DRAFT

Can Pricing to Market Explain the fact that $1AUD+$1NZ<$1USD?

Mark Crosby[*]
Department of Economics,
University of Melbourne,
Parkville, Vic, 3010,
Australia.
mcrosby@unimelb.edu.au

Abstract

There are two features of exchange rate behaviour that are difficult to explain using conventional theoretical explanations. Firstly, exchange rates are very volatile relative to fundamentals, and secondly, departures from "fair value" are very persistent. In this paper the implications of pricing to market models for exchange rate behaviour are examined. It is found that these models do better at explaining exchange rate behaviour than traditional models, though it would seem that there is still some way to go before we have a full understanding of high to medium frequency fluctuations in the exchange rate.

[*] Paper to be prepared at the Macro Workshop in Wellington, New Zealand, April 2002. Any comments or suggestions on this draft are welcome. All errors are mine or possibly Rabee Tourky's.

1. Introduction

The most common textbook models of exchange rate determination are the Dornbusch overshooting model, and the relative PPP model. In the Dornsbusch model monetary shocks cause a temporary overshooting of the long run equilibrium level of the nominal exchange rate because of the assumed rigidity of the nominal price level. In the relative PPP model fluctuations in the nominal exchange rate are driven by differential inflation rates across countries, so that real exchange rates should be (reasonably) stable.

The empirical behaviour of exchange rates do not fit either of these textbook models particularly well. Exchange rates are very volatile, there is a very high correlation between the nominal and the real exchange rate, and macroeconomic fundamentals do not do a very good job at explaining fluctuations in nominal exchange rates. Figures 1a and 1b illustrate the failings of PPP in a very simple way. The figures show the percentage depreciation of the $A or $NZ against the $US and the difference between home and US inflation in annual data since 1975. If relative PPP held exactly, the two lines in each figure should be coincident. Clearly this is not the case – exchange rate volatility is far greater than relative inflation volatility. In addition, the correlations in both cases are not significantly different from zero, and significantly different from the theoretical correlation of one under PPP. These conclusions are the same if one uses more recent data, or if higher frequency data is examined (in general the volatility and correlations become less consistent with PPP as the frequency gets higher).

Figures 2a and 2b illustrate the high correlation between the real and the nominal exchange rates for Australia and New Zealand. This evidence suggests that there are large fluctuations in the relative prices of goods baskets across countries over time, again inconsistent with PPP. Further, Engel (1999) has shown that these fluctuations in the relative prices of goods across countries occur even at the level of prices of highly traded individual goods.

A further point that can be seen from examination of Figures 2a-b is that fluctuations in real and nominal exchange rates are highly persistent. While there is much debate about the existence or non-existence of unit roots in real and nominal exchange rates, there is no question that shocks to either series are highly persistent. A standard conclusion about the real exchange rate is that the half-life of shocks to PPP is around 4 years – in other words the real exchange rate takes 4 years to return half-way back to its equilibrium level after a shock.

Are these fluctuations in real and nominal exchange rates due to volatile fundamentals? Extensions to the basic PPP model suggest that productivity differentials across countries will drive fluctuations in the real exchange rate, while another potential explanation for fluctuations in the real exchange rate is time variation in transport costs for traded goods. The now vast literature on exchange rate determination has had very little success in explaining nominal and real exchange rate movements using standard macroeconomic fundamentals (see Flood and Rose (1995) and Froot and Rogoff (1995) for surveys).

Figure 1a: Purchasing Power Parity in Australia?

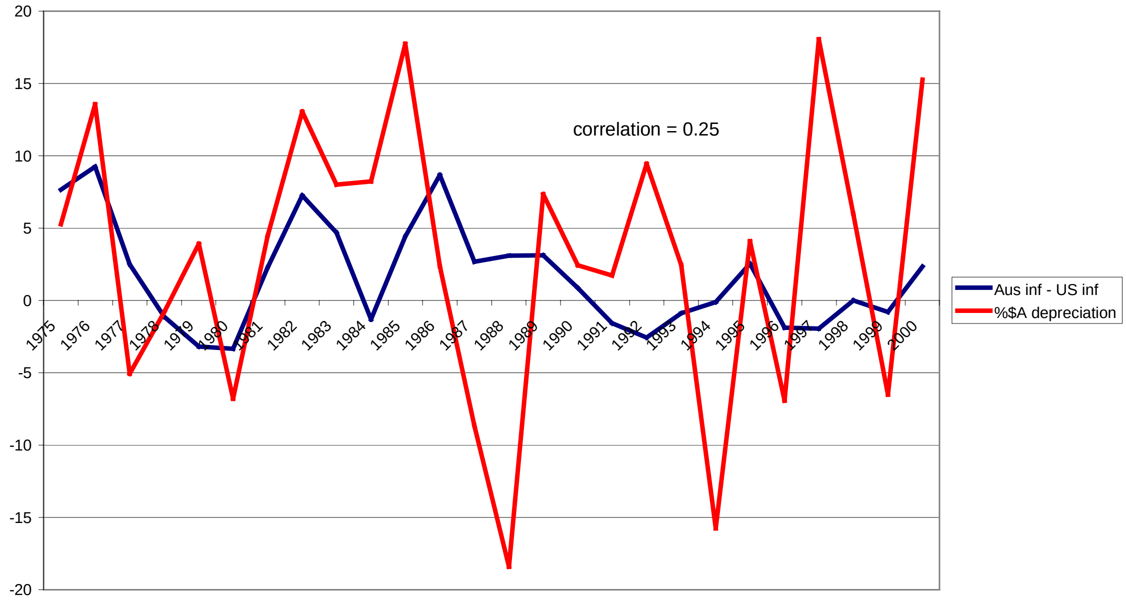


Figure 1b: Purchasing Power Parity in NZ?

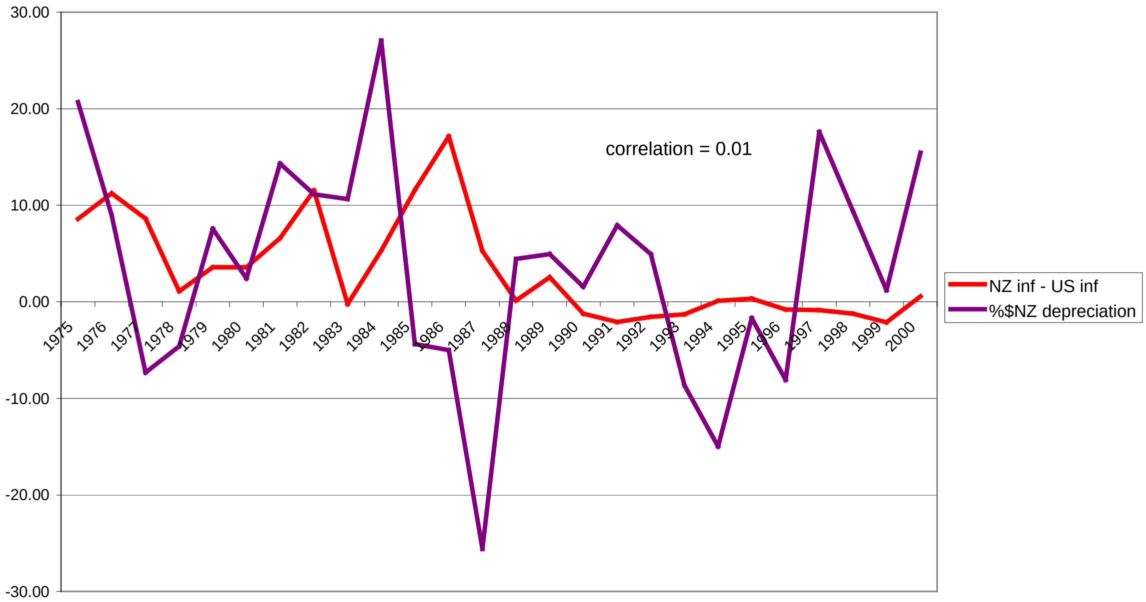


Figure 2a: Real and $US exchange rate indices, Australia (1995=100)

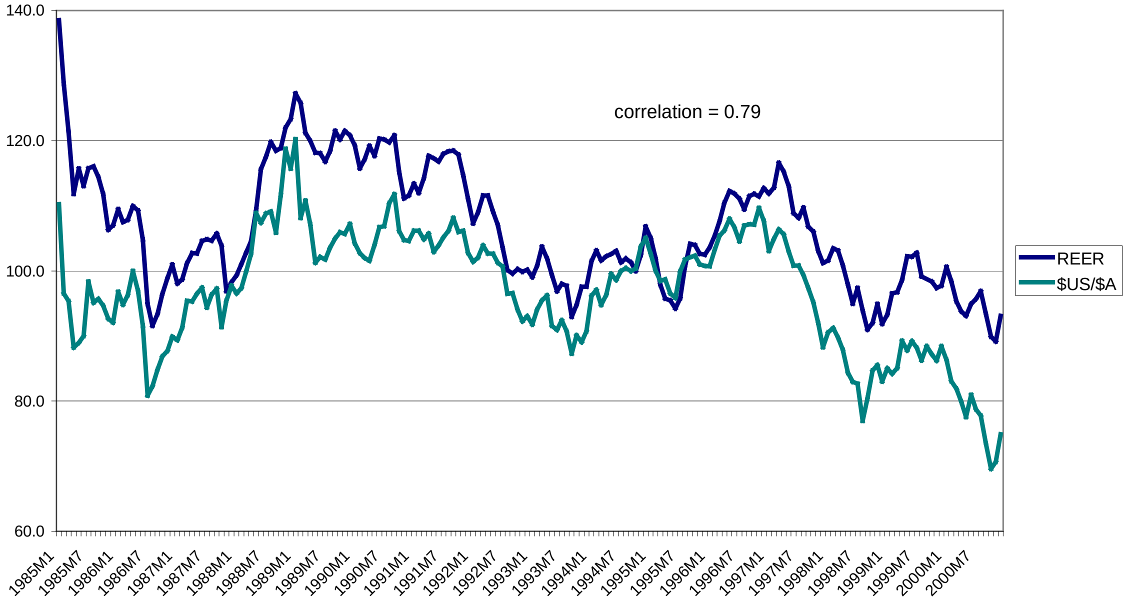
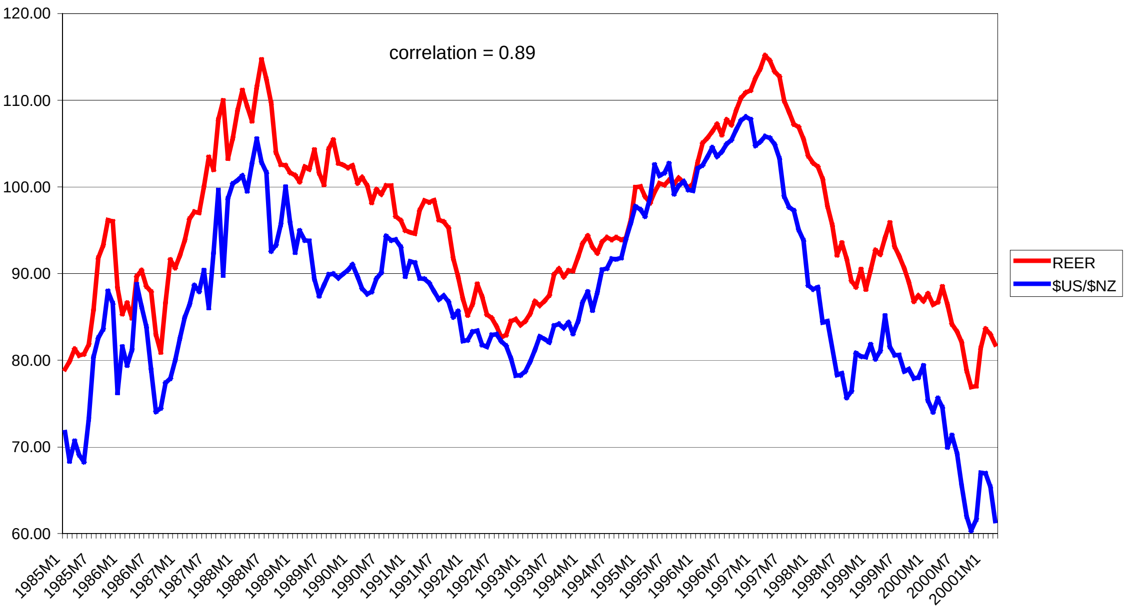


Figure 2b: Real and $US exchange rate indices, NZ (1995=100)



Are there any theoretical models that are consistent with the empirical behaviour of exchange rates? In recent years the literature has focussed on three modeling assumptions that might separately or jointly explain exchange rate behaviour. The first assumption is the assumption of sticky goods prices, along the lines of the recent Keynesian menu cost literature. The second assumption is that goods are priced in local currency (LCP), rather than in the currency of the producer. The third assumption is that producers "price-to-market" (PTM), so that the same good can have different prices in different countries.

While the assumption of sticky prices draws from the earlier exchange rate literature the recent literature also relies on quite a distinct modeling set-up. Most models are general equilibrium, assume rational expectations, dynamics are modeled, and in general it is possible to make welfare statements about the desirability of distinct monetary or fiscal policies, or about different exchange rate regimes. The existence of LCP and PTM suggests that at least some goods markets are not competitive, and so firms pricing decisions are based on mark-up or other price setting behaviour.

In the rest of this paper I sketch a standard PTM model, and use the solutions to the model to describe the properties of simulated nominal and real exchange rate behaviour. In particular, the aim will be to try and explain the volatility and persistence of exchange rates with PTM models. I also present the separate empirical evidence on pass-through and PTM in Australia and New Zealand, and also outline extensions to the model that may have more success in explaining exchange rate behaviour.

In answer to the question of the title of this paper, yes, but not really. PTM models are able to explain considerable volatility in exchange rates. PTM models are less good at explaining exchange rate persistence however. Additionally, it is still the case that PTM models rely on shocks to fundamentals to move exchange rates, and it would seem that we still have too little volatility in fundamentals to explain the high frequency volatility in exchange rates. In short, we explain why $1AUD+$1NZD<$1US, but it is difficult to explain why we remain so cheap for so long.

2. A PTM model.

In this section of the paper I sketch a PTM model and its solutions, focusing in particular on the solutions for the behaviour of the real and nominal exchange rate. The model draws heavily from Betts and Devereux (1996,2000), who in turn build on Obstfeld and Rogoff (1995). For a survey of this literature see Lane (2001).

The model is a general equilibrium model in which the exchange rate is endogenous, while the structure of national market segmentation and local currency pricing is exogenous. Local currency prices are assumed to be sticky, so that unanticipated shocks to the exchange rate lead to deviations from the law of one price.

Assume individuals maximise the following utility function;

$$U=\sum_{t=0}^{\infty}\beta^t\left(\log C_t+\frac{\gamma}{1-\varepsilon}\left(\frac{M_t}{P_t}\right)^{1-\varepsilon}+\eta\log(1-h_t)\right),$$

where $C_t=(\int_0^1 c(i,t)^{(\rho-1)/\rho}di)^{\rho/(\rho-1)}$ is aggregate consumption of a unit measure of differentiated consumption goods, $c(i)$ is consumption of good i, h represents hours worked, and M/P are real money balances. Of the consumption goods a fraction n are produced in the home country, and $1-n$ are produced in the foreign country. A fraction s of producers can price discriminate across countries, so that P, the home country CPI is defined as

$$P_t=\left[\int_0^n p(i)^{1-\rho}di+\int_n^{n+(1-n)s}p^*(i)^{1-\rho}di+\int_{n+(1-n)s}^1(eq^*(i))^{1-\rho}di\right]^{1/(1-\rho)},$$

where $p(i)$ is the home currency price of the home produced good, $p^*(i)$ is the home currency price of a foreign PTM good, and $q^*(i)$ is the foreign currency price of a foreign non-PTM good, and the spot exchange rate is given by e. The household budget constraint is

$$P_tC_t+M_t+d_tF_t=W_th_t+\pi_t+M_{t-1}+TR_t+F_{t-1},$$

where M are money holdings, F are home currency denominated nominal bonds, and d is the price of a bond.

Households maximise utility subject to their budget constraint, so that

$$c(i,t)=\left(\frac{v(i,t)}{P_t}\right)^{-\rho}C_t$$

will be the optimal choice of each differentiated good, where $v(i,t)$ is equal to the relevant price of good i (either p, p^* or eq^*). Optimal money demand and labour supply follow

$$\frac{M_t}{P_t}=\left(\frac{\gamma C_t}{1-d_t}\right)^{\frac{1}{\varepsilon}}$$

$$\frac{\eta}{1-h_t}=\frac{W_t}{P_tC_t}$$

The final first order condition is the Euler equation governing the households intertemporal consumption choices,

$$d_tP_{t+1}C_{t+1}=\beta P_tC_t.$$

Governments print money and impose taxes to finance government consumption, while firms produce output according to the simple linear technology,

$$y(i,t) = h(i,t).$$

For firms that segment markets, total output is divided between output sold at home $x(i,t)$ and output sold abroad, given by $z(i,t)$. The firm chooses the home and foreign prices to maximise profit, given by

$$\pi_t = p(i,t)x(i,t) + e_t q(i,t)z(i,t) - W_t(x(i,t) + z(i,t)) .$$

If the exchange rate and costs are known, the PTM firm can set p and q separately in each market to maximise profit. The optimal price markups will depend on the demand elasticities, and in this case it is straightforward to solve for the prices as

$$p(i,t) = e_t q(i,t) = \frac{\rho}{\rho - 1} W_t .$$

Demand for each variety of good is the same in both markets, so there will be no pricing-to-market, and the law of one price holds. Hence with flexible prices and exchange rates and costs known, PPP must hold. It is also possible to solve for the equilibrium exchange rate in this environment, which will be given by[1]

$$e = \frac{M}{M^*}\left(\frac{C^*}{C}\right)^{\frac{1}{\varepsilon}} .$$

With flexible prices money is neutral, and in this environment the presence of segmented markets has no interesting aggregate implications.

Now assume that prices are set in advance, and so cannot respond to shocks within a period. Assume also that firms satisfy *ex-post* market demand. PTM firms preset nominal prices in the domestic currency, so that exchange rate fluctuations lead to deviations from the law of one price. With prices pre-set for only one period, the long-run (period $t+1$) response is as above. In this set up deviations from PPP last as long as prices are fixed. The long run response of the nominal exchange rate and relative consumption levels are given by

$$\hat{e}_{t+1} = \hat{M}_{t+1} - \hat{M}^*_{t+1} - \frac{1}{\varepsilon}(\hat{C}_{t+1} - \hat{C}^*_{t+1})$$
$$\hat{C}_{t+1} - \hat{C}^*_{t+1} = (1/\sigma)\frac{dF_t(1-\beta)}{\overline{P}\overline{C}^W(1-n)} - (1/\sigma)\frac{(dG_{t+1} - dG^*_{t+1})}{\overline{C}^W}$$

where $\overline{P}$ is the initial price level, $\sigma = (\rho - 1 + \rho\eta)/(\rho - 1 + \eta)$ and $\overline{C}^W$ is the initial value of world consumption (equal to $nC_t+(1-n)C_t^*$), and hats above a variable denote the proportional deviation from the initial equilibrium value of a given variable (these solutions are derived by linearising the model around the deterministic steady state).

[1] Assuming also that government expenditures and initial bond holdings are zero in both countries.

The period t values of the price indices and the exchange rate are given by

$$\hat{P}_t = (1-n)(1-s)\hat{e}_t$$

$$\hat{P}_t^* = -n(1-s)\hat{e}_t$$

$$\hat{e}_t = \frac{(1+\sigma/r)\varepsilon(\hat{M}_t - \hat{M}_t^*) + \frac{(dG_t - dG_t^*)}{\overline{C}^W} + (1/r)\frac{(dG_{t+1} - dG_{t+1}^*)}{\overline{C}^W}}{(1-s)(\varepsilon(1+\sigma/r)+\rho-1) + s(1+\sigma/r)\frac{(1+1/r)}{(1+1/\varepsilon r)}}$$

where $r=((1-\beta)/\beta)$. This final equation shows that an unanticipated rise in M or in G leads to an exchange rate depreciation, whether or not there is PTM. With no PTM (s=0) the depreciation is smaller the larger is the elasticity of demand ρ. This is the usual expenditure switching story – the larger is ρ the greater is the shift away from foreign goods towards home goods for a given exchange rate movement, and the change in the exchange rate required will be smaller.

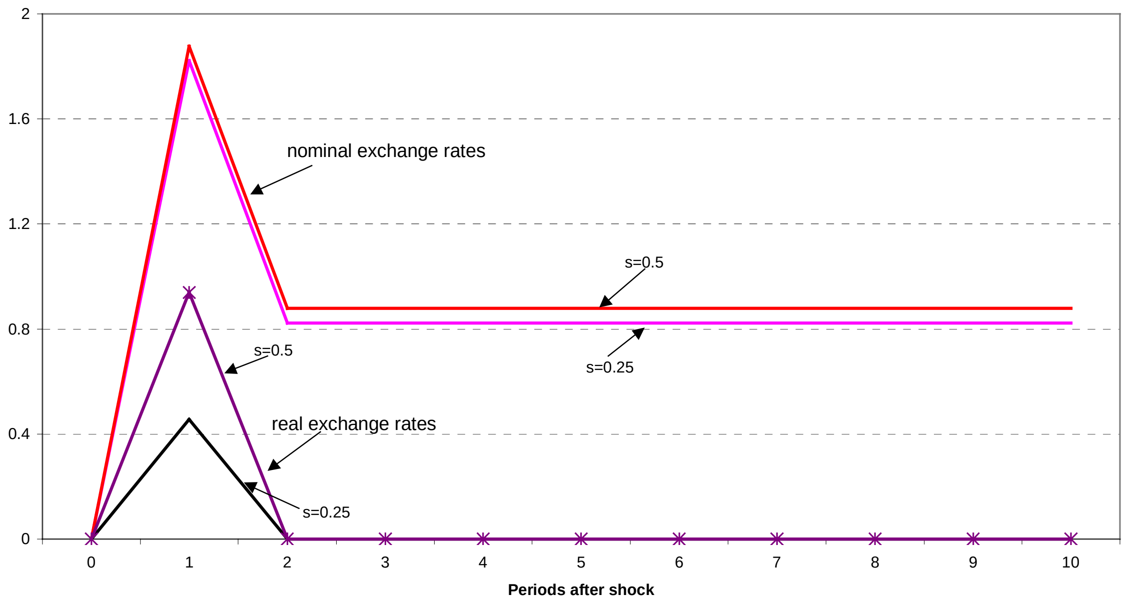
With full PTM price levels in both countries are unaffected by a shock. A rise in M affects the exchange rate through changes in home versus foreign consumption and interest rates, and thus through asset holdings. A rise in s will magnify the response of the exchange rate to both monetary and fiscal shocks so long as

$$\rho - 1 + (\varepsilon - 1)\frac{(1+\sigma/r)}{(1+1/\varepsilon r)} > 0$$

Since ρ > 1, a sufficient condition for PTM to magnify the response of the exchange rate to shocks is that ε ≥ 1, or in other words that the consumption elasticity of money demand is no greater than unity, which appears to be true empirically.

It is straightforward to analyse the short and long run responses of the endogenous variables to monetary and fiscal shocks. Figure 3 plots the response of the real and the nominal exchange rates to a unit monetary shock for some “reasonable” parameter values. The impulse responses illustrate a number of features of the model. Firstly, the response of the real and the nominal exchange rate is greater the larger is s, the share of firms that price to market (here it is assumed that ε = 2). Secondly, the correlation between the real and the nominal exchange rate is high with pricing to market, and the volatility of the real exchange rate approaches the volatility of the nominal exchange rate as $s \to 1$. Finally, the real exchange rate in this model returns to its equilibrium level one period after a shock, and remains at this level thereafter.

Figure 3: Response of real and nominal exchange rates to unit shock to M.



It is also straightforward to analyse both transitory and permanent fiscal shocks in this model. We can also solve for the impacts of these monetary and fiscal shocks on consumption, the trade balance, price levels and output levels. However, since the focus here is on the exchange rate, we will ignore these considerations in this paper.

How does the model stack up with the empirical behaviour of exchange rates illustrated in Figures 1 and 2? Firstly, pricing to market is able to generate larger fluctuations in both the real and the nominal exchange rate. Betts and Devereux (2000) simulate the model and find that PTM (with s = 0.45, calibrated to US data) is able to generate a 30% increase in exchange rate volatility for a given level of volatility in fundamentals. Secondly, the model clearly captures the correspondence between movements in real and nominal exchange rates. However, the model does not seem to be able to explain persistent departures from the equilibrium exchange rate, and it is still true in this model that exchange rate fluctuations are driven by standard macroeconomic fundamentals. The fact that the empirical nominal exchange rate literature has had at best mixed success in explaining this variable suggests that alternative factors, such as beliefs for example, may also be playing a role in determining short to medium run fluctuations in the nominal (and real) exchange rate.

3. Extensions to the Model

Is it possible that extensions to the model might better explain the empirical properties of exchange rates? There seem several possibilities. Firstly, an increase in PTM might explain any increase in observed exchange rate volatility. A second possibility is that staggered price setting or other changes to the structure of the model might increase the theoretical persistence of the real exchange rate.

Webber (1999) and Dwyer and Leong (2001) examine pass-through in the Asia-Pacific region and in Australia, respectively. Webber takes a cointegration approach and examines long run relationships between the domestic and foreign currency price of imported goods and the exchange rate. The long run impact of an exchange rate change on the domestic currency price of imported goods can thus be estimated. Webber estimates his model over the period 1978 to 1994, and finds that long run pass-through from exchange rates to imported goods prices is 0.26 for Australia, and 0.36 for New Zealand. These estimates are much lower than for the other countries in his sample (Korea, Pakistan, Philippines, Japan and Singapore), and his results are also consistent with the general finding that pass-through tends to be lower in OECD economies than in developing economies. Webber also finds that the short run adjustment coefficients are generally small, with 26% of exchange rate changes being passed-through to prices in Australia, and only 15% in New Zealand.

Dwyer and Leong (2001) take a less formal approach than Webber, but they do examine the evidence on whether there has been any change in the nature of pass-through in Australia since 1985. They show graphically that the response of imported goods prices in Australia to exchange rate changes is quite different in the 1990s from the 1980s. In the mid 1980s a sharp depreciation led quickly to a rise in the imported goods prices component of the CPI, consistent with speedy and a very high level of pass-through. Depreciations in 1992-3 and 1997-9 saw very little response of imported goods prices. In the latter period the depreciation was passed through immediately into a rise in imported goods prices "on the docks" (as in the earlier episodes) while imported goods prices in the CPI *fell* slightly.

I have taken a (slightly) more formal approach to Dwyer and Leong (2001) to see how clearly their conclusions show up in the data. I have run simple OLS regressions of changes in the imported goods prices in the CPI on lags of changes in the exchange rate (lags 2to 6) over two periods – 1985:1 to 1992:2 and 1992:3 to 1999:3.[2] The results for Australia[3] are clearly consistent with the Dwyer and Leong conclusions. The sum of the coefficients on the exchange rate terms is 0.29 in the first sub-sample, and 0.01 in the latter sub-sample. The p-value for the sum of the coefficients equal to zero is .09 in the early period, and .88 in the latter period.

What can be made of this pass-through evidence? Firstly, it should be noted that all of this evidence is not *prima-facie* evidence of PTM or LCP. The retail price of imported goods contains a large component of non-traded services, and perhaps a pass-through rate of around 20-30% is all we should ever expect to see. However, the combination of the evidence of Engel (1999) and the fact that import goods prices seem to be increasingly disconnected from exchange rate changes suggests that there is considerable PTM/LCP occurring in Australia and New Zealand. The decrease in pass-through in Australia (and perhaps NZ) would be consistent with an increase in exchange rate volatility, and therefore perhaps a level of the exchange rate for both countries well below historical norms simply as a result of a couple of big negative draws from the exchange rate distribution. One fact that stands against this is the fact that there has not really been any obvious change in exchange rate volatility in recent years. Figure 4 shows the 2 year moving average standard deviation of the monthly real exchange rate in Australia and in New Zealand since 1985.[4] Volatility moves around, but it is not obvious that the 1990s are any different from the 1980s – if there

---

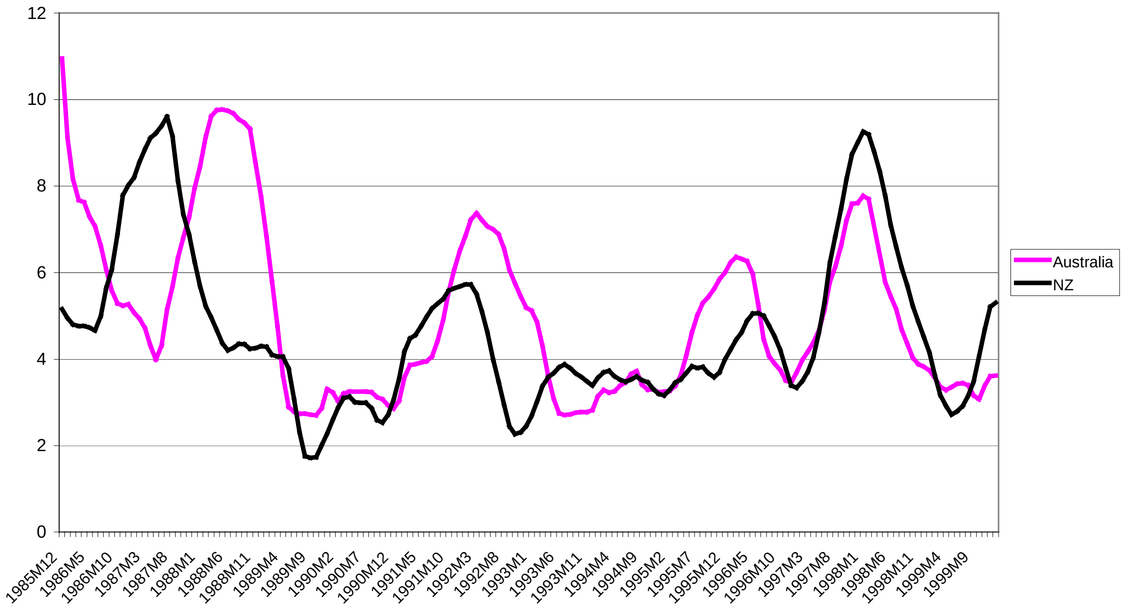
[2] There is no reason for choosing this breakpoint other than it is in the middle of the sample. There isn't enough data to be really fancy on choosing the break date, and let's face it, the regression is a pretty dodgy first go to begin with!

[3] I cannot yet locate imported goods in the CPI data for NZ.

[4] The same conclusion would be drawn if a three year window or changes in the exchange rate were graphed.

has been an increase in PTM, why hasn't this shown up as an increase in exchange rate volatility?

Figure 4: Real Exchange Rate Volatility



Bergin and Feenstra (2001) extend the theoretical approach of Obstfeld and Rogoff (1995) in order to try and capture the volatility and persistence of exchange rate changes. The model is similar to Betts and Devereux (2000) but with two important modifications. Firstly, while prices are still pre-set, there is also *staggered* price setting (along the lines of Taylor (1980) and others), and secondly, preferences are assumed to be translog in form.

The Bergin and Feenstra modifications do explain why exchange rates can be more volatile and to some extent why exchange rate movements can be more persistent. With staggered price setting any individual price setter will know when adjusting price that not all price setters will be adjusting price. This causes price adjustments to be only partial, and leads to further price adjustments later in time. Hence exchange rate changes are passed through more slowly into imported goods prices when prices are staggered. While this assumption works theoretically, it is not at all clear whether it is relevant empirically. While adjusting wages can be complicated and costly, leading to infrequent and staggered wage adjustments, it is not nearly so clear that price adjustment is so difficult or so costly. Maybe there are menu costs to adjusting prices? But it is not clear which way this goes – with menu costs the inclination may be to adjust prices fully to their final equilibrium level when the decision is made to alter prices. Further, since exchange rate changes lead all PTM/LCP firms to have prices depart from the equilibrium price in the same proportion and at the same time, it seems likely that decisions to change price will be correlated, rather than staggered.

The assumption of translog utility is a little more difficult to develop intuition about. Translog utility causes the demand curve faced by firms to have an elasticity that depends on their relative price. The expenditure share for each good will now be inversely related to the goods relative price. Note that in the results developed in section 2 exchange rate volatility depends on the various elasticities assumed, as well as on the extent of price setting. The more inelastic is demand the greater is the ability of firms to set different prices in different countries and the greater is the potential for pricing to market.

Bergin and Feenstra conclude that their model is well able to capture the extent of real exchange rate volatility that we observe. They admit however, that their model is less able to explain to explain the amount of persistence observed, though they have made progress over earlier modeling efforts.

There appear to be many other fruitful directions for further research and extensions of these kinds of models that may better be able to explain the empirical behaviour of exchange rates. An obvious extension that I am examining is the ability of productivity shocks in these types of models to explain persistence. The right kinds of productivity shocks ought to be able to explain permanent changes to the real exchange rate, for example. Whether such permanent changes actually exist or not we'll never know, but it surely looks like such changes are possible.

Another extension to PTM models would be to try and model *s*. In PTM models this fraction can be interpreted as the proportion of firms that take advantage of market power. These firms allow margins to vary as exchange rates depart from expected levels. However, it also seems reasonable to think that the fraction of firms that allow margins to vary will depend on exchange rate volatility – a small shock to the exchange rate in this period might lead firms with relatively little market power to allow margins to vary. Hence it would seem possible that there is feedback from shocks to the fraction of firms that price to market. In the model described in this paper all firms have the same degree of market power, and so it is difficult to address these considerations. It is true though that since all firms have the same degree of market power PTM should be an all or none phenomenon. (Possible that multiple equilibria can arise – either through beliefs about exchange rate volatility affecting *s*, or beliefs about other firms behaviour (*s*) affecting exchange rate volatility(though this might make the equilibrium unique?). Also, in countries like Australia and New Zealand the ability of exporters to price to market may be different from the ability of importers – because commodity exports are sold at world prices for example. How would the assumption of $s \neq s^*$ alter our conclusions, if at all? Relatedly, how do price shocks affect the model – in Australia/NZ it is often assumed that TOT shocks affect the exchange rate. In the current PTM models there are no TOT shocks, and it is exchange rate shocks that affect the TOT. A model with monetary and TOT shocks may better be able to explain the empirical correlation of the TOT and the exchange rate in small countries such as Australia and New Zealand.

4. Conclusions

In this paper I have outlined some recent theoretical work on exchange rates and tried to give an idea of how well these models match up to the empirical behaviour of exchange rates. In answer to the question of this workshop, can these models explain why the value of the $A and $NZ are so low relative to the usual measures of the fundamental values of these exchange rates.[5] Clearly these models are going some way towards explaining greater medium frequency volatility in exchange rates, and also the high correlation between the real and the nominal exchange rate. These models do not, however, seem able to explain the persistence of departures from PPP, or the high frequency volatility in the exchange rate. While the model would seem to have potential for explaining persistence, I would argue that it is unlikely that these models will be able to capture high frequency volatility in exchange rates. These models still rely on standard macroeconomic fundamentals to determine the exchange rate, and it seems that there is just too little action in fundamentals to explain day to day and month to month movements in exchange rates. It also seems likely that persistence and high frequency volatility are related. If departures from PPP persisted for only a few months (say) forex traders would presumably arbitrage away such departures, reducing exchange rate volatility. So persistent departures from PPP are necessary for high exchange rate volatility. According to this argument departures from PPP must persist for long enough (certainly 3-4 years would seem long enough) that it is difficult for traders to hold positions and make profits – hence these departures won't be arbitraged away.

To misquote one of Australia's former Treasurer/PMs…the cause of exchange rate volatility is a lot of 20 year old spivs in shiny suits in Sydney and New York who can't see past the end of their screen.

[5] The presumption of this conference is that both the $A and the $NZ *ought* to be more valuable. To us antipodeans who have travelled just about anywhere recently this seems obvious. More formal evidence suggests that the correct $US/$NZ rate ought to be in the 50-60c region (Brook and Hargreaves (2000), while a fundamental value for the Australian rate would be in the high 60c/low 70c region.

References

Bergin, P. and R. Feenstra (2001) "Pricing-to-Market, staggered contracts, and real exchange rate persistence," *Journal of International Economics,* **54,** 333-359.

Betts, C. and M. Devereux (1996) "The exchange rate in a model of pricing-to-market," *European Economic Review,* **40**, 1007-21.

Betts, C. and M. Devereux, (2000) "Exchange rate dynamics in a model of pricing-to-market," *Journal of International Economics,* **50**, 215-44.

Brook, A-M. and D. Hargreaves (2000) "A macroeconomic balance measure of New Zealand's equilibrium exchange rate," Reserve Bank of New Zealand.

Devereux, M. (2001) "The New International Macroeconomics: Some Policy Implications," *Economic Papers,* Special Edition, 30-41.

Dwyer, J. and K. Leong (2001) "Changes in the Determinants of Inflation in Australia," Research Discussion Paper 2001-02, Reserve Bank of Australia.

Engel, C. (1999) "Accounting for U.S. Real Exchange Rate Changes," *Journal of Political Economy,* **107,** 507-538.

Flood, and A. Rose (1995) ","in G. Grossman and K. Rogoff (Eds) *Handbook of International Economics, Volume 3.* North-Holland, Amsterdam, -1646

Froot, K. and K. Rogoff (1995) "Perspectives on PPP and long-run real exchange rates," in G. Grossman and K. Rogoff (Eds) *Handbook of International Economics, Volume 3.* North-Holland, Amsterdam, 1647-88.

Lane, P. (2001) "The new open economy macroeconomics: a survey," *Journal of International Economics,* **54**, 235-66.

Obstfeld, M. (2001) "International Macroeconomics: Beyond the Mundell-Fleming Model," NBER Working Paper 8369, July.

Obstfeld, M. and K. Rogoff (1995) "Exchange Rate Dynamics Redux," *Journal of Political Economy*, **103,** 624-60.

Obstfeld, M. and K. Rogoff (2000) "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause," *NBER Macroeconomics Annual 2000.* MIT Press, Cambridge MA.

Taylor, J. (1980) "Aggregate Dynamics and Staggered Contracts," *Journal of Political Economy,* **88**, 1-23.

Webber, A. (1999) "Dynamic and Long Run Responses of Import Prices to the Exchange Rate in the Asia-Pacific," *Asian Economic Journal,* **13**, 303-20.