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EXCHANGE RATES, INTERNATIONAL TRADE AND TRADE POLICIES

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EXCHANGE RATES, INTERNATIONAL TRADE AND TRADE POLICIES

by

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Abstract

The exchange rate plays an important role in a country's trade performance. Whether determined by exogenous shocks or by policy, the relative valuations of currencies and their volatility often have important repercussions on international trade, the balance of payments and overall economic performance. This paper investigates the importance of exchange rates on international trade by analysing the impact that exchange rate volatility and misalignment have on trade and then by exploring whether exchange rate misalignments affect governments' decisions regarding trade policies. The methodology consists of estimating fixed effects models on a detailed panel dataset comprising about 100 countries and covering 10 years (2000-2009). The findings of this study are generally in line with those of the recent literature in supporting the importance of exchange rate misalignment while disregarding that of exchange rate volatility. In magnitude, exchange rate misalignments result in trade diversion quantifiable in about one per cent of world trade. This paper also shows evidence supporting the argument that trade policy is used to compensate for some of the consequences of an overvalued currency, especially with regard to anti-dumping interventions. The findings of this research carry three broad policy implications. First, policymakers need to pay attention to the exchange rates of their countries and those of other countries as the effect of currency misalignments on international trade is considerable. Second, the relative valuation of currencies can explain only a small part of global trade imbalances. Adjustments in exchange rates can be only part of the solution for global rebalancing and need to be accompanied by other policy actions. Finally, strategies to avoid the resurgence of protectionist measures should include multilateral cooperation related to the stabilization of exchange rates towards their equilibrium level.

Keywords: Trade policy, international trade, exchange rate

JEL Classification: F13, F14, F31

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1. Introduction

The recent debate on persistent trade imbalances and on the resurgence of non-traditional trade restrictive measures has led to a renewed interest in better understanding the effect of exchange rates on international trade. In spite of the increasing number of studies on the topic, the actual effect of exchange rates on international trade is still an open and controversial question. The theoretical literature on the issue provides little guidance as the presumption that exchange rates directly affect trade depends on a number of specific assumptions which do not hold in all cases.

This paper contributes to understanding the relationship between exchange rates and international trade by investigating the effect of exchange rate volatility and misalignment on international trade and by exploring whether exchange rate misalignment affects trade policy decisions. The methodological framework consists of fixed effects regressions estimated on a detailed panel dataset comprising about 100 countries and covering 10 years (2000-2009).

The first aspect of the relationship between exchange rates and trade relates to exchange rate volatility. The basic argument for which an increase in exchange rate volatility would result in lower international trade is that there are risks and transaction costs associated with variability in the exchange rate, and these reduce the incentives to trade. The findings of the economic literature on this issue have evolved in the last few decades. While early studies found adverse effects of exchange rate volatility on trade (Ethier, 1973; Clark 1973; Baron, 1976; Cushman, 1983; Peree and Steinherr, 1989) subsequent studies report very small impacts (Franke, 1991; Sercu and Vanhulle, 1992). More recently, the use of refined quantitative methods resulted in more scepticism about causality of short-term exchange rate volatility on international trade (Clark, Tamirisa and Wei, 2004; Teneyro, 2006). In summary, the relationship between the two variables is most likely driven by underlining long-term policy credibility rather than the short-term causality (Klein and Shambaugh, 2006; Qureshi and Tsangarides, 2010).[1] In addition, any relation between volatility and international trade could be driven by reverse causality, in which trade flows help stabilize real exchange rate fluctuations, thus reducing exchange rate volatility (Broda and Romalis, 2010). In any case, there are several reasons why volatility is often not a critical issue for international trade. One particularly compelling argument is that the risks associated with volatile exchange rates are softened by the increasing number of financial instruments available (e.g. forward contract and currency options) that allow firms to hedge against these risks (Ethier, 1973). Another critique is related to the presence of sunk cost in exporting (Krugman, 1989; Franke 1991). The higher the fixed costs of exports are, the less responsive firms (and therefore international trade) are to exchange rate volatility. All this makes exchange rate volatility less of a critical issue for international trade. In modern cross-border transactions firms often decide to hedge against the risk in the exchange rate or to bear the cost associated with possible exchange rate fluctuations as part of their export strategy.

The second aspect of the relationship between exchange rates and international trade pertains to currency misalignments. The influence of currency misalignment on international trade is largely driven by its impact on relative import prices (Mussa, 1984; Dornbusch, 1996).[2] An undervalued currency, whether determined by exogenous shocks or by policy, increases the competitiveness of the export- and import-competing sectors at the expense of consumers and the

[1] Ozrurk (2006) provides a review of the literature on volatility. A more recent review on volatility and misalignment is provided in Auboin and Ruta (2011).

[2] Relative prices respond to exchange rate movements at least in the short run. In the long run, with no market distortions, relative prices return to their equilibrium level and thus the exchange rate has no effect on international trade or any other economic variable. However, this is largely a theoretical proposition as in practice there are many distortions which may hinder the adjustment of relative prices.

non-tradable sector (Frieden and Broz, 2006). In this regard, the effects of misaligned currency on prices are similar to those of an export subsidy and import tax. The literature on the topic provides a great amount of evidence on how responsive trade flows are to changes in relative prices consequent to movements in exchange rates (Hooper and Marquez, 1995; Bernard and Jensen, 2004). Still, as in the case of volatility, there are a number of issues that greatly complicate the relationship between exchange rate misalignment and international trade (Staiger and Skyes, 2010). Of particular importance is the issue that part of the undervaluation or overvaluation of the exchange rate is often absorbed by firms which do not fully adjust their price in the destination country (Goldberg and Knetter, 1997). Related to this is the presence of irreversible sunken costs of entry which act as powerful incentives for firms to stay in the market even when there is substantial undervaluation of the importer currency (Baldwin, 1988; Froot and Kemperer, 1989). Finally, vertical integration and the role of production networks (the presence of a large share of imported inputs) make currency misalignment less important (Zhao and Xing, 2006).[3]

The final issue on the relationship between exchange rates and trade explored here regards the effect of exchange rate misalignments on trade policy. The rationale is that the stance of the exchange rate may indirectly affect governments' decisions regarding other policies, especially those affecting international trade.[4] The recent literature on this topic is more limited and largely focused on contingency measures. Most of the studies find that long periods of overvalued exchange rates are often associated with an increase in the use of protectionist trade policies, especially anti-dumping (Frieden, 1997; Knetter and Prusa, 2003; Irwin, 2005; Oatley, 2010).[5] Trade policy may be used to compensate for some of the effects of an overvalued currency. Domestic firms that lose competitiveness as a result of a real exchange rate appreciation may lobby for restrictive trade policies. In practice, disputes over exchange rate policies among trading partners could foster an increase in domestic political pressures and unilateral action on trade (Copelovitch and Pevehouse, 2010). In more general terms, countries may also be using trade policy as a substitute for exchange rate overvaluation, so as to deal with persistent disequilibria in the trade balance.

The main findings of this paper can be summarized as follows. First, exchange rate volatility does not affect international trade except in the occurrence of currency unions and pegged exchange rates. That is, any relationship between the volatility and trade variables is most likely driven by the underlining long-term policy credibility provided by currency unions and pegged exchange rates rather than short-term volatility itself. The second finding is that exchange rate misalignments do affect international trade flows in a substantial manner. Currency undervaluation is found to promote exports and restrict imports and conversely in the case of overvaluation. In magnitudes, misalignments across currencies result in trade diversion quantifiable in about one per cent of world trade. Finally, this paper finds some evidence supporting the argument that trade policy is used to compensate for some of the repercussions of an overvalued currency. However, the policy response seems to be largely restricted to anti-dumping interventions. The evidence of a response in terms of slower overall tariff liberalization in periods of currency overvaluation is small.

[3] A large number of studies have also focused on the relationship between exchange rate misalignments and international trade in terms of competitive devaluation. The empirical literature is generally supportive in finding evidence of the effects of exchange rate misalignments on economic growth. On one hand, an overvalued currency is generally found to hamper economic growth (Gala 2008; Rajan and Subramanian, 2009). On the other hand, an undervalued currency is often found to stimulate economic growth (Rodrik, 2008; Berg and Miao, 2010, Korinek and Serven, 2010).

[4] For example, Eichengreen and Irwin (2009) suggest that protectionism in the early 1930s was at least as much a consequence of governments' exchange rate policies as a result of the collapse of aggregate demand.

[5] Fernández-Arias, Panizza and Stein (2003) examine the relationship between exchange rates and trade policy in a regional agreement context.

The remainder of this paper is organized as follows. Section 2 presents the empirical approach while section 3 presents some descriptive statistics and the econometric results. Section 4 concludes.

2. Empirical strategy

In investigating the three aspects of the relationship between exchange rates and trade, the empirical strategy takes advantage of a detailed bilateral dataset comprising trade, trade policies, and exchange rate data. Bilateral trade data originate from the United Nations COMTRADE, while primary tariff data are from UNCTAD TRAINS.[6] Data on anti-dumping are from the World Bank Temporary Trade Barriers Database (Bown, 2010), while the data utilized for the construction of exchange rate indices originate from the Penn World Tables and OANDA.[7]

The estimating framework for assessing the effect of exchange rate volatility and misalignment consists of an econometric model where a set of fixed effects controls for all the determinants of trade flows normally included in gravity model specifications. The relationship between exchange rate appreciation and trade policy is similarly explored with a fixed effects model. Before entering into the details of the estimating frameworks some discussion on the variables of interest is in order.

2.1 Measurement of exchange rate and trade policy variables

Although there is voluminous literature on exchange rate volatility, there is no consensus on how to measure it. Volatility measures vary from simple deviations from an average level, to more sophisticated econometric estimations following co-integration methods (Lothian and Taylor, 1997).[8] This paper utilizes the commonly used measure where bilateral exchange rate volatility is measured as the standard deviation of the first difference of the monthly exchange rate.[9] More formally, exchange rate volatility between countries *k* and *j* in year *t* is given by:

$$ERvol_{kjt} = std.dev.[\ln(ER_{kjt,m}) - \ln(ER_{kjt,m-1})]$$

where *ER* is the nominal exchange rate and *m* denotes months.[10] A value of $ERvol_{kjt}$ equal to zero implies no volatility as in the case of a fixed exchange rate regime. The standard deviation is calculated over a one-year period so as to measure short-run volatility. The aggregated volatility at the country level is simply the trade weighted average of bilateral volatility. This indicator is commonly referred to as the effective volatility of a country's exchange rate.

As with volatility, there are several methods to measure exchange rate misalignment. Since misalignment is simply the difference between the observed exchange rate and its estimated

[6] Both trade and tariff data are available through the WITS portal (wits.worldbank.org)

[7] Historical data on nominal exchange rates are available at www.oanda.com.

[8] Moreover, exchange rates may be endogenous as central banks may try to stabilize the exchange rate against main trading partners. To correct for this endogenous element, some of the measures of volatility use a conditional variance approach which allows for more information than the simple standard deviation method (Karolyi, 1995).

[9] Rose (2000) and Tenreyro (2003).

[10] Often volatility is estimated in real rather than nominal terms. Empirically, it does not make much of a difference whether using real or nominal exchange rates as the measures are highly correlated in the short term.

equilibrium level, the key issue is how to calculate the equilibrium exchange rate. Measures of the equilibrium exchange rate vary from simple approximations to complex estimates which take into account various possible determinants. The simplest measure of misalignment consists of the percentage difference of the observed level of the currency to its level in a reference period. This measure is clearly subject to the choice of the reference period and thus is more appropriate to measure appreciation or depreciation trends rather than misalignment itself. More common measures of misalignment utilize currency deviations from its purchasing power parity (PPP) value. The PPP approach can be refined to various degrees as in the case of the fundamental equilibrium real exchange rate (FEER).[11] In general, the measurement of exchange rate misalignment is a controversial issue. Even the more sophisticated estimates are subject to critiques, as any estimate would depend on the estimating period and the included set of determinants.[12]

For the purpose of this paper, the measure of exchange rate misalignment follows a relatively simple PPP approach (Rodrik, 2008). This method consists of three steps. First, the real exchange rate term is computed as the nominal exchange rate divided by the PPP conversion factor. In more formal terms:

$$\ln(RER_{kt}) = \ln(ER_{kt} / PPP_{kt})$$

where as before *k* denotes the country and *t* is time. When the RER exceeds one, it implies that the currency is valued below what is indicated by its purchasing power parity. Second, to calculate the level of misalignment the RER needs to be confronted with the fact that price levels of non-traded goods are correlated with the country's level of development (the Balassa-Samuelson effect). This is taken into account by regressing the RER on per capita GDP (GDPPC), or more formally:

$$\ln(RER_{it}) = \alpha + \beta \ln(GDPPC_{it}) + \phi_t + u_{it}$$

where ϕ_t is time-fixed effects and u is an error term. Then, the measure of misalignment is given by the difference between the observed exchange rate and the exchange rate adjusted for the Balassa-Samuelson effect. The level of undervaluation or overvaluation between two countries is then approximated simply by adding the respective levels of misalignments.[13] This variable is labelled Mis_EXrate_{kjt}.

In regard to trade policy variables, this paper utilizes two variables for capturing trade policy changes. The first variable is change in the level of the overall tariff structure. The argument for linking this variable to the exchange rate is that countries whose currency is appreciating would be less inclined to pursue trade liberalization as the overvalued currency already exposes domestic industries to increased foreign competition. The overall level of tariffs is measured by the tariff trade restrictiveness index (TTRI) calculated by Fugazza and Nicita (2011) and based on the work of Kee, Nicita and Olarreaga (2008 and 2009).[14] In the construction of the TTRI, the aggregation across products uses import demand elasticities to take into account the fact that the imports of

[11] The FEER approach is the method favoured by the IMF. However, their statistics on misalignment are strictly confidential and not publicly available.

[12] Determinants in the estimation of the FEER often include terms of trade, output per worker, government spending, net foreign assets and openness (Froot and Rogoff, 1995).

[13] In the calculation of exchange rates the reference currency is the United States dollar.

[14] The authors show that the calculation of the MTRI can be greatly simplified in a partial equilibrium setting so as to take into account only own price effects, while ignoring cross price effects on import demand (Feenstra, 1995). In doing so, the OTRI can be calculated as a weighted average of the levels of protection (tariff and non-tariff measures) across products where the weights are functions of import shares and import demand elasticities.

some goods may be more responsive to an overvalued exchange rate.[15] In formal terms, the TTRI faced by country *j* in exporting to country *k* is:

$$TTRI_{jkt} = \frac{\sum_{hs} x_{jkt,hs} \varepsilon_{jk,hs} T_{jkt,hs}}{\sum_{hs} x_{jkt,hs} \varepsilon_{jk,hs}}$$

where *x* indicates exports from country *j* to country *k*, ε is the bilateral import demand elasticity, *T* is the bilateral applied tariff, and *hs* are HS 6-digit categories. The TTRI reflects any preferential tariff imposed and faced by each country.

The second measure of trade policy is related to anti-dumping (AD). The hypothesis is that firms may lobby a government to initiate an anti-dumping investigation to counteract some of the effect of a trading partner's undervalued currency. In such cases, one would expect an increase of anti-dumping investigations when the misalignment between two currencies increases. The trade policy variable thus consists of the number of anti-dumping cases initiated during the year.[16] This variable is labelled $ADPolicy_{jkt}$.

2.2 Estimating frameworks

In order to test the relationship between exchange rates and trade, this paper employs a simple panel analysis on a dataset covering 95 countries from 2000 to 2009. The estimating framework applies two models. The first model is suited to explain the impact of the exchange rate on the level of trade, while the second model measures the impact of the exchange rate on trade policy.[17]

The relationship between trade and exchange rate volatility and misalignment is measured by a panel gravity model where a set of fixed effects controls for all the determinants of trade flows normally included in the standard gravity model specifications. More formally, the estimation of the effect on trade due to changes in the exchange rate is based on the following specification:

$$\ln X_{jkt} = \beta_0 + \beta_1 xrate_{jkt} + \beta_2 \ln(1 + TTRI_{jkt}) + \beta_3 GDP_{jt} + \beta_4 MR_{jkt} + \omega_j + \psi_k + \varsigma_t + \theta_{kj} + \phi_{jkt}$$

where the subscript *j* denotes exporters, *k* denotes importers and *t* denotes year, and where X is the value of total exports, *xrate* denotes the variables capturing volatility ($ERvol_{kjt}$) and misalignment (Mis_EXrate_{kjt}). The TTRI controls for changes in bilateral trade policies, $\omega_j, \psi_k, \theta_{kj}, \varsigma_t$, are a set of fixed effects and ϕ_{jkt} is an error term. Multilateral resistance (Anderson and Van Wincoop, 2003) is proxied by adding multilateral resistance variables as in Baier and Bergstrand (2009) and

[15] Intuitively, products where imports are less sensitive to prices (inelastic) should be given less weight because an overvalued exchange rate would have a lesser effect on the overall volumes of trade.

[16] By using changes instead of levels, the variable accounts for the fact the some countries may be more assiduous users of AD than others.

[17] Although these two models could possibly be more efficiently estimated in a simultaneous equation model context, that is beyond the purpose of this paper. In addition, by estimating the system in two separate equations the estimates may be not efficient but are still consistent, and any misspecifications in one of the equations will not affect the results of the other.

Baier, Bergstrand and Mariutto (2010). This methodology produces consistent estimates and, contrary to using country-time effects, allows the estimation of the impact of time-varying country specific factors such as exchange rates. The model is also estimated within a specification where country-pair fixed effects are replaced by standard bilateral gravity variables (distance, contiguity, language and colonial links). This accounts for the effect of pegged currencies which otherwise would be fully captured by country-pair fixed effects.

The second model tests the hypothesis that the choice and pace of trade liberalization may also be affected by exchange rates. This model empirically explores whether exchange rate misalignment has an effect on trade policy response in terms of tariffs and anti-dumping investigations. The general estimating equation is:

$$tradepolicy_{jkt} = \beta_0 + \beta_1 Mis\_EXrate_{jkt} + \beta_2 X_{jkt} + \beta_3 GDP_{jt} + \omega_j + \phi_t + \theta_{kj} + \phi_{jkt}$$

where the subscripts are defined as above. This equation is estimated in a series of specifications where tradepolicy is measured by the TTRI ($TariffPolicy_{jkt}$) or by the number of anti-dumping investigations ($ADPolicy_{jkt}$).[18] Two additional variables, import growth (X_{jkt}) and GDP, control for other factors that may influence the demand for protection (e.g. a sudden increase in imports or a decline in GDP). Country fixed effects (ω_j) control for time-unvarying country specific characteristics and time fixed effects (ϕ_t) control for global macroeconomic shocks. Country-pair fixed effects (θ_{kj}) control for any time-unvarying bilateral factors such as PTA that may influence bilateral trade policy.

[18] As count data are generally not normally distributed, the anti-dumping specification is estimated using a negative binomial regression.

3. Results

This section first presents some descriptive statistics related to the variables of interest. Then, it discusses the econometric results on the relationships between exchange rate and international trade and trade policy.

3.1 Descriptive statistics

Figures 1a and 1b show the distribution of effective short-term exchange rate volatility[19] for each of the years between 2000 and 2009 and then for each currency across years.[20] As monthly exchange rate data are not always available the volatility variable is calculated only for 68 countries. Overall volatility bottomed during the period of 2004-2006 to sharply increase at the onset of the financial crisis. In just a few months at the end of 2008 some currencies oscillated 20 per cent or more in relation to the major reserve currencies.

Figures 1a and 1b. Exchange rate volatility, distributions by year and by country

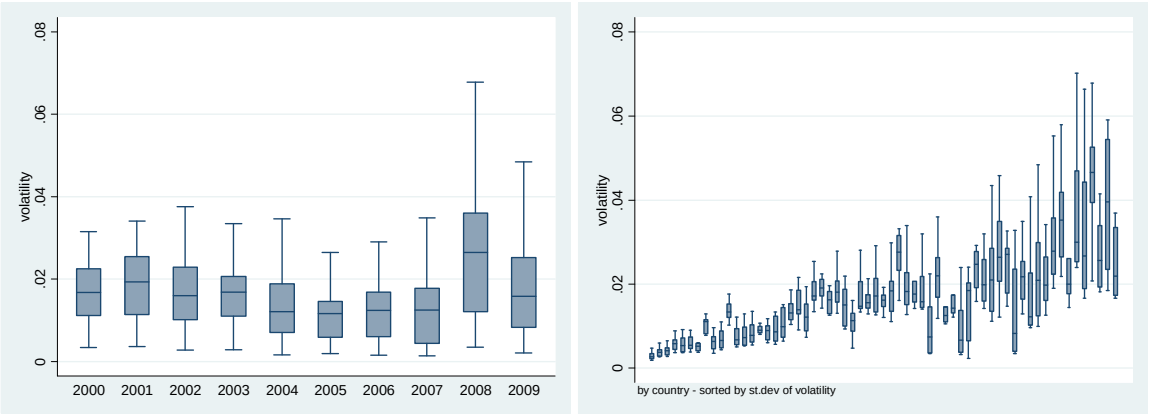


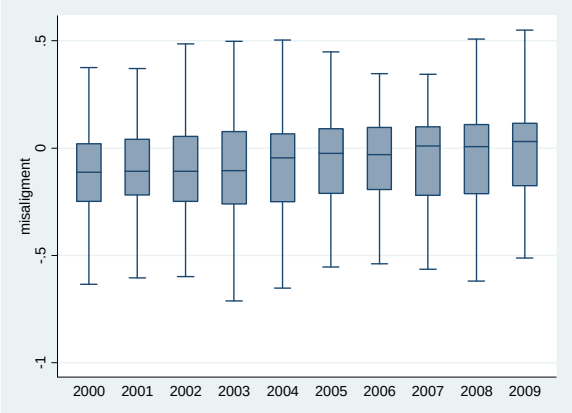
Figure 1b shows that volatility is not a common problem to all currencies, but tends to be concentrated in about half of the currencies in the sample. That is, while about half of the currencies are more or less aligned with those of their trading partners (for example, because of managed or pegged exchange rates), the other half fluctuates more widely. Currency fluctuation may be detrimental to international trade as it increases the risk of cross-border transactions.

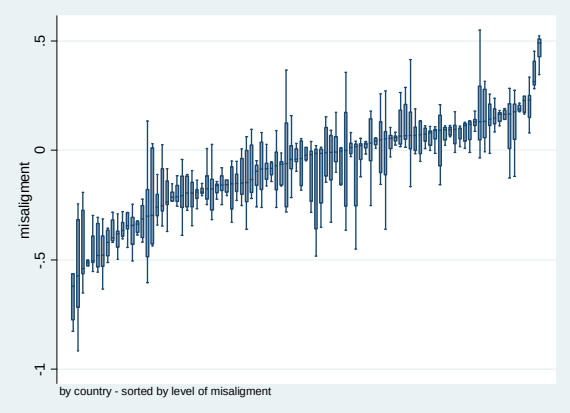
In regard to currency misalignments, figures 2a and 2b illustrate their distribution for each year during the period of analysis and for each country. For the purpose of this graph, the misalignment is not bilateral but is computed as a trade-weighted average as in the case of effective volatility. The graphs report the distribution of the average misalignment faced by the currency vis-à-vis a basket of currencies whose weight is determined by their trade importance. A value of misalignment above zero implies overall overvaluation.

[19] Short-term effective volatility is the average intra-year volatility of a currency versus all other currencies weighted by imports.

[20] For every year the box plot includes all values between the twenty-fifth and seventy-fifth percentiles, while the bar represents the median. The interval between the lines outside the box comprises observations between plus and minus 1.5 times the interquartile range which is normally used as a boundary to identify outliers.

Figures 2a and 2b. Currency misalignments, distributions by year and by country

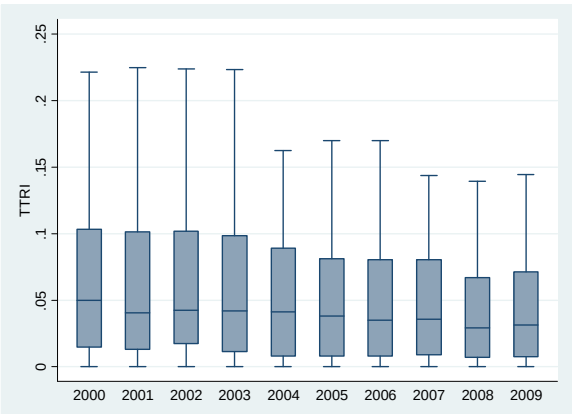


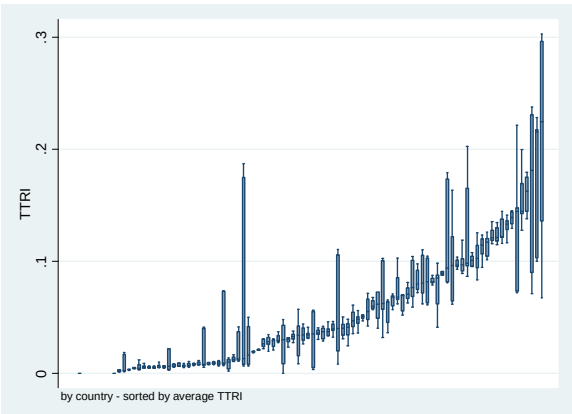


The first insight regarding misalignment is that currencies are generally not very aligned to their respective purchasing power parity level (especially in 2003, 2004 and the last two years of the analysis). A second insight is that while in the earliest years the majority of currencies were undervalued, the latest years show a trend towards a more fair valuation.[21] A third insight is that between 2000 and 2009 only a limited number of currencies maintained a relatively stable, but not necessarily aligned, valuation. For most currencies, their levels of valuation fluctuated substantially during the period of analysis. For about half of the currencies analysed here, their valuation alternated between overvaluation and undervaluation. About 30 per cent of currencies remained within undervalued levels, while about 20 per cent remained constantly overvalued.

In relation to trade policy, figures 3a and 3b illustrate the distribution of the TTRI for each year and then for each country. Tariff restrictions have been progressively reduced during the period of analysis. The average TTRI across countries went from about 5 per cent for 2000 to about 3 per cent for 2009. Such liberalization has been the result both of unilateral reductions of MFN tariffs as well as the increasing number of bilateral and regional trade agreements. At the country level, tariff liberalization has occurred in most of the countries in the analysis, especially in those where tariffs were higher to start with.

Figures 3a and 3b. Tariff trade restrictiveness index, distributions by year and by country





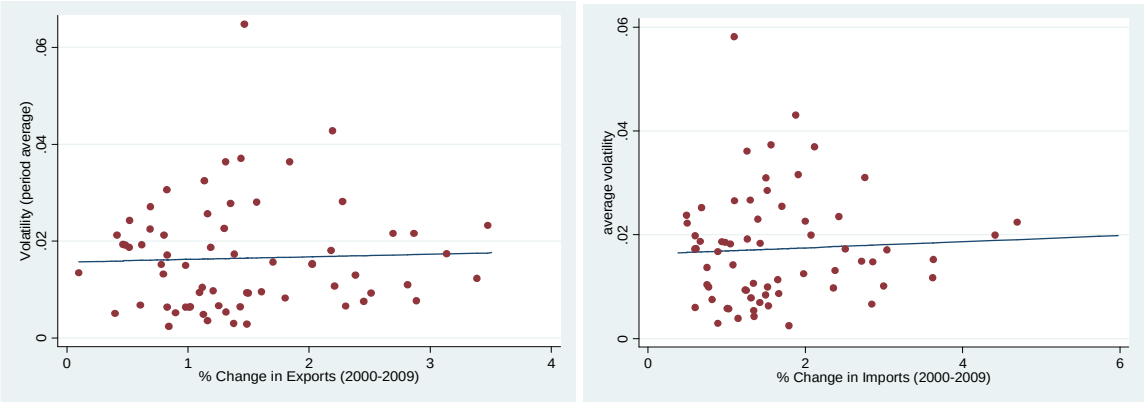
[21] Given the economic turmoil of 2008 and 2009, this may seem surprising. However, this trend is largely a result of the progressive depreciation of the United States dollar.

With regard to anti-dumping, the analysis is based on data available for 33 countries (with the European Union counting as one). The average number of anti-dumping investigations initiated each year is about 255. The use of anti-dumping was more frequent in the early years of the analysis and bottomed out in 2008, to later rebound in 2009. Although the use of anti-dumping procedures has spread, it is largely concentrated in a few countries. The 5 most intensive users account for more than half of the initiations, while 10 countries account for more than three quarters.

Next are some simple figures on the cross-country correlation between exchange rate variables and import, export and trade policy. As a cautionary note, the analysis presented in this section is purely illustrative as it does not control for other determinants that may influence the exchange rate and/or trade. More compelling evidence on causality is presented in the discussion of the econometric results.

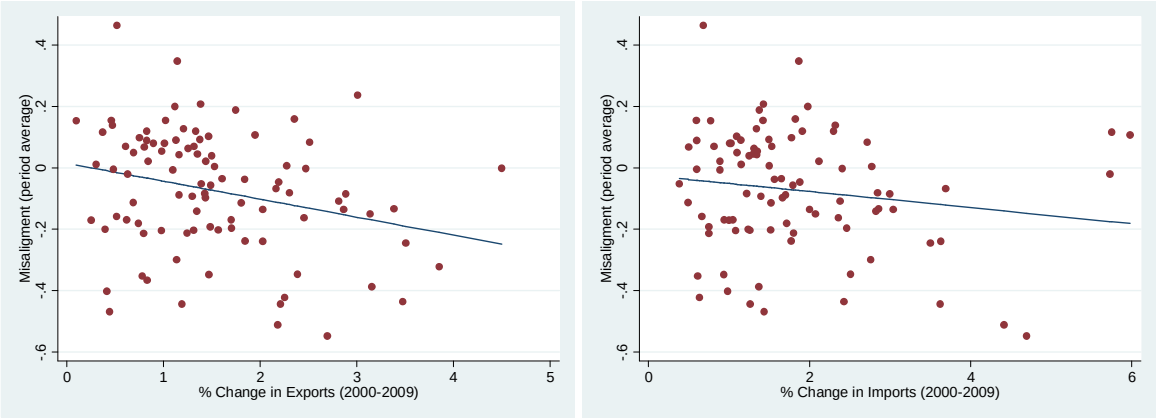
To start with exchange rate volatility and trade, it should be recalled that effective volatility provides an indication of the stability of a currency with respect to the currencies of trading partners. One would expect that countries whose currencies are more volatile would engage in less trade because volatility increases trade costs. However, the cross-country correlation between effective volatility and the export or import growth in figures 4a and 4b does not seem to support this hypothesis. In practice, countries whose currencies have been more volatile do not seem to have had lower rates of growth both in terms of imports and exports.

Figures 4a and 4b. Exchange rate volatility and international trade



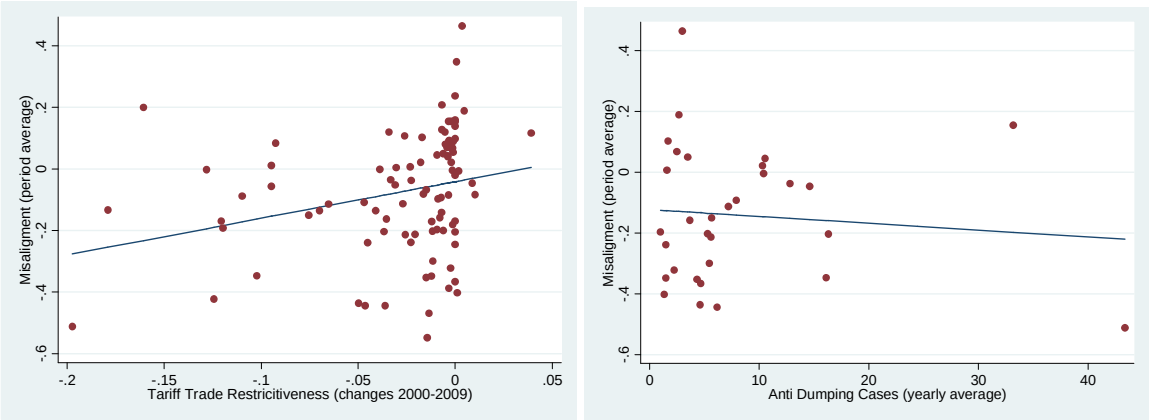
With regard to misalignment, its effect on international trade is related to the impact of the exchange rate on relative prices or tradable and non-tradable goods. Conceptually, an undervalued currency favours domestically produced tradable goods and thus protects domestic firms from imports and gives them an incentive to export. According to this principle, countries with undervalued currencies would have relatively higher exports and lower imports. The cross-country evidence illustrated in figure 5a seems to support the argument that undervalued currencies promote exports, because exports have grown relatively more in countries whose currencies have remained undervalued. On the other hand, figure 5b suggests a weaker but still positive relationship between undervaluation and import growth. This is counterintuitive, as one would expect a negative correlation because undervaluation is expected to act as a tax on import, and thus lower imports rather than raise them. One possible explanation is that the positive correlation between exports and undervaluation pass spreads also on imports because increases in exports have to be supported by increases in intermediate inputs. Although this argument may not be relevant to all countries, it may be sufficient to explain the weaker positive correlation in figure 5b.

Figures 5a and 5b. Exchange rate misalignment and international trade



With regard to the relationship between exchange rates and trade policy, figures 6a and 6b plot the average misalignment against the TTRI and the number of anti-dumping investigations. Countries with overvalued currencies may find it more difficult to pursue trade liberalization. The rationale is that some countries may resist trade liberalization in order to counteract the surge in imports caused by an overvalued currency. This argument is supported by figure 6a, which shows that countries with overvalued currencies have liberalized tariffs relatively less.

Figures 6a and 6b. Exchange rate misalignment and trade policy



With regard to anti-dumping, the argument is similar to that of tariffs. Countries with an overvalued currency may be more willing to use anti-dumping procedures to defend their domestic industries. This argument is not substantiated by the raw data of figure 4b in which the weak negative correlation is largely driven by two outliers. There is no conclusive evidence that countries with undervalued or overvalued currencies are keener to use anti-dumping to counteract the effect of currency misalignment.

3.2 Econometric results

Although informative, the relationships between exchange rates and trade presented in section 3.1 are primarily for illustrative and preliminary purposes rather than for establishing causality. To better infer the effects of exchange rates on international trade and trade policy, one needs to control for the multitude of determinants that may influence the variables of interest. This is done here by econometrically estimating the relationship between the exchange rate and

international trade according to the models presented in section 2.3. The purpose of the econometric estimation is to explore whether bilateral trade is affected by changes in the volatility and misalignment between two currencies once all other determinants of trade have been adequately controlled for. In practice, what matters for better assessing causality is not so much the cross-country evidence but rather to what extent periods of exchange rate overvaluation or volatility – within each country – are associated to lower trade or slower trade liberalization.

Table 1 reports a series of specifications where the level of bilateral trade is regressed against the policy variables discussed above. These specifications are quite accurate in isolating the effects of exchange rate variables on international trade as a series of fixed effects control for cross-country variations, time-specific factors and time-unvarying bilateral factors that could influence the level of trade. The change in trade policy is controlled for by the TTRI variable. Fixed effects also control for the endogenous nature of the exchange rate to trade (a country may be willing to pursue a more stable exchange rate with a major trading partner). This empirical approach provides an identification strategy to measure the effects of exchange rates on trade.

Specifications (1), (2) and (3) report the results where the level of trade (exports) is regressed on the two exchange rate variables (bilateral volatility and bilateral misalignment), controlled for trade policy, multilateral resistance and a full set of fixed effects (importer, exporter, time and country pair). The results indicate that short-term volatility does not have a significant impact on trade, while misalignment does. The negative coefficient on the misalignment term implies that exports decline when currencies become more overvalued. The results remain qualitatively similar when the two variables are used simultaneously. Note that the level of misalignment matters even when the model is estimated on the much smaller sample for which the volatility variable could be computed. This suggests that the significant effect of misalignment on trade is not driven by minor currencies.

Table 1. Exchange rates and trade flows

dependent variable - log of exports

	(1)	(2)	(3)	(4)	(5)	(6)
Log Gdp Importer	0.776***	0.770***	0.783***	0.676***	0.703***	0.684***
	(0.069)	(0.057)	(0.069)	(0.081)	(0.066)	(0.081)
Log Gdp Exporter	0.671***	0.562***	0.666***	0.588***	0.509***	0.583***
	(0.097)	(0.071)	(0.097)	(0.105)	(0.080)	(0.105)
Log distance				-1.176***	-1.290***	-1.176***
				(0.010)	(0.008)	(0.010)
Common Border				0.0439	0.319***	0.044
				(0.036)	(0.035)	(0.036)
Colonial Links				0.482***	0.478***	0.482***
				(0.032)	(0.030)	(0.032)
Common Language				0.565***	0.631***	0.565***
				(0.023)	(0.020)	(0.023)
Misaligment		-0.101***	-0.0781**		-0.104***	-0.0767**
		(0.027)	(0.032)		(0.028)	(0.031)
Volatility	-0.377		-0.381	-1.797***		-1.802***
	(0.318)		(0.317)	(0.459)		(0.459)
Log (1+TTRI)	-1.084***	-0.917***	-1.080***	-1.517***	-1.466***	-1.514***
	(0.237)	(0.183)	(0.237)	(0.143)	(0.103)	(0.143)
Observations	38318	64770	38318	38318	64770	38318
Adjusted R^2	0.427	0.355	0.427	0.858	0.826	0.858

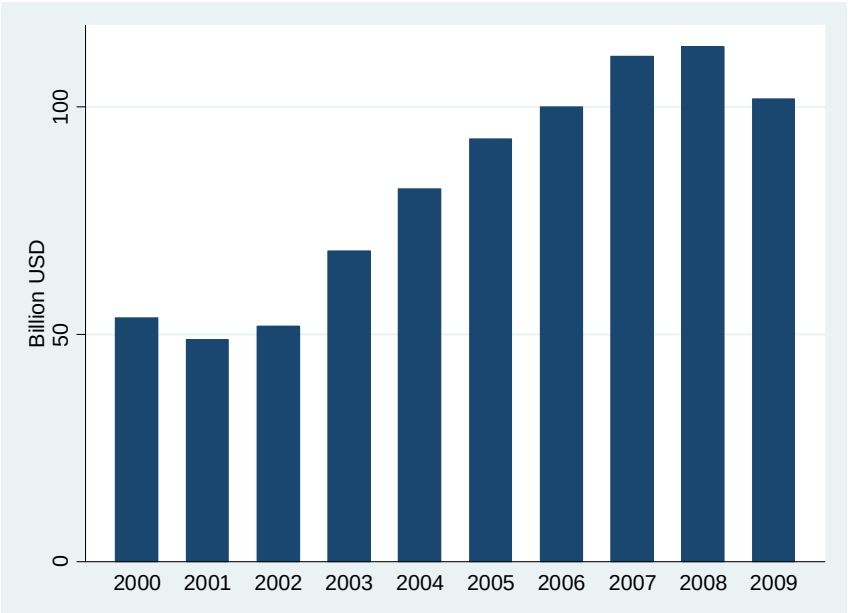
Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Specifications (4), (5) and (6) report the same model but with the country pair fixed effects replaced by the four standard gravity variables (distance, shared border, colonial links and common language). Although these variables cannot control as well as fixed effects for bilateral trade determinants (and for the possible endogenous nature of the exchange rate variables to trade), it is important to also estimate the model in this manner. The main reason is that the use of country pair fixed effects cancels the effect of perfectly aligned exchange rates (currency unions and fully pegged exchange rates that were in force during the entire period of analysis). Thus, removing country pair fixed effects allows unvarying exchange rates to weigh in the estimation of the coefficients. While the results on misalignment remain virtually unchanged, the econometric results point to a strong significance of the volatility term. This suggests that volatility is important only when there is none, as in the case of currency unions or completely pegged exchange rates. However, this strong result is more likely driven by long-term policy commitments related to currency union and pegged exchange rates rather than by short-term volatility. In practice, the actual effect of volatility on trade is that of specification (3), which indicates no significant causality. The model of table 1 is estimated on exports. Symmetric results for misalignment are found when the model is estimated on level of imports. In this case, misalignment is positively correlated with imports. All in all, the results are supportive that currency overvaluation results in higher imports and lower exports. The opposite is true for undervalued currencies.

These econometric results can be used to provide an approximation of the aggregate impact of exchange rate misalignment on trade diversion. The overall impact of misalignment on world trade is measured by multiplying for each country pair the measure of misalignment, the respective level of trade and the relevant coefficient. The figures are based on the results of specification (3) of table 1. The impact is illustrated in figure 7 which shows the effect of overall currency misalignments on international trade for each year. In practice, the figure is to be interpreted as the value of world exports that is diverted from countries with overvalued currencies to countries with undervalued currencies. Note that this is an incomplete approximation of the overall effect of misalignments on world trade as it does not take into account trade disruption (part of the effect of misalignment on trade is not diverted but internalized by the domestic economy).

Figure 7. Overall trade diversion effect of exchange rate misalignments



The trade diversion effect of misalignment is quantified in slightly less than 1 per cent of world trade and varies between US$50 billion in the 2000-2002 period to almost US$120 billion in 2008. In other words, a completely aligned exchange rate system would shift about US$120 billion of exports from countries with undervalued currencies to ones with overvalued currencies.

Table 2 reports the results on the relationship between trade policy and exchange rate misalignment. Specifications (1) to (2) report the results testing for the hypothesis that a misaligned exchange rate may affect trade policy. Specifications (3) and (4) report the results of exchange rate misalignment on anti-dumping.

Table 2. Exchange rate misalignment and trade policy

dependent variable - Log (1+TTRI)

	(1)	(2)	(3)	(4)
Log Trade Value		-0.0025***		0.0101***
		-(0.0002)		(0.0035)
Log Gdp Importer		-0.0202***		-0.0387
		(0.0020)		(0.0534)
Misalignment	0.0016*	0.0016*	0.16***	0.17***
	(0.0009)	(0.0009)	(0.0264)	(0.0265)
Observations	65068	65068	18466	18466
Adjusted R^2	0.629	0.632	0.262	0.275

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In specification (1) the TTRI is regressed on misalignment and a series of fixed effects. Country and time fixed effects control for country characteristics and global economic shocks. Country pair fixed effects control for bilateral factors which may affect trade policy (e.g. RTAs and import composition). The coefficient on misalignment has a positive sign, indicating that periods of overvaluation are associated with less tariff liberalization. However, the effect of misalignment is relatively small and only marginally significant. Specification (2) shows substantially unaffected coefficients when two specific control variables (trade and GDP) are added. The signs on these variables are as expected. Trade and GDP are negatively correlated with the level of tariffs. This implies that tariff liberalization has happened relatively more slowly when trade or GDP has declined. In summary, the results suggest that exchange rate overvaluation is related to less tariff liberalization; however this evidence is not very strong. In magnitude, the average impact in terms of slower tariff liberalization is about 0.1 per cent.

Specifications (3) and (4) report the results on the effect of exchange rate misalignment on the number of anti-dumping investigations initiated. As this is a count variable, the relationship between the two variables is estimated with a negative binomial model. The results indicate a strong relationship between misalignment and anti-dumping. Periods of exchange rate appreciation are positively related to the number of anti-dumping investigations. This outcome remains unchanged when the two control variables are added in specification (4). As expected, the number of anti-dumping investigations is also found to increase with imports but not with GDP.

On the whole, there is evidence that exchange rate overvaluation impacts the choice and the pace of trade policy. However, its effect seems to be largely restricted to anti-dumping. The effect of overvaluation on tariff liberalization is more muted.

4. Conclusions and policy implications

This paper investigates the extent to which the exchange rate affects international trade and trade policy. The analysis is based on the econometric estimation of fixed effects models utilizing a bilateral dataset of trade flows, exchange rates and trade policy for about 100 countries comprising a period of 10 years.

The findings of this paper are generally in line with those of the recent literature supporting the importance of exchange rate misalignment while disregarding that of exchange rate volatility. In more detail, the results indicate that exchange rate misalignments do affect international trade flows in a substantial manner. Currency undervaluation is found to promote exports and restrict imports, while the converse holds in the case of overvaluation. In magnitude, misalignments across currencies result in trade diversion quantifiable in about 1 per cent of world trade.

With regard to volatility, the analysis indicates that exchange rate volatility is probably not a major policy concern. From the perspective of enhancing trade, the effects of lower volatility are indirect, and originate from long-term exchange rate commitments such as currency unions and pegged exchange rates rather than short-term exchange rate fluctuation. The limited importance of exchange rate volatility is possibly related to the increasing availability of financial instruments to hedge against exchange rate risks (e.g. forward contract and currency options) and to the increasing share of intra-industry trade.

This study also finds evidence supporting the argument that trade policy is used to compensate for the effect of an overvalued currency. However, the policy response seems to be largely restricted to anti-dumping interventions. The evidence of a response in terms of a slower pace in tariff liberalization is more muted. Although this correlation should be better investigated, if confirmed it may have repercussions for the multilateral trade liberalization process, as large exchange rate misalignments may reduce the incentives to remove existing trade barriers. Of greater concern is that those results imply that persistent exchange rates misalignments may increase incentives to recur to non-traditional protectionist policies.

More generally, this research carries three broader policy implications. First, whether determined by exogenous shocks or by policy, policymakers need to pay attention to exchange rates of their countries and those of other countries as the effect of currency misalignments on international trade is considerable. This implies that countries should monitor their exchange rate relative not only to that of their trading partners but also in relation to that of their competitors. Second, exchange rate misalignments cannot explain the full extent of global imbalances. Therefore, exchange rate adjustment can be only part of the solution for global rebalancing and needs to be accompanied by other policy actions. Finally, strategies to avoid the resurgence of trade protectionist measures should include multilateral cooperation related to the stabilization of exchange rates towards their equilibrium level.

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