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Pricing to Market and a Volatile AUD

by
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Abstract:
There are two features of exchange rate behaviour that are difficult to explain with conventional theoretical explanations. First, exchange rates are very volatile relative to fundamentals, and, second, 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.

Keywords:
EXCHANGE RATES; VOLATILITY; PRICING-TO-MARKET.

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1. Introduction

The most common textbook models of exchange rate determination are the Dornbusch overshooting model, the relative PPP model, and the flexible price monetary 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 monetary model has money supply and demand conditions determining inflation, which in turn determines exchange rates through the assumption that PPP holds.

There is now a very large literature that tests the models above. For example, Rapach and Wohar (2002) test the monetary model on more than onehundred years of data, and they find some support for the model's ability to explain long-run movements in exchange rates in seven of eight European countries. This paper is typical of a recent literature that uses cointegration techniques to model the long-run properties of exchange rates. A common finding in this literature is that macroeconomic fundamentals such as inflation differentials or monetary growth rates are able to explain long-run trends in exchange rates. However, there are three features of exchange rates that are far less easily explained using conventional modelling techniques: Exchange rates are very volatile; there is a very high correlation between the nominal and the real exchange rate in the short run; and macroeconomic fundamentals do not do a very good job at explaining high frequency (i.e. short run) fluctuations in nominal exchange rates.

Figures 1 and 2 illustrate these failings in a very simple way. Figure 1 shows the percentage depreciation of the AUD against the USD and the difference between Australian and US inflation in annual data from 1975 to 2002. 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, particularly since the floating of the exchange rate in 1983. In addition, the correlation between inflation differentials and exchange rate changes is not significantly different from zero, and significantly different from the theoretical correlation of one under PPP. These conclusions are the same if one uses a different sample of countries or time period, or if higher-frequency data is examined (in general the volatility and correlations become less consistent with PPP with higher-frequency data).

Figure 2 illustrates the high correlation between the real and the nominal exchange rates for Australia. 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 when only traded goods are examined. This is consistent with the findings of Menon (1993), for example, who found that exchange rate changes are not passed through to imported automobile prices in Australia.

A further point that can be seen from examination of figure 2 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

Figure 1
Purchasing Power Parity in Australia?

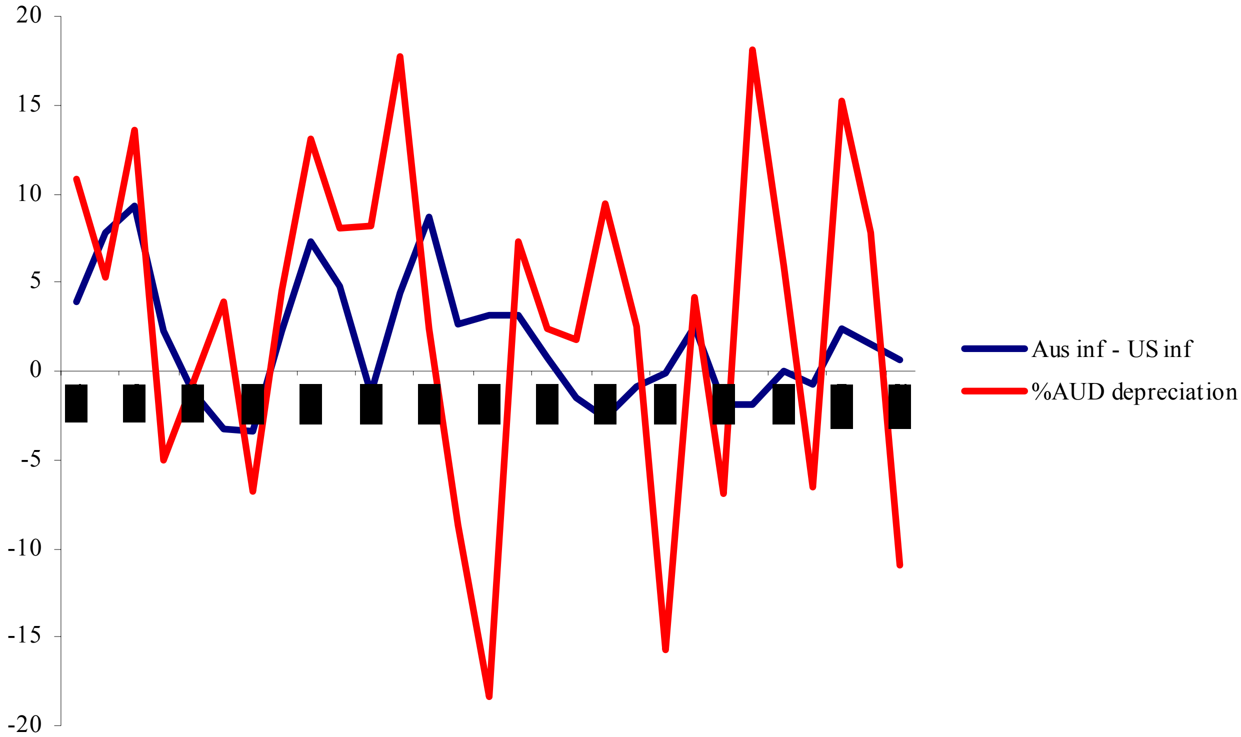
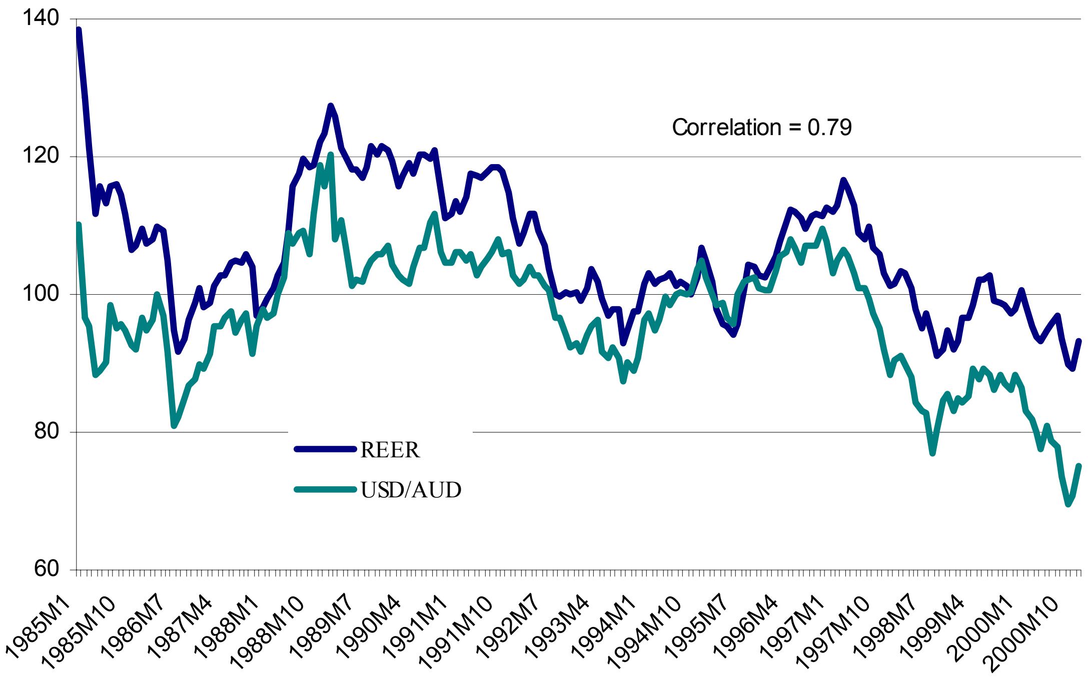


Figure 2
Real and USD Exchange Rate Indices, Australia (1995=100)



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 medium to short run movements in nominal and real exchange rates using standard macroeconomic fundamentals (see Frankel & Rose 1995; Froot & Rogoff 1995 for surveys).

Are there any theoretical models that are consistent with the empirical behaviour of exchange rates? In recent years the literature has focussed on three modelling 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, as described in Krugman (1989).

While the assumption of sticky prices draws from the earlier exchange rate literature, the recent literature also relies on quite a distinct modelling set-up. Most models are general equilibrium, assume rational expectations, dynamics are modelled, 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 outline extensions to the model that may have more success in explaining exchange rate behaviour.

Can these new models do better in explaining high-to-medium frequency fluctuations in the exchange rate? PTM models are capable of explaining greater volatility in exchange rates than traditional models. PTM models are not as 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. These models might be capable of explaining how the AUD fell below 0.50USD, but it is difficult to explain how the exchange rate remained near this level 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;

$$U=\sum_{t=0}^{\infty}\beta^{t}\left(\log C_{t}+\frac{\gamma}{1-\varepsilon}\left(\frac{M_{t}}{P_{t}}\right)^{1-\varepsilon}+\eta\log(1-h_{t})\right) \tag{1}$$

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, M/P are real money balances, and γ, η, and ε are constants. 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

$$P_t = \left[\int_0^n p(i)^{1-\rho} di + \int_n^{n+(1-n)s} p^*(i)^{1-\rho} di + \int_{n+(1-n)s}^1 (eq^*(i))^{1-\rho} di\right]^{1/(1-\rho)} \tag{2}$$

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

$$P_tC_t + M_t + d_tF_t = W_th_t + \pi_t + M_{t-1} + TR_t + F_{t-1} \tag{3}$$

where M are money holdings, F are home currency denominated nominal bonds, W is wealth, TR are transfers to the household, and d is the price of a bond.

Households maximise utility subject to their budget constraint, so that

$$c(i,t) = \left(\frac{v(i,t)}{P_t}\right)^{-\rho} C_t \tag{4}$$

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

$$\frac{M_t}{P_t} = \left(\frac{\gamma C_t}{1-d_t}\right)^{\frac{1}{\varepsilon}} \tag{5}$$

$$\frac{\eta}{1-h_t} = \frac{W_t}{P_t C_t} \tag{6}$$

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

$$d_t P_{t+1} C_{t+1} = \beta P_t C_t \,. \tag{7}$$

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

$$\pi_t = p(i,t)x(i,t) + e_t q(i,t)z(i,t) - W_t(x(i,t) + z(i,t)) \,. \tag{8}$$

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 mark-ups will depend on the demand elasticities, and in this case it is straightforward to solve for the prices as

$$p(i,t) = e_t q(i,t) = \frac{\rho}{\rho - 1} W_t \,. \tag{9}$$

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 with known exchange rates and costs, PPP must hold. It is also possible to solve for the equilibrium exchange rate in this environment, which will be given by[1]

$$e = \frac{M}{M^*}\left(\frac{C^*}{C}\right)^{\frac{1}{\varepsilon}} . \tag{10}$$

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

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

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

$$\hat{e}_{t+1} = \hat{M}_{t+1} - \hat{M}^*_{t+1} - \frac{1}{\varepsilon}(\hat{C}_{t+1} - \hat{C}^*_{t+1}) \tag{11}$$

$$\hat{C}_{t+1} - \hat{C}^*_{t+1} = (1/\sigma)\frac{dF_t(1-\beta)}{\overline{P}\overline{C}^W(1-n)} - (1/\sigma)\frac{(dG_{t+1} - dG^*_{t+1})}{\overline{C}^W} \tag{12}$$

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

$$\hat{P}_t = (1-n)(1-s)\hat{e}_t \tag{13}$$

$$\hat{P}^*_t = -n(1-s)\hat{e}_t \tag{14}$$

$$\hat{e}_t = \frac{(1+\sigma/r)\varepsilon(\hat{M}_t - \hat{M}^*_t) + \frac{(dG_t - dG^*_t)}{\overline{C}^W} + (1/r)\frac{(dG_{t+1} - dG^*_{t+1})}{\overline{C}^W}}{(1-s)(\varepsilon(1+\sigma/r) + \rho - 1) + s(1+\sigma/r)\frac{(1+1/r)}{(1+1/\varepsilon r)}} \tag{15}$$

where $r = ((1-\beta)/\beta)$. Equation (15) 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

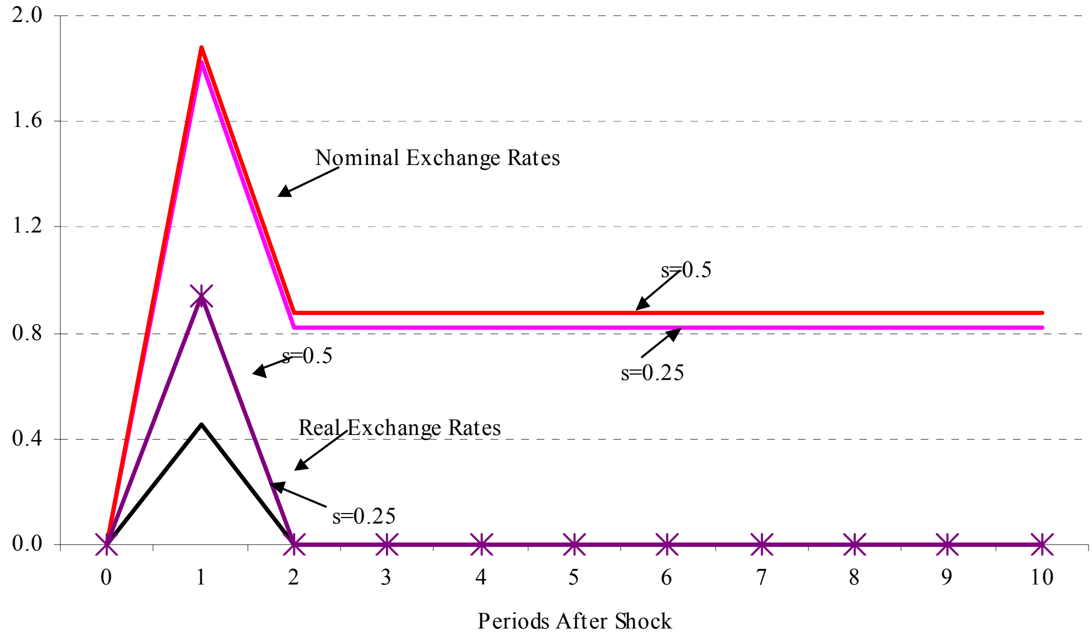
$$\rho - 1 + (\varepsilon - 1)\frac{(1+\sigma/r)}{(1+1/\varepsilon r)} > 0$$

Since $\rho > 1$, a sufficient condition for PTM to magnify the response of the exchange rate to shocks is that $\varepsilon \geq 1$, 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 $\varepsilon = 2$). 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 match up to 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, or that changes in the structure of the economy have been such that the model is now a better (or worse) description of the way that the economy works? There seem several possibilities. Firstly, an increase in PTM might explain any increase in observed exchange rate volatility. On the modelling front, staggered price setting or other changes to 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 more formal approach to Dwyer and Leong (2001) to show 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 2 to 6) over two periods—1985:1 to 1992:2 and 1992:3

to 1999:3—as well as over the entire 1985 to 1999 period.[2] Table 1 shows the results for these regressions, which are clearly consistent with the Dwyer and Leong conclusions. The sum of the coefficients on the exchange rate terms is –0.34 in the first sub-sample, and –0.04 in the latter sub-sample—a 1% depreciation of the exchange rate causes imported goods prices in the CPI to rise by just over one-third of one percent prior to 1992 within eighteen months. Since 1992 there is almost no pass through to prices inside eighteen months. The *p*–value for the sum of the coefficients equal to zero is 0.02 in the early period, and 0.60 in the latter period, so the difference in the coefficients is both quantitatively and statistically significant. It is also the case that we can use a Chow-test to reject the null-hypothesis of stability of the coefficients on the exchange rate terms over the two sub-periods. In short, pass-through is much stronger prior to 1992 than since in Australia.

Table 1

A Change in Pass-Through Behaviour in Australia?

Regression Equation: (change in) Import Prices = a + $\sum b_i$ ΔUSD + errors			
Coefficient	1985:1 to 1999:2	1985:1 to 1992:2	1992:3 to 1999:2
Constant	0.62	1.28	0.12
	(0.00)	(0.00)	(0.42)
ΔUSD_{t-2}	–0.01	–0.07	–0.00
	(0.84)	(0.18)	(0.99)
ΔUSD_{t-3}	0.03	–0.05	0.06
	(0.43)	(0.36)	(0.30)
ΔUSD_{t-4}	–0.03	–0.06	–0.07
	(0.48)	(0.18)	(0.15)
ΔUSD_{t-5}	–0.01	–0.04	0.05
	(0.83)	(0.34)	(0.36)
ΔUSD_{t-6}	–0.09	–0.12	–0.07
	(0.01)	(0.01)	(0.21)
Coefficient Sum	–0.10	–0.34	–0.04
	(0.22)	(0.02)	(0.60)

Note: *F*–test, structural break in 1992:2; and
test stat. = 2.93, reject no-break null at 5% level.

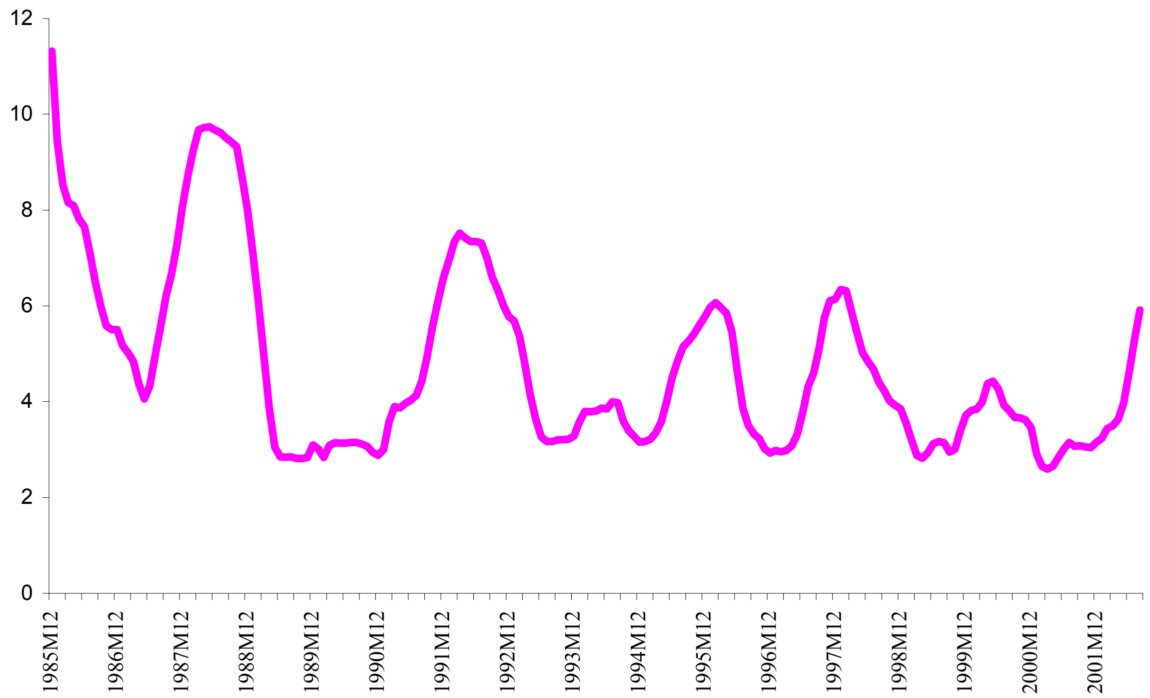
What can be made of this pass-through evidence? Firstly, it should be noted that all of this evidence is not *prima-facie* evidence of PTM or LCP. The retail price of imported goods contains a large component of non-traded services, and perhaps a pass-through rate of around 20–30% is all we should ever expect to see. However, the combination of the evidence of Engel (1999) and the fact that import goods

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 more formal in choosing the break date. The price data that I have used is for imported goods in the CPI. This data is only available until the end of 1999.

prices seem to be increasingly disconnected from exchange rate changes suggests that there is considerable PTM/LCP occurring in Australia. The decrease in pass-through in Australia would be consistent with an increase in exchange rate volatility, and therefore it is possible for the exchange rate to move well below or above historical norms simply as a result of a couple of big negative or positive draws from the exchange rate distribution. Standing against this is the fact that there has not really been any obvious change in exchange rate volatility in recent years—according to the model the increase in PTM should lead to increased exchange rate volatility. Figure 4 shows the 2-year moving average standard deviation of the monthly real exchange rate in Australia since 1985.[3] Volatility does vary, but it is not obvious that the 1990s are any different from the 1980s—if there 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 in Australia



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

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

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 good's 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 modelling 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. One extension that could be examined is whether productivity shocks in these types of models can explain persistence. Another extension to PTM models would be to try and model s, the share of price discriminating producers. 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. (It is possible that multiple equilibria might then arise—either through beliefs about exchange rate volatility affecting s, or beliefs about other firms behaviour (s) affecting exchange rate volatility). Also, in countries like Australia 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 terms of trade shocks affect the exchange rate. In the current PTM models there are no terms of trade shocks, and it is exchange rate shocks that affect the TOT. A model with monetary and terms of trade shocks may better be able to explain the empirical correlation of the terms of trade and the exchange rate in small countries such as Australia.

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. The 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), foreign exchange 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.

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