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## **U. K. Inflation Targeting and the Exchange Rate**

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# U.K. inflation targeting and the exchange rate

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## Abstract

The United Kingdom's monetary policy strategy is one of floating exchange rates and inflation forecast targeting, with the targeted measure referring to consumer prices. We consider whether it is welfare-reducing to target inflation in the CPI rather than in a narrower index; and the role of the exchange rate in the transmission of monetary policy actions to CPI inflation. We argue that it is appropriate to model imports as intermediate goods rather than as goods consumed directly by households. This leads to a simpler transmission mechanism of monetary policy, while also offering a sustainable explanation for the weakness of the exchange rate/inflation relationship and making consumer price inflation an appropriate monetary policy target.

Keywords: inflation targeting, exchange rate, intermediate goods, United Kingdom.  
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## 1. Introduction

Since 1992, the United Kingdom's monetary policy strategy can be characterized as one of floating exchange rates and inflation forecast targeting, with the targeted measure of inflation referring to consumer prices.<sup>1</sup> A floating exchange rate gives the central bank the ability to use monetary policy to pursue an inflation target directly, in a way that commitment to a fixed exchange rate does not. Beyond that, however, the precise role and significance of the exchange rate in an inflation-targeting regime, such as the U.K.'s, is a source of contention, both in practical policy discussions and within the theoretical literature.

Some principles, intended to apply in a wide range of circumstances, have been advanced. For example, members of the Monetary Policy Committee (MPC), which sets the short-term interest rate in the U.K., have, for the most part, endorsed the principle that the exchange rate only matters for monetary policy insofar as it has implications for the inflation forecast (see for example, Vickers, 1999, who affirms the recommendation of Bernanke and Gertler, 1999). Even this has, however, been questioned (e.g. Cecchetti, Genberg, Lipsky, and Wadhvani, 2000, and Wadhvani, 2001; for a discussion see Allsopp, 2002). There is perhaps still less agreement over whether the price-level implications of a sustained change in the exchange rate should be accommodated or reversed (though no disagreement over the need to resist the "second-round" effects that arise via expectations or wage and price indexation). In practice, the biggest questions concern the likely extent of "pass-through" to retail prices following an exchange rate change. Whilst it is often argued that the implications of an exchange rate movement depend on the source of the underlying shock that produced the change (King, 1997), this in no way overturns the importance of modeling openness accurately. Moreover, typical open-economy models imply some relations between the exchange rate and inflation that are not strongly dependent on the source of the shock, and which can be held up against empirical evidence to assess the plausibility and relevance of the models' assumptions and structure.

This paper considers the issues of exchange rate pass through in three stages. First, Section 2 considers the evidence and the stylized facts. Section 3 critically looks at how the standard New Keynesian model treats these issues, extending and updating the material in Kara and Nelson (2003). Section 4 returns to the implications for inflation targeting in the U.K. Section 5 concludes.

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<sup>1</sup> The targeted series was the RPIX until 2003. A change in target to a different index of consumer prices, the CPI, was announced by the Chancellor of the Exchequer in December 2003 (Brown, 2003).

## 2. The evidence for the U.K.

In this section we present some basic empirical evidence from the U.K. on the relationship between movements in the nominal exchange rate and in nominal aggregates such as import prices and consumer prices (which for this paper we measure as the RPIX series). Tables 1 and 2 slightly update the correlation evidence reported in Kara and Nelson (2003) and discussed in H.M. Treasury (2003, pp. 18–19). We see from these tables that the connection between nominal exchange-rate change and aggregate retail price inflation in the U.K. is weak, both before 1980 and in the subsequent period of considerably better inflation control.<sup>2</sup> Import price inflation and exchange-rate change, on the other hand, enjoy a close and significant relationship across subsamples. The correlation between exchange rate movements and import price inflation has persisted throughout the post war period, and is actually higher in recent decades than previously.

Table 1. Correlations between U.K. retail price inflation and nominal effective exchange rate change	
1958 Q4–2003 Q1	0.099
1958 Q4–2003 Q1, controlling for 1979 and 1990 tax changes	0.152 <sup>a</sup>
1958 Q4–1979 Q2	0.287 <sup>a</sup>
1980 Q1–2003 Q1	–0.067
1980 Q1–2003 Q1, controlling for 1990 tax change	–0.067
<i>a.</i> Statistically different from zero at 0.05 significance level.	

Table 2. Correlations between U.K. import price inflation and nominal effective exchange rate change	
1958 Q4–2003 Q1	0.498 <sup>a</sup>
1958 Q4–1979 Q2	0.478 <sup>a</sup>
1980 Q1–2003 Q1	0.578 <sup>a</sup>
<i>a.</i> Statistically different from zero at 0.05 significance level.	

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<sup>2</sup> As shown in Kara and Nelson (2003), the weakness of this relationship prevails even after allowing for lags.

These “stylized facts” are, on the face of it, surprising. What the data suggest is that there is strong pass-through from the exchange rate to import prices, which then gets lost before it gets through to consumer prices. Whilst this would not puzzle some of those in the monetarist tradition (where one set of prices going up would be balanced by falls elsewhere so long as nominal aggregate demand were under control; see e.g. Friedman, 1953), it appears strongly at variance both with the assumptions built into traditional forecasting models, such as that used by the Bank of England,<sup>3</sup> and into “standard” New Keynesian models. Typically, consumer prices are there seen as a weighted average of domestic (or domestically generated) prices and import prices. From the perspective of that approach, the problem raised by Tables 1 and 2 is how to explain the seemingly negative relationship between import price inflation and the inflation of domestically produced goods and services. These issues are further discussed below.

Table 3 supplements the correlation evidence by looking at inflation behavior during the large exchange rate changes associated with devaluations—those in 1949, in 1967, and in 1992. Additional evidence from the late 1990s is also presented in the table. Broadly, the picture is confirmed, though pass-through to prices was relatively substantial in 1967. In particular, the 1992 depreciation was fully passed through to import prices, whilst RPIX inflation actually fell. (Not surprisingly, forecasting models at that time tended to overpredict the inflationary consequences of the depreciation.)

The large appreciation of the exchange rate between 1996 and 2000 needs further examination—which, for the most part, we postpone to Section 4. Here we note that the conventional story is that a large negative contribution from import price inflation was balanced by a rise in “domestically generated inflation” (DGI), leaving inflation approximately at its target rate of 2.5%. The stylized facts above, as well as the experience of the 1992 depreciation, suggest that the conventional story needs close re-evaluation against alternative accounts of what was going on. On the face of it, the experiences of 1992 and of 1996–2000 are not anomalous; they look similar to, and in line with, the longer-term correlation evidence.

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<sup>3</sup> We are referring here to the Bank of England core macro-econometric model as used from the inception of the MPC. A new model was introduced in 2004.

Table 3. The behavior of the nominal exchange rate, import prices, and retail prices in three devaluations and one appreciation

1949 devaluation (using annual data)			
<i>Change in:</i>	Year before devaluation	Year after devaluation	Difference
Exchange rate	7.50	24.32	16.82
Import price deflator	2.82	13.17	10.36
Retail price index	3.07	2.77	-0.30
1967 devaluation			
	Year before devaluation	Year after devaluation	Difference
Exchange rate	-2.61	10.38	12.99
Import price deflator	0.30	13.21	12.91
Retail price index	1.61	5.68	4.07
1992 devaluation			
	Year before devaluation	Year after devaluation	Difference
Exchange rate	-0.58	10.30	10.88
Import price deflator	-1.34	11.08	12.42
Retail price index	5.31	2.86	-2.45
1996 appreciation			
	Year before appreciation	Year after appreciation	Difference
Exchange rate	-0.66	-17.97	-17.31
Import price deflator	2.20	-8.40	-10.58
Retail price index	2.83	2.57	-0.26
Note: The “year before” devaluation/appreciation is the average of the quarterly annualized percent change of the variable for the four quarters preceding the quarter when the exchange rate begins to move. The “year after” includes the quarter of the exchange rate movement.			

This simple evidence is sufficient to rule out several hypotheses as useful descriptions of U.K. inflation outcomes. First, “pricing-to-market” models (e.g. Devereux and Engel, 2002) have been advanced as a possible explanation for the weak relationship between exchange rate movements and aggregate inflation. These models hypothesize that import price-setters ignore the exchange rate when making their decisions. The close relationship between exchange-rate movements and import price inflation in Table 2 is inconsistent with this hypothesis.<sup>4</sup> Another set of hypotheses emphasizes monetary policy regime as a decisive factor. Gagnon and Ihrig (2004), for example, have argued (following Taylor, 2000) that in an inflation-targeting regime, import price-setters may not respond to current movements in the exchange rate, on the grounds that policy has anchored expectations of future values of the nominal exchange rate. The weak relationship between consumer price inflation and the exchange rate is then rationalized by a weaker response of import price-setters to exchange rate movements. Whatever its merits as a description of the experience of other open economies, this explanation cannot provide a satisfactory explanation for the looseness of the relationship between the exchange rate and consumer price inflation in the U.K. For, in common with pricing-to-market models, this explanation relies on a weakening or obliteration of the connection between nominal exchange rate changes and import price inflation.

### **3. The New Keynesian approach**

In this section we discuss the problems of accounting for the stylised facts within the commonly used New Keynesian framework. It is argued below that the “standard” setup cannot account for the facts. An alternative, proposed by McCallum and Nelson (1999, 2000) treats imports not as consumer goods, but as intermediate inputs. Thus an exchange rate movement impacts costs, while the direct channel to consumer prices is eliminated. This model is far more successful at accounting for the data. Finally, we discuss the implication of the alternative specification for inflation targeting.

#### *The “standard” New Keynesian framework*

We first document problems with modeling inflation dynamics in the U.K. using a “standard” open-economy New Keynesian Phillips curve (NKPC) (e.g. Galí and Monacelli, 2002). This “standard” specification posits that nominal prices of

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<sup>4</sup> This rejection of pricing-to-market models has also been observed in cross-country studies that use disaggregated data, notably Campa and Goldberg (2002).

domestically produced goods are sticky, with the stickiness being of the Calvo (1983) type and, accordingly, those prices are set as a forward-looking function of marginal cost—see e.g. Sbordone (2002). Imports are assumed to be final consumer goods, and to be priced flexibly, and so there is full and instantaneous pass-through. Supplemented with an exogenous disturbance term, the implied NKPC describing consumer price inflation is:

$$\pi_t = \beta E_t \pi_{t+1} + \lambda ulc_t + \phi(\Delta q_t - \beta E_t \Delta q_{t+1}) + u_t, \lambda > 0, \phi > 0, \quad (1)$$

where  $ulc$  is log real marginal cost. The material effect of openness is to augment the Phillips curve with the term  $(\Delta q_t - \beta E_t \Delta q_{t+1})$ , i.e. the difference between current real exchange rate depreciation and next period's expected depreciation.

We note three features of this specification. First, the equation predicts that a certain aspect of the relationship between exchange rate changes and inflation will prevail regardless of the shock that produces exchange rate movements. Specifically, for a given path of real marginal cost, movements in the real exchange rate and inflation relative to their expected future values will be tightly related. The source of the shock and the monetary policy rule in force can only produce divergences between inflation and exchange rate movements through specific channels: by their effect on the expected future values of each variable; and through their effect on the response of domestic costs to the shock. Secondly, incomplete pass-through lowers the value of  $\phi$  in equation (1), but not the prediction of a tight conditional relationship between the exchange rate and inflation. All that is required in this framework for such a tight relationship to hold is for pass-through of exchange rate changes to be nonzero, a condition that seems certain to hold in U.K. data in light of the evidence of Table 2. Thirdly, in conjunction with policy rules of the type found to describe U.K. data well, this Phillips curve has the generic implication that nominal exchange rate change and aggregate consumer price inflation will be tightly related. This prediction of the standard New Keynesian Phillips curve is clearly inconsistent with the U.K. evidence presented in Tables 1 and 2.

The problems of the open-economy New Keynesian Phillips curve as a description of U.K. data are demonstrated also by direct instrumental variables estimates of equation (1) in Kara and Nelson (2003). Here we report updates of those estimates and, in addition, report results for Australia. The results for the latter country confirm that the empirical problems with the open-economy NKPC that we stress are not specific to the U.K.

Table 4. Estimates of Baseline NKPC for U.K. and Australia			
<i>Coefficient</i>	U.K. 1964 Q2– 2002 Q3	U.K. 1980 Q1– 2002 Q3	Australia 1971 Q1– 2001 Q3
$\beta$	1.002 (0.075)	0.982 (0.110)	0.992 <sup>a</sup> (----)
$\lambda$	0.167 (0.162)	0.092 (0.154)	0.226 (0.292)
$\phi$	0.034 (0.040)	–0.061 (0.036)	–0.195 (0.135)
<i>Dummy variables—U.K.:</i>			
Heath price controls	–0.005 (0.001)	—	—
Sales tax increase, 1968 Q2	0.032 (0.026)	—	—
VAT introduction, 1973 Q2	0.040 (0.026)	—	—
VAT cut and food subsidies, 1974 Q3	–0.058 (0.035)	—	—
Increase in VAT, 1979 Q3	0.246 (0.027)	—	—
Poll tax introduction, 1990 Q2	0.074 (0.024)	0.077 (0.018)	—
<i>Dummy variables—Australia:</i>			
Medical insurance tax cut, 1975 Q3	—	—	–0.082 (0.045)
Sales tax increase, 1975 Q4	—	—	0.112 (0.041)
Medical insurance tax increase, 1976 Q4	—	—	0.225 (0.051)
Sales tax increase, 2000 Q3	—	—	0.120 (0.033)
<p><i>a.</i> Constrained parameter.  Standard errors in parentheses. Instruments are:  U.K.: Dummies, constant, lags 1–5 of inflation, lags 1–4 of <i>ulc</i>, <math>\Delta q</math> and Hodrick Prescott filtered log GDP.  Australia: Dummies, constant, lags 1–5 of inflation, lags 1–2 of <i>ulc</i>, <math>\Delta q</math> and Hodrick Prescott filtered log GDP.</p>			

Estimates are given in Table 4. In addition to the terms that appear in equation (1), the estimated specifications include dummy variables that control for distortions to inflation due to temporary factors such as indirect tax changes and price controls.

From Table 4 we see that the exchange-rate term in the Phillips curve (the estimate of  $\phi$ ) is not statistically significant for the full sample for the U.K.; while for the period since 1980, it is wrongly signed. The estimate of the key openness parameter is also wrongly signed for Australia.

In Table 5 we report some robustness results. These establish that the weak or wrongly-signed coefficients on the term involving  $\Delta q$  in our estimates for the U.K. are neither a product of our inclusion of dummy variables for price level shocks, nor due to low pass-through. Regarding the dummies, Table 5 shows that re-estimation after dropping them from the specification actually makes the  $\phi$  coefficient wrongly signed for the *full sample*, not just from 1980. In addition, failure to control for price-level shocks makes the point estimate for the discount factor  $\beta$  implausibly low.

Table 5 also reports results with real import price inflation instead of the change in real exchange rate. The former would be more appropriate to use in the specification if pricing-to-market behavior were important. In fact, the anomalies become *worse* with the import-price specification of the NKPC: relative to Table 4, the coefficient on the external-price variable is less significant for the full sample, and remains wrongly signed (and quite precisely estimated) from 1980; and the estimates of  $\beta$  are less plausible.

We conclude that the open economy version of the NKPC with imported consumer goods is not satisfactory as a description of U.K. consumer price inflation, nor do pricing-to-market variants of this specification offer a way out. Attempts to reconcile the Phillips curve with data by moving to specifications with no forward-looking behavior at all, also do not resolve the problem (see Kara and Nelson, 2003). Across these variations, as in the baseline estimates, the importance in the New Keynesian approach of the change in the exchange rate (which should matter via its influence on imported consumer goods price inflation) fails to be supported.

Table 5. Robustness Results for U.K. NKPC Estimates			
	Dropping Dummies	Using Real Import Price Inflation Instead of $\Delta q$	
<i>Coefficient</i>	1964 Q2–2002 Q3	1964 Q2–2002 Q4	1980 Q1–2002 Q4
$\beta$	0.923 (0.007)	0.926 (0.069)	1.027 (0.108)
$\lambda$	0.309 (0.213)	0.261 (0.154)	0.059 (0.154)
$\phi$	-0.093 (0.051)	0.019 (0.071)	-0.140 (0.066)
<i>Dummy variables:</i>			
Heath price controls	—	-0.004 (0.001)	—
Sales tax increase, 1968 Q2	—	0.028 (0.026)	—
VAT introduction, 1973 Q2	—	0.032 (0.026)	—
VAT cut and food subsidies, 1974 Q3	—	-0.052 (0.034)	—
Increase in VAT, 1979 Q3	—	0.245 (0.041)	—
Poll tax introduction, 1990 Q2	—	0.075 (0.024)	0.073 (0.017)
Standard errors in parentheses. Instruments are as in Table 4.			

*An alternative: imports modeled as an intermediate good*

One way forward is to model all imports as intermediate goods so that there are no imported consumer goods (as in McCallum and Nelson (MN), 1999, 2000). In this framework, pass-through of exchange rate movements into imported raw materials prices is assumed to be complete, while price stickiness refers—as in closed economy models—to aggregate consumer prices. A change in the exchange rate will then matter for inflation solely through its effect on the output gap so that, for example, in response to a depreciation, export demand will rise and, via the increase in the cost of producing domestic goods, potential output will fall. Inflationary pressure will increase to the extent that these reactions and those of domestic spending give rise to a positive output gap. In the standard New Keynesian model, by contrast, all imports are final consumer goods, and directly enter the retail price index. Under the full pass-through assumption, price stickiness in the New Keynesian baseline refers to the price index for domestically produced goods. Thus, an exchange-rate depreciation matters for inflation not only via export demand and the output gap channel (common with the MN model) but also directly. The transmission mechanism for each version appears in Figures 1 and 2.

Results in the earlier part of this section provide no support for the standard open economy NKPC; the real exchange rate *change* term is negligible. The exchange rate may nevertheless matter for inflation behavior, if the *level* of the exchange rate is important. The level term, in the MN framework, can be interpreted as capturing the presence of intermediate imported goods, which imply the presence of  $q$  in the expression for potential output (and thus marginal cost). We note that there is no inconsistency of this approach, whereby imports enter the production function, with the property of dynamic optimizing models that potential output depends on exogenous real shocks (see e.g., Woodford, 2003). Relative to a standard model, the specification of imports as an intermediate good places imports in a domestic producer's decision problem, and excludes them from appearing directly in the representative household's consumption bundle. As in the standard model, the flexible-price equilibrium implies a representation of potential output in terms of real shocks. Imports in the production function thus serve as one of the conduits through which real shocks are transmitted to potential output.

As Woodford (2003) and Ravenna and Walsh (2006) discuss, once sticky-price equilibria are considered, a modeler needs to take a stand on the appropriate definition of potential output when the production function includes non-labor inputs (capital in

Figure 1. Transmission mechanism in McCallum & Nelson (1999) model

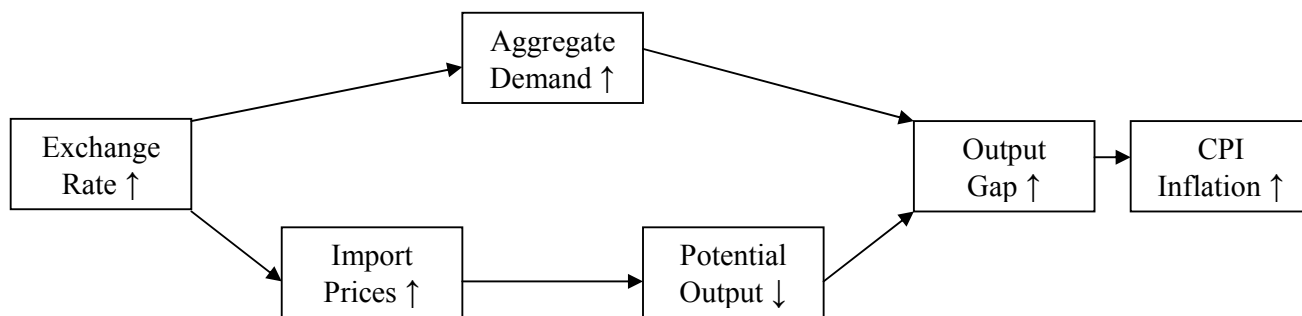
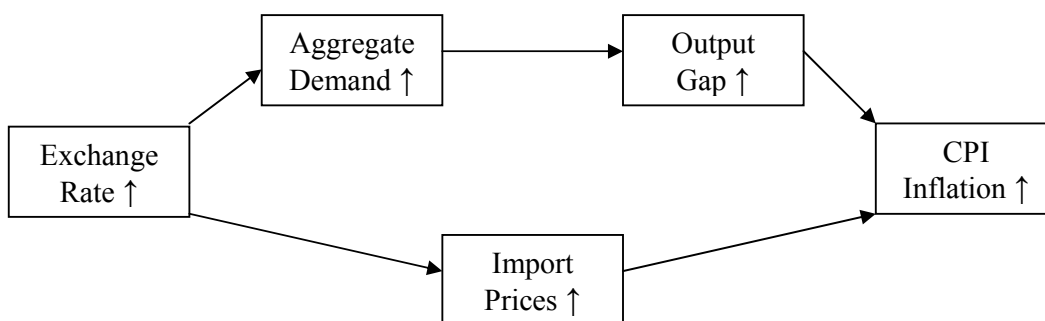


Figure 2. Transmission mechanism in “standard” model



Woodford's case; the nominal interest rate in Ravenna and Walsh's model; the real exchange rate in ours) whose sticky-price values are affected by the monetary policy rule specification. MN (1999) use the actual real exchange rate,  $q_t$ , rather than its flexible-price value, in defining potential output. This is consistent with Woodford's position that potential output should be defined as conditional on the realized, sticky-price values of non-labor inputs. If one instead preferred to define potential output as conditional on flexible-price  $q$ , then the use of the actual real exchange rate in the expression can be justified as an approximation that reflects the fact that under realistic specifications of the monetary policy rule and price stickiness,  $q_t$  and its flexible-price analogue  $q_t^*$  are highly correlated and, in particular, exhibit similar responses to disturbances to the uncovered interest parity (UIP) relation, which typically account for a large fraction of exchange-rate volatility.

Kara and Nelson (2003) derive a NKPC consistent with the MN approach, and show it implies that  $q_t$  enters with a positive coefficient.<sup>5</sup> They also provide supporting evidence using quarterly U.K. data for the period 1964 Q1–2002 Q2 and sub-samples. In addition, stochastic simulations of the alternative models suggest (a) that the intermediate good alternative can match the structure of U.K. data reasonably well; and that (b) if the standard specification were true, then one would expect a strong correlation in the data between exchange rate changes and inflation changes—which is not observed.

But how reasonable is it to treat imports as intermediate goods? A relevant consideration is that of Wilson (1976, p. 5), who observed that “all imports require the services of domestic factors... [A]ll domestic output, or virtually all, requires imported inputs at some stage in the productive process.” The empirical failure of models that assume that imports are consumer goods is pervasive across sample periods. Though the assumption may appear extreme, the evidence suggests that the assumption that all imports are intermediates is a much better working hypothesis for the U.K. than the alternative, and equally extreme, hypothesis that all imports can be treated as consumer goods.

The reason the alternative, MN, specification works is surely that it addresses the key paradox thrown up by U.K. data—the tendency, strongly present in the data, for exchange-rate changes to pass through to import prices but not to consumer prices.

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<sup>5</sup> The issue just noted of definition of potential output is not material for their NKPC derivation, because they use marginal cost rather than the output gap in the Phillips curve, and it is unambiguously the actual real exchange rate that should enter the expression for marginal cost.

### *Policy implications*

This modeling choice has immediate implications for the choice of the inflation target aggregate. It is a well-known principle in the New Keynesian literature that the index whose inflation rate is targeted should refer to the set of prices which are sticky and which prevent the instantaneous achievement of the flexible-price equilibrium (an instance of the even more well-known, but informal, principle that policy should normally target the market failure). Thus, in the closed economy case, with Calvo pricing, it is goods prices that should be targeted. With staggered contracts in the labor market, the target should be for wages (and with both, there would be a mixture). In the “standard” or baseline model, the prices of imported consumer goods are flexible, and should not form part of the target aggregate—leading to the suggestion that the target should refer to domestically generated inflation (see Meade, 1951; Aoki, 2001; Erceg, Henderson and Levin, 2000; Woodford, 2003; and for an explicit open economy context, Clarida, Galí, and Gertler, 2001, 2002). In the MN model, all goods have sticky prices (e.g., due to Calvo pricing), so the index targeted should be that for consumer prices. (Note that, strictly speaking, there are no imported consumer goods; more importantly, however, there are no consumer goods to which stickiness does not apply.)

The broader policy implications arise from the way in which openness is modeled and the way in which exchange rate changes impact on inflation. In the standard model, there is a direct and immediate effect on the price of imported consumer goods, which then impacts directly on inflation. (There are also demand effects, which will affect the output gap.) In the alternative approach, the direct link is absent. Instead, the key channel of transmission is via the effect on potential output and the output gap. Exchange rate changes operate like supply shocks rather than affecting prices directly. (Again, there are of course, demand effects, which are common to both approaches.) This means that, with imports treated as intermediate inputs, openness makes considerably less difference to inflation targeting than under the more conventional and usual specification.

## **4. Policy**

Insights from the new open economy macroeconomics are clearly important to the operation of monetary policy in the U.K., though the influence is often indirect, shaping the way in which issues are looked at rather than being directly applied (Allsopp, 2002).<sup>6</sup> This paper has suggested two things: first, that the stylized facts on

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<sup>6</sup> Thus central bankers seldom seem inclined to adopt policy rules and clearly believe in making discretionary deviations from these rules.

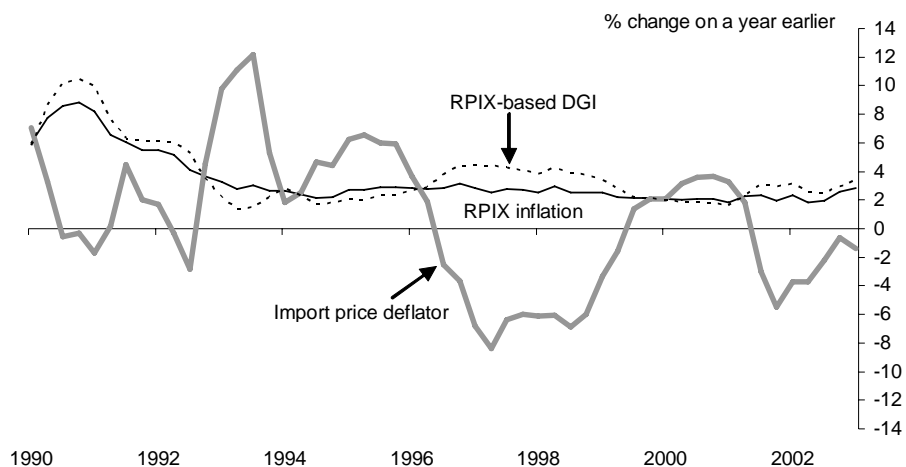
pass-through is that it does occur through to import prices, but that it is at best weak as far as the general rate of consumer price inflation is concerned. Second, a reconciliation has been put forward in the context of the New Keynesian framework, which involves modeling imports as an intermediate good. *Inter alia*, this has the implication that the appropriate target aggregate is inflation in consumer prices rather than alternatives such as domestically generated inflation.

Taking the last first, it is unlikely that the choice of the aggregate will be greatly influenced by such demonstrations, for the simple reason that the target is laid down for the MPC by the Chancellor of the Exchequer. It is not a choice variable as far as the MPC is concerned. (And, at present, the issues over the formulation of the target are in any case dominated by the shift of the official target to the new CPI measure.) This does not mean, however, that issues concerning domestically generated inflation (DGI) are not on the agenda. On the contrary, especially in the context of the appreciation of the exchange rate from 1996 to its plateau in 2000–2002, the behavior of various measures of domestically generated inflation has been much discussed. What is more, various indicators are published (see Figure 3). One implication of the analysis in this paper is that the RPI-based DGI indicator could be misleading.

RPI-based DGI is computed on the assumption that import prices are a component of RPIX. The weight on import prices, derived from input output tables, is about 0.2. Since import prices fell in the late 1990s, there is a direct implication that computed DGI rose in a compensating way. The empirical evidence reported in this paper suggests that the procedure is unsafe—at the very least, further investigation is necessary.

Does it matter? We would argue that it does. The constructed data support a story about the impact of the exchange rate appreciation in the late 1990s, which may not be true. The longer-term evidence about pass-through and the experience of the depreciation of 1992 suggest that the apparently small pass-through of import prices to RPIX inflation may actually be in line with historical experience. One explanation of the period would be that import prices were feeding into the system much as if they were intermediate goods. In turn, that would have important implications for the way in which possible future changes in the exchange rate would be expected to matter for inflation and hence for monetary policy. There are direct ways in which the linkages could be further investigated and which should be pursued.

Figure 3. RPIX-based DGI and components



The U.K. monetary system is an inflation-forecast target regime, supported by a core macroeconomic forecasting model (as well as ancillary models of various kinds). The properties of this model are extremely important in the “back-and-forth” process underlying the production of the quarterly *Inflation Report* assessments, which feed directly into the policy decisions. The model has strong exchange rate pass-through effects—which have from time to time been toned down, delayed, or overruled by judgmental adjustment. The material assembled here suggests that the pass-through to import prices has, historically, been quite high, whereas to inflation it is weak. It has been suggested above that the link to inflationary pressure from exchange rates could, and perhaps, should, be seen as operating via the supply side and the output gap rather than through a direct link to consumer prices. More work obviously needs to be done, but if it turned out that the linkages were as suggested, this would have large implications for interest rate policy in the face of changes in exchange rates.

Finally, what about the point that there is a case for encouraging persistent real exchange rate changes to come through by tolerating the price level consequences? If second-round effects can be adequately choked off, the argument is persuasive. The analysis of this paper, suggests, however, that the first-round shift in prices may not be as large as usually assumed—for the simple reason that the direct link to consumer prices may be absent or attenuated.

## 5. Conclusions

We offer the following conclusions regarding the modeling and targeting of inflation in the U.K., compared to the case for a more closed economy.

1. The specification of the exchange rate/inflation relationship implied by “standard” New Keynesian models, which postulate that imports serve as finished consumer goods, is inconsistent with the U.K. empirical evidence. Typically, the parameter in the Phillips curve summarizing the influence of the exchange rate has the wrong sign when estimated on U.K. data; and when this parameter is constrained to take a value suggested by the standard model, the implied exchange rate/inflation correlation patterns are inconsistent with U.K. evidence.
2. When imports are intermediate goods, following the specification used and recommended by McCallum and Nelson (1999), the U.K. evidence can be reconciled with optimizing theory. In particular, the weak relationship observed between consumer price inflation and exchange-rate changes, despite strong rates of pass-through, can be rationalized. Furthermore, this modeling strategy implies that it is appropriate to target consumer price inflation.
3. Monetary policy regimes do matter for the exchange rate/inflation relationship, but not in the manner argued in the literature. Several studies have appealed to the role of monetary policy regime in blocking the pass-through of exchange-rate movements to imported goods prices. The U.K. evidence instead is consistent with substantial pass-through to import prices across regimes. Monetary policy regime determines whether the accompanying movements in aggregate consumer prices are substantial, or whether the import price changes are instead manifested mainly in relative price adjustment.
4. Adjustment of the relative price of imports is often a desirable response to real shocks hitting the economy. To some extent, this adjustment may be facilitated by permitting a one-time rise in the aggregate price level even if at the cost of inflation temporarily moving away from the target. The U.K. experience under inflation targeting, however, suggests that only minor deviations of inflation from target would be required for this purpose.
5. Finally, what is the role of the real exchange rate in monetary policy formulation is, according to the modeling approach advocated here? Our framework does lend

support to the principle that the exchange rate matters only via its effect on inflation, but provides a more internally consistent version of that principle. Arguments that the exchange rate should be taken into account only via their influence on the forecast for consumer price inflation are open to the criticism that standard models suggest that consumer prices constitute too broad an index to target, and that the imported component should be removed from the targeted inflation rate. Our method of treating imports as an intermediate good, on the other hand, does support targeting inflation in consumer prices. Regarding the role of the exchange rate in monetary policy, the key point is that our model would deliver a welfare function that penalizes variations in consumer price inflation and the output gap. The exchange rate only matters for welfare via its effects on these two variables; and, indeed, its implications for inflation manifest themselves solely via an output-gap channel. A properly-measured output gap (i.e. one which takes into account the negative impact on potential output of a higher real cost of imports) is an adequate summary of the implications of exchange-rate movements for welfare.

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