	0.376*	0.389*	0.585***	0.321**
	(0.187)	(0.171)	(0.20)	(0.232)	(0.185)	(0.162)
Exchange rate	2.757***	0.993***	3.886***	1.878***	0.675***	3.101***
	(0.282)	(0.169)	(0.307)	(0.197)	(0.175)	(0.255)
Financial Variables						
*exch.rate*FCB*	-19.127***	-6.637***	-23.891***	-16.948***	-4.926**	-19.035***
	(2.339)	(1.856)	(1.916)	(2.274)	(1.957)	(1.718)
*exch. rate*fin.dvt*	-4.782***	-3.430***	-3.320***			
	(0.583)	(0.779)	(0.805)			
$exch.rate*(fin.dvt)^2$	6.606***	3.805***	4.356***			
	(0.774)	(0.953)	(0.873)			
Magnification Variables						
*exch.rate*ext.dep*	-6.753***		-12.158***	-6.118***		-8.207***
	(0.873)		(0.984)	(0.616)		(0.670)
$exch.rate^2$		-0.011*	-0.083***		-0.031***	-0.047***
		(0.006)	(0.007)		(0.005)	(0.005)
Observations	828	828	828	828	828	828
R^2	0.71	0.65	0.77	0.66	0.63	0.73
Estimation method		DOLS			DOLS	

Note: Significance levels: *10%, **5%, ***1%. All variables are in logarithms. Robust Standard Errors are in parentheses. All regressions include time, countries, quarterly dummies, and differentiated lags. One differentiated lead and lag are introduced for each independent variable. Intercept is not reported.

to borrow in order to enter[12]. As a consequence, a large depreciation of the exchange rate should not lead to the entry of new firms if the country is characterized by a high degree of financial market imperfections : the large depreciation will enhance the foreign currency borrowing channel through a higher value of repayments, as well as the credit constraints channel through a lower level of cash flow and borrowing capacity, for the firms that have previously borrowed in a foreign currency. Of course, we should expect the theoretical result provided by Baldwin and Krugman (1989) if the local financial market was perfectly working; however, the existence of financial market imperfections help us understand why a large exchange rate depreciation should lead to a lower increase - or a decrease - of exports, in emerging market economies.

The last three columns in table 2 present some robustness checks, which confirm the stability and the significance of the coefficients presented in the previous estimations. Moreover, the inclusion of a banking crisis dummy (not reported here) does not significantly change the results presented above. On the basis of the estimated coefficients in (A), we computed the estimated impact of currency depreciation on the volume of export for each country of the sample, by using the real countries' characteristics given in table 5 (Appendix). Whereas the mean impact is positive (a 1 percent depreciation is found to increase the volume of exports by about 1 percent), our results emphasize significant differences across countries. The larger competitiveness effect is found for Peru and Ecuador, for which the overall response of exports is found to be more than 60 percents larger than the sample mean. This result can be understood by taking into account both the very low level of financial development and the low degree of external dependence of these countries, mostly specialized in primary goods. As mentioned above, countries with a very low level of financial development will not face credit constraints. In these countries, firms are more constrained by the scarcity of capital than by the amount of collateral they need to provide to financial institutions. Thus, even if the share of firms' level of foreign currency borrowing is high, the traditional competitiveness effect may be observed in these countries, especially if exports do not heavily rely on finance. At the other side of the sample, countries like Malaysia, Thailand or Singapore are predicted to react very negatively to an exchange rate depreciation: their response is twice less important than the mean of the sample. The combination of sufficiently developed financial markets, high share of foreign currency borrowing and specialization biased toward externally dependent goods explain this finding and the sluggish reaction of exports in these countries after the 1997-1998 Asian crisis. Finally, the reaction of industrial countries is found to be around the mean of the sample. Their high degree of external dependence prevents them to get a real expansionary effect of the depreciation, but their very developed financial markets and their very low propensity to use foreign currency borrowing decrease the risk of enduring negative balance-sheets effects after a depreciation.

6   Conclusion and Directions for further Research

This paper examines how financial factors determine the reaction of countries' exports to exchange rate variations. In particular, we consider the role of countries' financial market imperfections, i.e. foreign currency borrowing and credit constraints. We also investigate the role of the financial structure of exports and the extent of the depreciation as magnification factors. Taking these financial factors into account allows us to better understand why some currency crises did not generate an increase in the volume of exports, as the traditional theory would expect.

Our results indicate that financial market imperfections have a negative impact on the reaction of countries' ex-

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[12]Of course, the extent of borrowing depends on the industry we consider.

ports to the depreciation. While the level of foreign currency borrowing always has a negative impact when the shock happens, the level of financial development - which is inversely related to the level of credit constraints - has a positive impact beyond an *intermediate* level of financial development, which is consistent with our data. Our results explain why exports did not increase after the currency crises that occured in Latin America at the end of the 1990's, since countries like Argentina and Brazil are characterized by low levels of financial development and high levels of foreign currency borrowing.

We also show that amplification effects are in action: a more financially dependent structure of exports and a larger depreciation are associated with a more negative reaction of exports, since these two variables amplify the financial market imperfections channel. Here, the financial dependence of exports is especially useful in explaining why South-East Asian economies did not demonstrate an increase in exports after the currency crisis in 1997.

Our results have several policy implications. They stress in particular the importance of considering financial factors when studying the expected impact of exchange rate movements on trade, especially when an exchange rate depreciation or devaluation is expected to kick-start an economy in period of recession. Our results emphasize the fact that such a depreciation or devaluation can either improve the trade balance or magnify the recession by decreasing the volume of exports, the final result depending principally on firms' financial behavior and country's specialization.

All our results are consistent with the hypothesis that the more negative reaction of the aggregate volume of exports to a currency depreciation, is a consequence of the existence of financial market imperfections that lead to a decrease in the extensive margin. Whereas a little depreciation leading to a small increase in the debt service can be balanced at the firm level by an increase in the demand for home produced goods abroad, large depreciations will lead to large firms exits of firms that will not benefit from the pro competitive effect.

Further research should intend to better measure the variations in the extensive and intensive margins of trade consecutive to an exchange rate variation, using firm level data.

References

[1] P. Aghion, J.M. Angeletos, A. Banerjee, and K. Manova. Volatility and growth: Credit constraints and productivity-enhancing investment. Harvard Working Paper, 2005.

[2] P. Aghion, P. Bachetta, and A. Banerjee. Currency crises and monetary policy in a economy with credit constraints. *European Economic Review*, 45(7):1121–1150, 2001.

[3] P. Aghion, P. Bachetta, and A. Banerjee. Financial development and the instability of open economices. *Journal of Monetary Economics*, 51(6):1077–1106, 2004.

[4] P. Bachetta. Monetary policy with foreign currency debt. Working Paper Study Center Gerzenzee, Lausanne, 2000.

[5] M. Bahmani-Oskooee and A. Ratha. The j-curve : a literature review. *Applied Economics*, 36(13):1377–1398, 2004.

[6] R. Baldwin and P. Krugman. Persistent trade effects of large exchange rate shocks. *Quarterly Journal of Economics*, 419:635–654, 1989.

[7] T. Beck. Financial development and international trade: is there a link? *Journal of International Economics*, 57:107–131, 2002.

[8] T. Beck. Financial dependence and international trade. *Review of International Economics*, 11 (2):296–316, 2003.

[9] B. Becker and D. Greenberg. Financial development and international trade. mimeo, 2004.

[10] N. Berman and A. Berthou. Exchange rate movements and international trade under foreign currency borrowing. Mimeo Paris I University, 2006.

[11] A. Bernard and B. Jensen. Why do some firms export? *The Review of Economics and Statistics*, 86-2:417–449, 2001.

[12] A. Bernard and J. Wagner. Export entry and exit by german firms. NBER Working Paper W6538, 1998.

[13] M. Braun. Financial contractibility and asset hardness. Harvard University, Department of Economics Working Paper, 2003.

[14] J. Breitung and M.H. Pesaran. Unit roots and cointegration in panels. Cesifo working paper series, 2005.

[15] J. Burger and E. Warnock. Diversification, original sin, and international bond portfolios. Board of Governors of the Federal Reserve System, International Finance Discussion Papers, Number 755, 2003.

[16] A.C. Burnside, M. Eicheinbaum, and S. Rebelo. Hedging and financial fragility in fixed exchange rate regimes. *European Economic Review*, 45 (7):1151–1193, 2001.

[17] J.M. Campa. Exchange rate crises and bilateral trade flows in latin america. IESE Research Papers D/470, 2001.

[18] J.M. Campa and L. Goldberg. Exchange rate pass-through into import prices: A macro or micro phenomenon? NBER Working Papers 8934, 2002.

[19] L.-F. Cespedes, R. Chang, and A. Velasco. Balance sheets and exchange rate policy. *American Economic Review*, 94(4):1183–1193, 2004.

[20] T. Chaney. Liquidity constrained exporters. Mimeo MIT, 2005.

[21] P. Clark, N. Tamirisa, S.-J. Wei, A. Sadikov, and L. Zeng. Exchange rate volatility and trade flows - some new evidence. IMF Working Paper, 2004.

[22] A. Deardorff. Financial crisis, trade, and fragmentation. The University of Michigan, School of Public Policy, Discussion Paper No. 458, 2000.

[23] R. Duttagupta and A. Spilimbergo. What happened to asian exports during the crisis? *IMF Staff Papers*, 51(1), 2004.

[24] J. Eaton, S. Kortum, and F. Kramarz. An anatomy of international trade: Evidence from french firms. Meeting papers 802, Society for Economic Dynamics, 2004.

[25] J. C. Echeverry, L. Fergusson, R. Steiner, and C. Aguilar. dollar debt in colombian firms: are sinners punished during devaluations? *Emerging Market Review*, 4:417–449, 2003.

[26] B. Eichengreen and R. Hausman. Exchange rate and financial fragility. NBER Working Paper no. 7418, 2000.

[27] B. Eichengreen, R. Hausmann, and U. Panizza. The mystery of original sin. In *Other People's Money: Debt Denomination and Financial Instability in Emerging Market Economics*. Eichengreen and Hausmann eds, 2003.

[28] R. Gelos and A. Werner. Financial liberalization, credit constraints, and collateral: Investment in the mexican manufacturing sector. IMF Working Paper No. 99/25, 1999.

[29] I. Goldfajn and S. Werlang. The pass-through from depreciation to inflation: A panel study. Working Paper 416, Department of Economics, PUC-RIO, Brazil, 2000.

[30] M. Goldstein and H.S. Kahn. The supply and demand for exports: a simultaneous approach. *Review of Economics and Statistics*, 60:275–286, 1978.

[31] M. Goldstein and H.S. Kahn. Income and price effects in foreign trade. *Handbook of International Economimcs*, 2:1041–1105, 1985.

[32] K.S Im, M.H. Pesaran, and Y. Shin. Testing for units roots in heterogenous panels. Wp, department of applied econometrics, university of cambridge, 1997.

[33] O. Jeanne. Why do emerging economies borrow in foreign currency? CEPR Discussion Paper 4030, 2003.

[34] C. Kao and M.-H. Chiang. On the estimation and inference of a cointegrated regression in panel data. mimeo, 1997.

[35] M. Kawai, H. Hahm, and G. Iarossi. Corporate foreign debt in east asia: Too much or too little? WorldBank Working Paper, 2003.

[36] P. Krugman. Analytical afterthoughts on the asian crisis. Mimeo, 1999a.

[37] P. Krugman. Balance sheets, the transfer problem, and financial crises. *International Tax and Public Finance*, 6(4):459–472, 1999b.

[38] Z. Ma and L. Cheng. The effects of financial crises on international trade. NBER Working Paper 10172, 2003.

[39] G.S. Maddala and S. Wu. A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61(0):631–52, 1999.

[40] K. Manova. Credit constraints in trade: Financial development and export composition. Harvard University, Department of Economics Working Paper, 2005.

[41] N.C. Mark and D. Sul. Cointegration vector estimation by panel dols and long-run money demand. Technical Report 0287, National Bureau of Economic Research, Working Paper, 2002.

[42] L. Martinez and A. Werner. The exchange rate regime and the currency composition of corporate debt: the mexican experience. *Journal of Development Economics*, 69:315334, 2002.

[43] R. McKinnon and H. Pill. International overborrowing: a decomposition of credit and currency risks. *World Development*, 7:1267–1282, 1998.

[44] M. Melitz. The impact of intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71:1695–1725, 2003.

[45] P. Pedroni. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, 61(0):653–70, 1999.

[46] P. Pedroni. Purchasing power parity tests in cointegrated panels. *The Review of Economics and Statistics*, 83(4):727–731, 2001.

[47] R. Rajan and L. Zingales. Financial dependance and growth. *American Economic Review*, 88:559–586, 1998.

[48] M. Schneider and A. Tornell. Balance-sheets effects, bailout guarantees and financial crises. NBER Working Paper 8060, 2000.

[49] J.H. Stock and M.W. Watson. A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica*, 61(4):783–820, 1993.

[50] M.C. Terra. Credit constraints in brazilian firms: Evidence from panel data. *Revista Brasileira de Economia*, 57:443–464, 2003.

[51] A. Tornell and F. Westermann. Credit market imperfections in middle income countries. NBER Working Paper 9737, 2003.

7 Appendix

7.1 Data Appendix

The sample covers quarterly data between the first quarter of 1990 and the first quarter of 2005. We provide a complete description of the variables and the data source below:

Volume of Exports: Export prices are used to deflate export revenues in order to obtain the volume of exports. Exports' value and export price indexes are both denominated in USD. As we reported above, export price indexes at a quarterly frequency are only available for a restricted number of countries ; this is the main reason why our database only contains 27 countries. All these data are available online from the IMF International Financial Statistics (IFS).

Volume of GDP: In the same way, we compute GDP volumes for each country as a ratio between the value of GDP and the GDP deflator. When the latter was unavailable, we used the country's Consumer Price Index. All these data also come from the IFS.

Trading Partners Revenue: We have computed an index foreign demand based on the country's trading partners. The index is computed as follows:

$$YW_i = \sum_{k=1}^{N} \omega_{ij} X_{ij} \qquad with \qquad \omega_{ij} = \frac{X_{ij}}{X_i}$$

where X_{ij} represents total exports of country i to country j, and ω_{ij} the share this trade flows with respect to the total exports of country i. Bilateral trade data comes from the DOTS database.

Prices: Producer Price Indexes come from the IFS, and are denominated in the local currency. In addition, we constructed an index of competitors' prices as a weighted average of countries' trading partners import prices. More precisely, we used the following methodology so as to compute our competitors' price indexes:

$$PC_i = \sum_{k=1}^{K} \sum_{j=1, j\neq i}^{J} s_k s_j PX_{jk} \qquad with \qquad s_k = \frac{X_{ik}}{X_i} \qquad and \qquad s_j = \frac{X_{jk}}{X_{Jk}}$$

where CP_i is country i's competitor price index given its K trading partner countries ; s_k is the share of country k in i's total exports ; s_j is the share of country j in k's total imports ; and PX_{jk} is the bilateral export price from country j to country k. Since this last variable is not available at a quarterly frequency, we adapt this *ideal* competitor price index in order to match the available data. We therefore use the following competitor price index :

$$PC_i = \sum_{k=1}^{K} s_k PM_k$$

Where PM_k is country k's import price at a quarterly frequency, as reported in the IFS. s_k is calculated for the year 2000 from the DOTS trade data. The CP_i remains imperfect since it does not take into account exporting countries' specialization; however, it better fits price dynamics than a world import price.

Exchange Rate: The exchange rate data come from the IFS. We consider the number of each country's currency units for one unit of SDR - an increase in the exchange rate term means a depreciation of the currency. We choose the SDR value of the exchange rate rather than the dollar one in order to better take into account the competitiveness effect of a currency depreciation. In addition, we should note that effective exchange rates were not available at a quarterly frequency for a sufficiently large number of countries.

Foreign Currency Borrowing: We constructed indexes of countries' level of foreign currency borrowing, using the WBES database provided by the Worldbank online. From this database, we more precisely learn which share of exporting firms' total external debt is denominated in a foreign currency, and compute a simple average of firms' foreign currency borrowing ratio in each country. Results are reported in table 5. Since the WBES database mostly includes small and medium size firms, ratios are quite low. Nevertheless, the ranking of countries in respect to this ratio is consistent with previous empirical studies ; in particular, the level of foreign currency borrowing in Argentina - a very "dollarized" economy - is by far higher than that level in the United States.

Financial Development: The data are availlable from Thorsten Beck's website. We use the ratio of Private Credit on GDP, and take five-years averages in order to smooth the data and avoid short-run variations and cyclical effects.

Financial External Dependence: We use the sectoral data of Rajan and Zingales (1998). These authors define the financial external dependence as the fraction of capital expenditures not financed with cash flows from operations. The authors computed levels of external dependence for 27 ISIC US industries. We use this data to compute a structural financial dependence of exports for each country, according to the share of each sector in the country's total exports. Sectoral trade data come from the COMTRADE dataset (United Nations). Rajan and Zingales (1998) use the ISIC classification, the construction of the external dependence indicator thus requires the conversion of ISIC codes to SITC ones. The computed index is simply:

$$ED_i = \sum_{j=1}^{k} \alpha_{ij} ED_j$$

where α_{ij} is the share of sector j in the exports of country i, and ED_j the external financial dependence of the sector as given by Rajan and Zingales (1998).

7.2 Stationarity Tests

Table 3: Fisher Stationarity Tests

		Without Trend		With Trend	
Variable	Number of Lags	Chi-2	Probability	Chi-2	Probability
Volume of Exports	3	54,7371	0,4465	29,7221	0,9971
Volume of GDP	4	63,4225	0,1782	49,7318	0,7481
Exchange Rate	3	57,2273	0,3563	39,3344	0,933
World Imports	6	2,0261	1	41,0676	0,9023
Producer Price	4	69,5416	0,0757	54,1325	0,4693
Competitors Price	4	60,7022	0,2471	17,2438	1
$\frac{CompetitorsPrice}{ProducerPrice}$	3	61,185	0,2358	20,4149	1

The number of lags is obtained by minimizing the Bayesian criteria for each variable and each individual, and then taking the average for each variable.

7.3 Cointegration test

Table 4: Pedroni cointegration test

panel v-stat	2.33939
panel rho-stat	-8.58166
panel pp-stat	-11.87111
panel adf-stat	-3.18544
group rho-stat	-8.53852
group pp-stat	-14.73760
group adf-stat	-0.75360

Results for 27 individuals and 61 time periods, for a cointegration relationship between the volume of exports (dependent variable) and four regressors : the volume of GDP, the exchange rate, world imports, and the ratio competitor price/producer price. All statistics are distributed N(0,1) under null of unit root or no cointegration

Table 5: Descriptive Statistics

Country	Foreign currency borrowing	Financial Development	External Dependence
Argentina	0.08	0.15	0.26
Australia	-	0.79	0.27
Brazil	0.04	0.27	0,28
Canada	0.02	0.80	0.38
Colombia	0.06	0.30	0.23
Ecuador	0.03	0.19	0.17
Hong Kong	0.01	1.35	0.42
Hungary	0	0.3	0.38
Indonesia	0.04	0.47	0,23
Israel	-	0.58	0.39
Japan	-	2.06	0.56
Jordan	-	0.58	0.42
Korea	-	1.07	0.48
Latvia	-	0.10	0.26
Malaysia	0.03	1	0.46
New Zealand	-	0.83	0.23
Norway	-	0.92	0.24
Peru	0.06	0.09	0.14
Philippines	0.03	0.28	0.24
Poland	0.04	0.17	0.33
Singapore	0.07	0.8	0.53
South Africa	-	0.53	0.26
Switzerland	-	2.05	0.55
Thailand	0.05	1.02	0.37
Turkey	0.03	0.12	0.27
United Kingdom	0.01	1.12	0.48
United States	0.01	1.49	0.49

Sources : External Dependence data from Rajan and Zingales (1998). Foreign currency borrowing : authors computations from WBES (Worldbank) data. Financial Development: WorldBank.