



## Macroeconomy, Economic Bias & Employment

### The Effect of Exchange Rate Volatility on Trade and Employment: A Brief Review of the Literature

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**June 2005**



**THE EFFECT OF EXCHANGE RATE  
VOLATILITY ON TRADE AND  
EMPLOYMENT: A BRIEF REVIEW OF  
THE LITERATURE**

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**Employment Growth & Development Initiative  
Human Sciences Research Council**

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## **1. Introduction**

The explanation of the factors determining the volatility of exchange rates is interesting but, from the practical and policy perspective of this project, it is not an end in itself. The more important questions in this regard are what the effect of exchange rate volatility is on the real economy. Two main areas of concern are evident from international research in this area: the relationship between exchange rate volatility on international trade and on employment or unemployment in the countries concerned.

Although for the most part these concerns have been researched separately, the findings in one area have implications for research in the other. For example, if the evidence suggests that exchange rate volatility has only a small effect on international trade, then this weakens the case for a strong effect of volatility on employment since changes in the trade balance are the channel via which changes in exchange rates are transmitted to growth and employment.

In both areas of research there is a huge and growing number of publications. This introduction to the literature relies on published surveys of the main work and findings in each area. However, where especially pertinent or key issues are examined some individual papers are specified. Section 2 examines the relationship between exchange rate volatility and international trade while section 3 examines the effect on employment.

## **2. The effect of exchange rate volatility on international trade**

Most research has presumed a negative relationship between exchange rate volatility and international trade and empirical studies have tried to estimate the size of this drag effect on trade. However, neither theory nor empirical evidence has been able to establish a clear link in this regard. McKenzie (1999) and Cote (1994) provide surveys of the relationship between exchange rate volatility and trade that try to explain this apparent paradox.

*Theory.* The standard model assumes a risk-averse exporting or importing firm. Increased volatility in the exchange rate is assumed to result in increased uncertainty by such firms about future profitability. The greater such uncertainty is, the less the supply of exports (or the demand for imports) and hence the negative relationship between volatility and the volume of international trade.

Early models deriving this relationship include Ethier (1973) and Clark (1973). Even at this early stage an important distinction is made between uncertainty about the exchange rate and uncertainty about profitability. Ethier's model includes hedging in the forward exchange market and uncertainty about the exchange rate determines the demand for forward cover but does not necessarily affect the level of trade. The level of imports is affected negatively only if it is assumed that the firm is unable to determine its profitability at different exchange rates. Hooper and Kohlhagen (1978) also develop a model in which a portion of trade is hedged in the forward exchange market such that volatility in the exchange rate only affects the portion of trade that is unhedged. Their model implies the standard negative relationship between exchange rate risk and the volume of trade.

Later research showed that the negative relationship between exchange rate variability and trade derived from the standard model depends on a number of restrictive assumptions. Relaxing these assumptions tends to weaken the negative relationship and may even result in a positive relationship. The main assumptions concern risk aversion, the extent to which transactions can be hedged, other sources of risk to the firm besides exchange rate variability, and the potential to profit from changes in exchange rates.

De Grauwe (1988) shows that the assumption of risk aversion is not sufficient to establish the negative relationship between changes in the exchange rate and trade. He demonstrates that the results obtained by Hooper and Kohlhagen (1978) depend on the assumption of constant absolute risk aversion. De Grauwe constructs a utility function which depends on the degree of risk aversion by exporters. Mildly risk-averse traders reduce their supply of exports as exchange rate risk increases, as in the standard models. However, very risk-averse firms want to avoid a collapse in revenues from the worst possible exchange rate outcome and thus their desired supply of exports increases as exchange rate risk increases. In other words, changes in exchange rate risk have both a substitution and an income effect on the volume of trade. The



net result depends on the degree of risk aversion of the traders populating the utility function. Other papers showing how the effect of exchange rate variability on trade depends on the risk aversion properties of the traders in the model include Dellas and Zilberfarb (1993) and Giovannini (1988).

Models that include the possibility of hedging transactions in the forward exchange market generally show little effect of exchange rate volatility on trade, although there are some important exceptions, such as Viaene and de Vries (1992). Moreover, hedging is not costless and the effective time-horizon of such facilities is normally less than a year. Manufacturing firms that have sales contracts extending over longer periods may find it more difficult to hedge their transactions.

However, it should also be recognised that for many firms exchange rate risk may be a relatively small and easily diversifiable risk. For example, changes in domestic production costs and prices may be partially offset by changes in nominal exchange rates in which case exchange rate volatility would have less effect on the firm's profitability. In this regard, Cushman (1983) shows that lower nominal exchange rate volatility could actually increase real exchange rate volatility and profit risk if it results in deviations from purchasing power parity.

The insulating effect of changes in nominal exchange rates on profitability is important from a local perspective. The bulk of our commodity exports are denominated in US dollars and the nominal exchange rate tends to move in the opposite direction to commodity prices. Thus when commodity prices decrease (increase) the profits of commodity producers are stabilized by a depreciation (appreciation) of the rand (see Gidlow 1987). Thus, a fixed rand exchange rate might lower nominal exchange rate risk but this would not necessarily lower the total risk (price risk and exchange rate risk) faced by exporters.

Various researchers have pointed out that exchange rate volatility presents the opportunity to make profits as well as the risk of losses. This is the case if one relaxes the standard model assumptions of disallowing production and exports to vary in response to changes in the exchange rate. Franke (1991) and Sercu and Vanhulle (1992) develop models showing how an exporting firm can benefit from increased exchange rate volatility and risk. The key to this result is that the firm faces various transactions costs or frictions that alter its response to changes in exchange rates. Franke's (1991) model assumes entry and exit costs which on average lead firms to enter sooner and exit later, and thus for the number of trading firms to increase as exchange rate variability increases. These findings appear counterintuitive as they imply a positive hysteresis effect. Hysteresis effects in international trade are generally thought to reduce the number of trading firms and the volume of trade.

To summarise, there are no clear theoretical implications regarding the relationship between exchange rate volatility and trade. The size and even the direction of the relationship depend on the assumed characteristics of the firm built into the model. With this in mind, more recent research has relied on a more disaggregated sectoral approach to empirical work.



*Empirical studies.* If the conclusions of theoretical models of the relationship between exchange rate volatility and trade are ambiguous, then empirical studies of the relationship are even more so. The main reason for this is that in addition to the theoretical question of how to model the relationship, there are various technical issues at the empirical level that remain unresolved. The most important of these is how to measure risk. As Cote (1994: 13) puts it “What is the best proxy for the uncertainty and adjustment costs that traders face as a result of exchange rate movements?” This question concerns the measurement of the exchange rate itself (that is, whether bilateral, effective, nominal or real exchange rates should be used) and the best way to measure the risk faced by the firm (that is, short-run versus long-run time horizons, *ex ante* or *ex post* variables, and changes in the trend of the exchange rate versus changes around the trend).

Farrell, De Rosa and McCowan (1983) and the IMF (1984) contain detailed surveys of the early empirical work. They conclude that the majority of the studies are unable to establish a systematically significant link between measured exchange rate variability and the level of trade. The more disaggregated studies on bilateral trade and exchange rates are a little more supportive of the hypothesized negative relationship. Cote (1994: 15) notes that these early studies include relatively few observations on the floating exchange rate period. Empirical studies published between 1978-88 include more observations under floating exchange rates. However, the evidence remains inconclusive with the aggregate studies producing contradictory results. The sectoral studies, although there are fewer of them, provide somewhat more support for the negative hypothesis. But although statistically significant, the size of the effect is small.

Cote (1994) surveys more recent empirical work published between 1988-93. She notes that the results of the different studies are difficult to compare since the sample period, countries and risk measures vary significantly. However, she concludes with the earlier surveys above that the evidence on the effect of exchange rate volatility on trade is mixed. Although a majority of the studies seem to find in favour of the negative hypothesis that exchange rate volatility depresses trade, in most cases the size of the effect is small. Some studies find evidence of a positive effect of exchange rate variability on export volumes (for example, Asseery and Peel 1991; Kroner and Lastrapes 1993).

Cote notes that the absence of a strong effect may be due to the reliance on aggregate data in most studies (although the only study she surveys using sectoral trade volumes also produces an insignificant result). A practical difficulty here is in obtaining good quality disaggregated data. Finally, Cote also points out that exchange rate volatility might only affect trade volumes indirectly by influencing investment location decisions. If so, then the lag between changes in exchange rates, production capacity and trade volumes would be a long one and difficult to detect.

A later survey by McKenzie (1999) echoes the conclusions by Cote (1994) both as regards theory and empirical evidence: “A general conclusion to be drawn from the literature is that a fundamental unresolved ambiguity exists. At the theoretical level, researchers have been able to construct models which show how exchange rate volatility may exert a positive or negative impact on trade. *A priori*, one cannot immediately establish the superiority of one class of model over the other. The



empirical literature contains the same mixed results as the evidence provided by world trade data most commonly fails to reveal a significant relationship. However, where a statistically significant relationship has been derived, they indicate a positive and negative relationship seemingly at random” (McKenzie 1999: 100).

The survey by Cote (1994) focuses on the experience in industrialised countries while the survey by McKenzie (1999) includes papers studying the evidence from the less developed countries. Although there appear to be relatively more findings supporting the negative hypothesis in the LDCs, even here there are important exceptions (for example, see Medhora 1990).

An econometric study by Arize, Malindretos and Kasibhatla (2003) of a sample of 10 LDCs (including South Africa) tested for long-run cointegration and used the error correction technique to model the short-run dynamics of the variables. They found that exchange rate volatility exerts a significant negative effect on export demand in both the short run and the long run in most of the countries studied. However, South Africa was an important exception where *positive* statistically significant exchange rate elasticities were obtained. These results were qualitatively similar whether nominal or real effective exchange rates were used and when ARCH residuals were used to measure exchange rate uncertainty.

The greater support for the negative hypothesis in the LDCs is attributed to the more limited hedging facilities and generally less developed financial services sector and infrastructure in such countries. The fact that South Africa has a relatively sophisticated foreign exchange market with a variety of hedging facilities readily available at low cost may help to explain the anomaly found in the study by Arize et al. The fact that the prices of a large proportion of South Africa’s exports are determined in world markets and denominated in dollars might also help explain why exchange rate volatility has little effect on competitiveness and the demand for such exports. An appreciation (depreciation) of the rand is at least partially associated with increases (decreases) in the world demand for and prices of commodities, especially gold. Hence it is not all that surprising that Arize et al. find a positive association between the rand exchange rate and export volumes.

McKenzie (1999) also examines more recent studies that test for the stationarity and cointegration of the time series data. The advantage of this approach is that it can detect whether there is a genuine long-run relationship between the variables concerned. The conventional OLS methodology used in the earlier studies is regarded as inadequate in this regard as it may produce spuriously significant regression estimates. McKenzie notes that recent papers using more discriminating econometric techniques such as cointegration and error correction modelling of the short run dynamics have had greater success in finding a statistically significant relationship between volatility and trade, although not necessarily the presumed negative relationship. The findings of the few cointegration studies surveyed by McKenzie are also mixed with some studies supporting the negative hypothesis (for example, Chowdhury 1993) and others the positive hypothesis (for example, Asseery and Peel 1991). The same can be said for trade models using VAR, ARCH and GARCH estimation techniques. It is too early at this stage to know whether the more

sophisticated econometric techniques and models will come up with more systematic evidence in support or one or other of the competing hypotheses.

Finally, McKenzie (1999) also notes that the evidence suggests that exchange rate volatility does not affect different markets or sectors in the same way. This argues against the use of aggregate data that may obscure a possibly significant relationship at a more disaggregated level.



### 3. The effect of changes in exchange rates on employment

Compared to the literature on the relationship between exchange rate volatility and trade, much less has been published on the effect of changes in the exchange rate on employment. The literature appears to fall into two categories: at the aggregate level the focus is on open economy macroeconomic theories in which the exchange rate is an endogenous variable. The exchange rate is both determined by, and has an influence on, the other variables in the theoretical set-up; at a more disaggregated level, empirical models try to capture the quantitative effect of changes in exchange rates in different industries or markets in particular countries, or even within specific regions of the countries studied.

*Theory.* In standard open economy models the main focus is on how macroeconomic policies might affect the levels of output and prices (or growth and inflation). Changes in employment and unemployment are linked to changes in output via a production function. They are thus passive or demand led variables in the standard models. The exchange rate is correlated with changes in output and prices brought about by changes in monetary and fiscal policies, but it is not usually modelled as an independent variable determining real output. On the contrary, the reverse direction of causation is often assumed – open economy models such as the Mundell-Fleming model and the sticky-price monetary model can be expressed either as models of the determination of output or of exchange rate determination depending on the assumptions made about the flexibility of goods and asset prices (see, for example, Sarno and Taylor 2002: 97-143).

As in theories of the closed economy, open economy macroeconomic models can be located between two extremes: models which assume that goods prices and wages are fixed and that real output (or unemployment) is an endogenous variable (for example, Keynesian and post-Keynesian); and models in which goods prices and wages are flexible and unemployment is an exogenous variable (for example, classical and new classical). These categories can be further subdivided (as in parentheses) depending on assumptions about expectations and the information efficiency of various markets. Depending on the precise mix of assumptions built into such models, they have vastly different implications as regards the relationship between exchange rates and employment. As a rule of thumb, the greater the assumed degree of price and wage flexibility and the more rationality imparted to expectations in such models, the less is the scope for any trade-off between nominal variables such as the exchange rate or inflation and real variables such as output and employment.

Hybrid models such as the standard open economy AD-AS model can accommodate short-run trade-offs between inflation and output (and hence between changes in the real exchange rate and employment) but without any real changes in the long run. However, as noted above, the exchange rate is not regarded as an independent ‘policy’ variable in such models. For example, in the AD-AS model an easy monetary policy increases aggregate demand which leads to a temporary increase in real output and a

depreciation in the national currency. Thus short-run changes in the exchange rate and output are correlated but this is not primarily a causal relationship. The main reason for the increase in output is the increase in gross domestic expenditure resulting from the lower interest rate. Depending on the price elasticities of demand for exports and imports the depreciation may improve the trade balance and, via the foreign trade multiplier, contribute to the increase in output in the short run. However as expected prices rise to match the increase in actual prices, the long-run equilibrium remains unchanged at the natural rate of output and the same real interest rate and exchange rate as before.

Obstfeld and Rogoff (1995) is regarded as a seminal study in the new open-economy macroeconomics. They built a two-country, dynamic general equilibrium model with micro foundations allowing for nominal price rigidities and imperfect competition. The agents in the model both produce and consume differentiated products and have identical preferences. The main focus of their paper is the effect of a monetary shock on real money balances and output. Under perfectly flexible prices they show that a permanent money shock has no real effects on output or the exchange rate, that is, money is neutral. If goods prices are sticky, Obstfeld and Rogoff show that monetary shocks can have persistent real effects on consumption, output and the exchange rate due to wealth effects from changes in the current account. However, in an appendix to their paper, Obstfeld and Rogoff show that for a small open economy this result does not hold. Unlike the two-country framework of their baseline model, in the small open economy version there are no wealth effects via the current account (which remains balanced). In the long run, money is neutral and the nominal exchange rate rises in proportion to the money stock.

Faria and Leon-Ledesma (2005) note that the usual neoclassical model of labour supply and employment determination has been based on a closed economy. They develop an open economy, optimising model where the equilibrium level of employment is a function of the real wage, real interest rate and real exchange rate. The supply of labour increases following an increase in the real wage and real interest rate and, given the neoclassical micro foundations of the model, so does the demand for labour and employment. A change in the real exchange rate has an ambiguous effect on employment as it depends on the relative strengths of the income versus substitution effects in the model. The authors hypothesize that the relationship is negative (real appreciation leads to a decline in employment). They estimate the model for the US and the UK using quarterly data for the period 1972:1 to 2001:4 and find that the results are consistent with the predictions of the model for the US but not for the UK. Thus for the US at least a real appreciation has a significant negative effect on employment. The authors also test for superexogeneity of the interest rate and exchange rate and find that the model is robust to the Lucas critique only in the case of the US.

*Empirical studies.* Mirroring the findings concerning the relationship between exchange rate volatility and trade, there are similarly ambiguous and mixed results from tests of the effects of changes in exchange rates on employment. This is to be expected since the effect of exchange rates on output is transmitted via the trade balance and the foreign trade multiplier. Because most studies fail to show a clear link between exchange rate volatility and trade, this weakens the likelihood of finding a significant



systematic relationship between the exchange rate and employment. Because the relationship between the exchange rate and employment is less direct and contains more intervening variables than between the exchange rate and trade, empirical models attempting to capture this relationship are more complex. Hence the results of econometric tests of such models are even more tentative and should be treated with more caution.

Although the older open economy models discussed in the theory section above have been estimated econometrically, this has generally been done in the context of policy issues as regards specific hypotheses (such as the various Phillips curve relationships between inflation, growth and unemployment) or as regards exchange rate determination. As regards the new open economy models, they have not faced close empirical scrutiny. As noted by Sarno and Taylor (2002: 165), there has been little effort to test the predictions of the new open economy models and they maintain that, “If a consensus in the profession on a particular model specification is to develop, the theoretical apparatus has to produce clear estimable equations”.

Most of the empirical work done on the relationship between exchange rates and employment has been done at the disaggregated level. The presumed relationship in these studies is negative: an appreciation of the currency is expected to lead to a decrease in employment. Researchers have focussed on the effect of changes in exchange rates on employment in different industries, markets and regions. The main concern has been with employment in manufacturing. Most studies concentrate on particular countries and much of the literature concerns the US.

However, some wider cross-sectional studies have been done. Burgess and Knetter (1996) evaluated the response of employment to exchange rate shocks at the industry level for the G-7 countries using a non-linear least squares estimation procedure on annual data over the sample period 1960-89. Their main finding is that exchange rates do not influence employment in the expected manner. The speed of adjustment depends on the market structure and regulation of the labour markets in the countries concerned. France and Germany are much less affected by exchange rate shocks and slower to adjust to long-run equilibrium than the US, Japan, Canada, the UK and Italy. Part of the reason for this appears to be different pricing-to-market practices. Such practices may offset the affect of exchange rate changes on export prices. Less evidence of pricing-to-market by US exporters helps explain why employment is much more sensitive to exchange rate changes in the US compared to Germany, for example.

Nucci and Pozzolo (2004) note that there are at least five ways in which firms with some degree of market power can adjust in response to a change in the exchange rate. Besides adjusting employment, such firms can adjust output, prices, wages and investment. This underscores the fact that intervening variables mediate the effect of changes in exchange rates on employment. Nucci and Pozzolo used firm level panel data to examine the exchange rate-employment relationship in Italy. They found that changes in the real exchange rate had a significant effect on employment and hours worked. However, the effect varied depending on the profit margins of the firms

studied. Also, depreciations led to increases in the hours worked via increased export revenues but this was offset by decreases due to higher input costs.

For the US the main studies of the exchange rate-employment relationship include Branson (1986); Branson and Love (1986; 1987a; 1987b); Revenga (1992); Campa and Goldberg (1998); and Goldberg and Tracy (1999). The papers co-authored by Branson find a significant and large negative relationship between the real exchange rate and manufacturing employment. Branson and Love (1987b) estimate that the strong real appreciation of the US dollar from 1980-85 led to a loss of about 1 million manufacturing jobs over this period or 5,7 percent of the 1980 total. They also decompose the change in employment by individual state and local regions and try to give reasons why some regions are affected more than others by the exchange rate.

Using data from the mid-1980s, Revenga (1992) found that exchange rates had significant effects on wages in the US. Campa and Goldberg (1998) also found pronounced effects of the exchange rate on wages, but much weaker implications for employment in US industries. They used a longer time series with twenty-five years of annual data, focussing on employment, wages and overtime at the two-digit industry level. The exchange rate effects were most significant for wages in the more trade-oriented and low profit margin industries.

Goldberg and Tracy (1999) study the effect of changes in the US dollar exchange rate using labour market data disaggregated both by industry and state. They found that local industries differ significantly in their earnings, hours worked and employment responses to exchange rates. The effects of changes in the exchange rate also differed significantly between different regions of the US, as in the study by Branson and Love (1987b). Wages were significantly affected by the dollar exchange rate in eight of the twenty manufacturing industries studied. Employment was found to be negatively related to changes in the exchange rate in twelve of the industries. On average, dollar appreciations were associated with employment declines for both high and low profit margin industrial groupings. The greater the export orientation of the industry the greater the negative effect on employment. Some of these effects were offset by the positive effect on the prices of imported inputs.

Less empirical work has been published as regards the exchange rate-employment relationship in developing or emerging market economies, partly due to the poorer quality of the available data. Koren (2004) studied the employment response to the real exchange rate for Hungarian firms but found that the relative importance of the demand and cost effect was highly industry specific. The overall effect of the exchange rate on labour demand was ambiguous. Using export and import specific exchange rates, Filiztekin (2004) found the net effect of depreciation to be *negative* for both employment and wages in Turkish manufacturing industries. This was due to the high dependency of Turkish manufacturing on foreign inputs which outweighed the positive effect of depreciation on competitiveness.

Frenkel (2004) studied the effect of changes in the real exchange rate on employment in Argentina, Brazil, Chile and Mexico and found that, on average for the group, a 10 percent appreciation in the real exchange rate is associated with a 5,6 percent increase in the unemployment rate with a two-year lag. However, using OLS regressions he



found a 6 percent per annum autonomous upward trend in the unemployment rate. He concluded that a stable and competitive real exchange rate is the best contribution macroeconomic policy can make towards higher growth and employment.

Frenkel's findings of a significant time trend underscore a potential problem with most studies of the exchange rate-employment relationship: if significant trends are present in the time series data, then it is likely that the variables are non-stationary. Hence the findings of significant regression estimates in the above studies may be spurious. Few if any studies of the exchange rate-employment relationship have used unit root tests to check for non-stationary and adjusted the time series data accordingly. As in some of the more recent studies on the relationship between exchange rates and trade, a cointegration technique and dynamic error-correction modelling may give more convincing results as regards the existence of a genuine longer-term relationship and the short-run dynamics of adjustment to exchange rate shocks.



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