THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE

Memorandum Series No. 179.

Price Determination in Ireland: Effects of Changes in Exchange Rates and Exchange Rate Regimes

by

Tim Callan and John Fitz Gerald

February 1989

Price IR£3

1. Introduction

It is well established by now that short-run purchasing power parity does not hold between major countries (see, for example, Frenkel 1981 or Isard 1977). This means that one cannot define an empirical counterpart to the single world price of simple small open economy (SOE) models. How, then, should one model the influence of foreign prices on the domestic prices of a small country? Several approaches can be adopted. The one which dominated empirical work on the determination of prices in Ireland when its exchange rate was fixed at parity with sterling was the use of prices in the UK, Ireland's largest trade partner, to proxy world prices. The alternative of using a trade-weighted basket of the prices of Ireland's major trade partners has also been given considerable attention.

In this paper we reassess these results, allowing for differences in the short-run response to exchange rates and foreign prices, and for possible changes in the relative importance of UK and German prices associated with Ireland's membership of the European Monetary System (EMS). We use quarterly data on the wholesale prices of manufacturing industry. Wholesale prices do not include VAT or retail distribution costs, so they provide more direct evidence on the influence of foreign prices than consumer prices, which also include a much larger non-traded component. We allow for the possibility of differential response to foreign currency price changes and exchange rate changes. We investigate possible changes in the relative importance of different countries, or other changes in the influence of foreign prices arising from

or associated with Ireland's EMS membership. Specifically, we examine econometric tests of the following questions:

1) Are Irish prices proportional to foreign prices in Irish currency in the long-run?

2) Do domestic unit wage costs exert at least a short-run influence on prices, as a mark-up model of pricing would suggest?

3) Do Irish prices react similarly in the short-run to changes in foreign currency prices and to exchange rate changes, or is there a differential response?

4) Is there evidence of an asymmetric response of Irish prices to increases and decreases in foreign prices?

5) Which specification of foreign price variables performs best: UK prices alone, a trade-weighted index, or the prices of several major competitors?

6) Has entry to the EMS led to a change in the relative influence of different countries, or to any other changes in the relationship between foreign and domestic prices?

The remainder of the paper is structured as follows. A brief review of previous work on price determination in Ireland is given in section 2. Section 3 describes the basic model and Section 4 gives results on the six main questions outlined above, based on analysis of wholesale prices indices for manufacturing industry treated as an aggregate. Section 5 deals with the results on these issues from the disaggregated analysis. Section 6 draws together the main conclusions from both aggregate and disaggregated analysis.

2. Review of previous work

In the 1970s a number of studies of price determination in Ireland, using data from the sterling link period, found that Irish prices closely followed prices in the UK (Geary, 1976a and b, Geary and McCarthy 1976, and Bradley 1977). The evidence presented by Bradley indicated that consumer prices in Ireland followed movements in prices in the UK within 3 to 5 months. The conclusions from this work, as

summarised by Honohan and Flynn (1986), were that "Irish price inflation was determined by, and more or less equal to, United Kingdom (UK) inflation." (p. 175)

This evidence led to a widespread expectation that EMS membership would rapidly lead to a situation in which Irish inflation was determined in a similar fashion by German inflation. The experience of EMS membership has been rather different. Whereas, in the sterling link period, there was no uncertainty concerning the future value of the sterling exchange rate, the relationship between the Irish pound and the Deutschemark has not remained fixed over time and firms have been faced with considerable uncertainty about future rates of exchange between the Irish pound and other EMS currencies. The uncertainty concerning the rate of exchange between the Irish pound and Sterling, which has remained outside the EMS, has been even greater. The pattern of Irish inflation since joining the EMS can not be explained by the simple SOE model of price determination: it is no longer closely tied to the UK rates, and it has not mirrored German rates. At first sight, this suggested a change in the foreign influence on Irish prices. However, Honohan and Flynn's analysis of the 1972-1984 period showed that a more flexible dynamic specification of the influence of foreign prices, using a trade-weighted index rather than simply UK prices, could yield an adequate model for both the sterling link and EMS sub-periods.

Neither Honohan and Flynn's trade-weighted approach, nor the earlier work based on UK prices, examines the question of whether the relative importance of different countries'

prices in determining Irish prices has changed over time, in particular in response to Ireland's membership of the European Monetary System (EMS). The use of trade weights, while valuable for many purposes, implies that the relative importance changes if and only if trade patterns change, thus simply imposing an answer to the question. The use of UK prices does not even allow this limited amount of flexibility.

Fitzgerald (1983) explored the issue using data disaggregating foreign price influence by country. However, that analysis was limited by the small number of post-EMS observations. The approach adopted there, and explored in more detail here, was to regress Irish output prices against the prices of Ireland's major competitors, notably the UK, Germany and the USA, allowing the relative importance to be more directly determined from the data. *A priori* one would expect considerable difference in behaviour between domestic Irish firms and foreign-owned firms, and also between different sectors. In order to examine this possibility, we repeat the analysis for selected sectors of manufacturing industry (as did Fitzgerald), some of which are dominated by multinationals, and others by domestic firms. (However, there are some limitations on the available data, which will be specified later).

Fitzgerald also found a stronger response to sterling price changes in the period 1979-81 than to sterling exchange rate changes, although attempts to disaggregate the exchange rate and foreign currency price changes for other countries gave less satisfactory results. This analysis strongly suggested further investigation of differential effects of exchange rate and foreign currency price changes, a

topic neglected in other analyses of Irish price determination.

Leddin's (1988) more recent analysis has investigated some of the issues addressed here, also using wholesale price index data for manufacturing industry. However, Leddin's specification imposed some crucial restrictions (including, for example, identical coefficients on foreign currency prices and exchange rates) which our tests indicate are rejected by the data. His conclusion that short-run purchasing power parity does not hold is supported by our more extensive tests, but our results show that a long-run version of purchasing power parity (not tested by Leddin) does hold.

3 Basic Model and the Data

We begin with two alternative general models which express the long-run determination of the level of prices in Ireland; these two models represent the polar cases of the pure SOE model and the closed economy alternative where prices are determined as a markup on input costs.

$$PIR^* = f_1(PF_i * XF_i \ ; \ i=1,n) \qquad (3.1)$$

$$PIR^* = f_2(W_j \ ; \ j=1,m) \qquad (3.2)$$

where

PIR^* = the wholesale price for Irish manufacturing output
PF_i = the wholesale price for manufacturing of country i.
XF_i = the rate of exchange between Ireland and country i.
W_j = the price index for input factor j

If prices are purely externally determined, as in equation 3.1, then, assuming that purchasing power parity holds in the long-run, Irish prices will be some weighted average of the prices of a possible range of other countries, all expressed in Irish pound terms. If, on the other hand, they are purely determined as a mark up on domestic costs then equation 3.2 is appropriate. In examining the behaviour of output prices we test for whether either of these two long-run models of price determination on their own or, alternatively, some mixture of the two is appropriate. This is done by combining equations 3.1 and 3.2 into the composite equation 3.3.

$$PIR^* = f_3(PF_i * XF_i \ , \ W_j \ ; \ i=1,n \text{ and } j=1,m) \qquad (3.3)$$

Taking equation 3.3 as the underlying long-term relationship determining Irish output prices, we allow for differential short-run effects from the prices and exchange rates of the UK, Germany and the US, and from the price of domestic factor inputs. This is implemented using error-correction type terms

which allow a long-run influence from prices in each of these countries and, possibly, from domestic costs; the only restriction imposed at this stage was that of long-run homogeneity, tested later. The structure of the model is, therefore, similar to that estimated on trade-weighted data by Honohan and Flynn (1986). The model can be written as follows where L stands for the lag operator and the suffixes IR,UK,GR and US stand for the relevant countries, while _IR£ indicates that the price in the foreign country has been converted to Irish pounds. The price of domestic factor inputs is approximated by domestic unit wage costs, W:

$$\Delta\log(PIR) = \sum_{i=1}^{3} \beta i(L)\Delta\log(PF_i) + \sum_{i=1}^{3} \gamma i(L)\Delta\log(XF_i) + \epsilon(L)\Delta\log(W)$$

$$+\lambda LN[w_1\log(PUK\_IR£)+w_2\log(PGR\_IR£)+w_3\log(PUS\_IR£)+w_4\log(W)$$

$$-\log(PIR)+\alpha/\lambda] \qquad (3.4)$$

The first three terms give the short-run responses to changes in foreign currency prices and exchange rates in the three countries and to domestic wage costs, while the last term is an error-correction mechanism by which Irish prices are brought into a long-run equilibrium ratio with a weighted average ($w_1+w_2+w_3+w_4=1$) of the Irish currency prices of the three countries and labour costs. The constant α/λ in the ECM term allows for the this equilibrium ratio to be some constant other than unity; in the estimated equations we report the coefficient for α. While the lag functions $\beta_i(L)$ and $\gamma_i(L)$ and $\epsilon(L)$ can be quite general polynomial functions, the lag on the error-correction mechanism must then be restricted to a simple one, in order to avoid collinearity in the regressors. This

model allows for deviations from purchasing power parity in the short-run. Homogeneity in the long-run is tested in a later section by adding an unrestricted term in $L^n(\log(PIR))$. Appropriate seasonal dummies were included in all the equations.

The data on the wholesale price of the different categories of manufacturing industry output, including total output, are taken from the CSO databank EOLAS. The data on unit wage costs for each sector are derived from a similar source. The data on exchange rates are partly taken from the EOLAS databank and partly from the Department of Finance databank of series from the OECD Main Economic Indicators publication. The output prices for each of the industrial sectors in the other countries are taken from Department of Finance databank of series from the OECD Quarterly Indicators of Industrial Activity publication. The exchange rate data for the three main countries (the USA, the UK, and West Germany) are period averages whereas the exchange rate data for certain other countries tried in the disaggregated equations are averages of end monthly values. The availability of the wholesale price indices basically determined the data period as the first quarter of 1975 to the third quarter of 1987. The estimation period, unless otherwise indicated, is the first quarter of 1976 to the third quarter of 1987.

4 Results for Total Manufacturing Industry

4.1 Basic Model

Equation 3.4 was applied to the output price of total manufacturing in Ireland. The wage cost variable proved insignificant. This suggests that the long-run relationship determining Irish prices is closer to the pure SOE model, described by equation 3.1, than to the mixed model underlying equation 3.3. As Baker (1985) has pointed out, the rapid growth of high technology sectors of the economy in the 1980's poses problems for the use of an aggregate wage cost variable covering all of manufacturing industry. As discussed in the next section, when examined on a disaggregated basis, wage costs proved to be a significant factor determining prices in a four sectors, i.e. chemicals, electrical engineering, timber and furniture, and paper and paper products.

Data for prices and exchange rates of three different countries, the UK, West Germany and the USA, were tried in the equation. However, in estimating 3.4, it was apparent that neither US prices nor the dollar exchange rate played any significant role in the determination of wholesale prices at an aggregate level. This is somewhat surprising, given the fact that price-setting in dollars has become increasingly important, especially in the office machines and data processing equipment and pharmaceuticals sectors, which have grown rapidly over the period to form a significant part of manufacturing industry. However, there are inherent difficulties in measuring the prices of these sectors. In particular, the problems posed by rapid quality change in the computing industry have led to the exclusion of its prices from the wholesale price index in Ireland, so that the lack of US

influence may reflect the exclusion from the index of the sector where prices are most obviously set in US Dollars.

Three lags on the change in German and UK prices and exchange rates were initially included, together with an error correction term lagged four periods. The lags proved significant on the exchange rate terms (though longer lags were not significant) but shorter lags proved sufficient to capture all the price effects, so that a nested test proved equation (4.1) below to be preferable.

The fit of the relationship is quite good, and almost all coefficients have significant values of the expected sign. The long-run coefficients are particularly well-defined. The exceptions are the coefficients on UK sterling prices, which are not significantly different from zero at the 5% level, and the coefficient on the current change in the Sterling exchange rate.

Equation 4.1

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		1.316			
		(5.5)			
Δ Ln PW	Germany	0.658			
		(3.5)			
Δ Ln RX	Germany	0.166	0.163	0.114	0.089
		(5.3)	(4.9)	(3.2)	(2.4)
Δ Ln PW	UK	0.148	-0.187	0.154	
		(1.1)	(1.5)	(1.3)	
Δ Ln RX	UK	0.032	0.136	0.062	0.081
		(1.0)	(4.8)	(2.1)	(3.2)
ECM-4	Germany	0.131			
		(5.4)			
ECM-4	UK	0.088			
		(4.8)			
Seasonal	dummies	0.018	0.014	0.004	
		(6.6)	(4.6)	(1.6)	

R^2 = .938 SER = .00534 F(18, 29) = 70.78
DW = 1.613 RSS = .000828
Mean = .0226 S.D. = .0170
Chow F [12, 35] = 1.5 AR F [4., 25.] = 1.02
DFFITS= 1.990 ARCH F [2., 25.] = .09

The diagnostic statistics are generally satisfactory. The LM test does not indicate that the errors are autocorrelated. There is some evidence of heteroscedasticity, which is not entirely surprising, given the change in exchange rate regime over the period; however, the ARCH test does not suggest that the heteroscedasticity takes an autoregressive - conditional form. The relationship is relatively robust to the dropping of the last 12 observations, as indicated by the Chow test: more detailed analysis of possible structural breaks related to the EMS regime is discussed below in section 4.2. The DFFITS statistic is just above the critical level suggested by Krasker, Kuh, and Welsch (1983) indicating that at least one observation is exerting significant leverage on the results. However, when estimated using bounded influence regression, the results were little changed (Krasker, Kuh and Welsch, 1983).

The strength of the influences from Germany, and the weakness of the UK influence are interesting. The coefficients on the ECM terms indicate that that long-run weight on German prices in Irish pound terms is 0.6 while that on the UK is 0.4. One might have expected the UK influence to be greater, even if some of it was indirectly mediating the effects of German prices. However, it may be that the influence of German prices on UK prices is reflected in the estimated coefficients.

The difference between the estimated short-run and long-run effects in this and other equations accounts for the autocorrelation found by Leddin (1988) in a specification which did not allow for these differential dynamics.

4.2 Tests of Parameter Stability and Structural Breaks

Equation 4.1, when three lags were included for all four short-term adjustment terms, was re-estimated for the post-EMS period when the fixed Sterling link was broken. A Chow test (Fisher, 1970) for a change in behaviour produced a value of 3.07, significant at the 5% level of type 1 error. When a more limited test of the stability of the long-run solution is undertaken this result was confirmed. The equation was re-estimated with two dummy variables, allowing for a change in the long run relationship between Irish prices and prices in the UK and Germany in 1979. (The dummies were 0 pre EMS and 1 post EMS. They were applied to the ECM terms for the UK and Germany.) The results are shown below as Equation 4.2.

Equation 4.2

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		1.229			
		(3.8)			
Δ Ln PW	Germany	0.591			
		(3.3)			
Δ Ln RX	Germany	0.136	0.122	0.098	0.059
		(4.1)	(3.3)	(2.7)	(1.5)
Δ Ln PW	UK	0.149	-0.170	0.204	
		(1.1)	(1.4)	(1.9)	
Δ Ln RX	UK	0.036	0.140	0.063	0.080
		(1.2)	(5.4)	(2.3)	(3.4)
ECM-4	Germany	0.028			
		(5.4)			
ECM-4 *Dummy	Germany	0.088			
		(2.1)			
ECM-4	UK	0.197			
		(3.5)			
ECM-4 *Dummy	UK	-0.106			
		(2.1)			
Seasonal	dummies	0.018	0.014	0.004	
		(6.5)	(4.7)	(1.6)	

R**2= 0.917 SER= .00490 F(20, 27) = 76.00
DW = 1.847 RSS= .000649 DFFITS= 2.387
AR F [4., 23.] = .93 ARCH F [2., 23.] = .26

The t-statistics on both of the additional variables are significant, and the joint-F test yields a value of 3.71 as against a critical F(2,27) of 3.39. These results imply that the long-run weights on German and UK prices changed on joining the EMS as shown in Table 4.1 below. The importance of UK output prices in determining Irish output prices was greatly reduced and there was a corresponding increase in the importance of German output prices.

Table 4.1

	Germany	UK
Pre EMS	0.123	0.877
Post EMS	0.559	0.441

A break in this estimated relationship, involving fixed weights on each country's price indices has two possible explanations. If the underlying world price determining Irish output prices were a trade weighted average of prices in our main trading partners the significance of the dummies could merely reflect a change in trade weights, i.e., the higher weight on German prices in the later period could be due solely to its increasing importance in Irish trade. This explanation can, however, be discounted, because of the evidence from the trade-weighted regressions below.

The alternative explanation, supported by these results, is that there was a change in price setting behaviour after Irish entry into the EMS. This suggests that the relative importance of German prices as against UK prices in Irish firms' pricing decisions may have been altered for more institutional reasons, perhaps associated with a more stable Deutschemark exchange rate under the new regime.

4.3 Test of Long-Run Homogeneity

Although this basic model allows for a non-homogeneous response to changes in the Irish pound value of foreign prices in the short-run, it imposes the theoretically expected long-run homogeneity. This restriction can be tested by the inclusion as an additional variable of the lagged level of Irish prices. The coefficient on this additional variable is, however, not significantly different from zero at the 5% level of type 1 error. Thus, long-run homogeneity is not rejected by the data.

4.4 Tests of Identical Short-Run Response to Changes in Foreign Currency Prices and the Exchange Rate

The results on this question are quite strong. Formulations which restrict the short-run responses of Irish prices to changes in foreign currency prices and exchange rates to be identical in each quarter are rejected against those which allow differential effects. This result holds very generally across countries, sectors and sub-periods. For example, the F-test for imposing an identical response restriction on the 3 lag version of equation 4.2 yields a value of 3.65 as against a critical value (F(8 , 23)) of 2.38. These tests confirm the result of Leddin (1988) that purchasing power parity, expressed on a period by period basis can be rejected: they also indicate, however, that Leddin's imposition of identical coefficients on the foreign price and exchange rate terms is rejected by the data.

However, if the identity of response to foreign price and exchange rate changes is assumed to apply within an annual context by restricting the sum of the adjustment

coefficients on prices and the exchange rates to be equal, the resulting restrictions are not rejected by the data. The F-test for imposing this restriction on the 3 lag version of equation 4.2 yields a value of 1.28 as against a critical value (F(2 , 23)) of 3.42.

The response to German price changes in DM terms tends to be larger (and better defined) than the response to exchange rate changes. In the case of the UK the opposite is the case with the exchange rate terms being generally better defined than the price terms. The short term response to exchange rate changes tends to be somewhat slower than to foreign currency prices.

The error correction towards a (relative) purchasing power parity equilibrium closes, each quarter, around 20 per cent of the gap between Irish prices and a weighted average of UK and German prices which remains after the first year. The estimates reported imply that a mean lag in the response of Irish prices to German prices of just under 3 quarters, and a mean lag in the response to German exchange rate changes of just over 3 quarters. The mean lag in response to UK price changes is over 10 quarters, while the mean lag in response to sterling exchange rate changes is about 8 quarters.

4.5 Tests of Asymmetric Response to Positive and Negative Changes in Foreign Prices

Baker *et al.* (1986) suggested that domestic prices would respond faster to a rise in the price of foreign currency than to a fall. The possibility of a stronger response to exchange rate induced increases in competitors' prices (in Irish pound terms) than to decreases was tested as follows. First, a dummy

variable was constructed taking the value 1 for an increase in the UK exchange rate and zero otherwise. An additional variable was formed by multiplying the short term exchange rate changes by this dummy variable, thus giving a variable equal to the exchange rate change if this was positive, but zero otherwise. (This was the approach adopted by Goldstein, 1974, in testing for an asymmetric response of wages to price increases and decreases). A positive, significant coefficient on this variable would indicate a greater response to positive exchange rate changes. The results show that the coefficients on the dummy variables, while all bearing the expected positive sign implying a faster response to a devaluation of the Irish pound, are jointly not significant from zero. However, due to the small number of observations, this test is not conclusive.

4.6 Non-nested Tests against Trade-Weighted Foreign Price Variables

Trade weights for the UK, Germany and the US move fairly steadily from 0.75, 0.13, 0.12, respectively, to 0.55, 0.20, 0.25 over the period 1975 to 1987. We have already seen that the implied weight on German prices in the aggregate level regressions is much greater than even this end period weight, and the implied weight on the UK is correspondingly lower. However, the fact that the trade weights move over the period to reflect the Germany's increasing trade share could give a trade-weighted approach some advantages over the fixed weights of the regression approach. Simple trade weights were used to create weighted averages of UK, German and US prices and exchange rates; the results reported below do not suggest that more sophisticated weighting systems would lead to different conclusions. Non-nested tests provide the appropriate framework for choosing between the trade-weighted and regression-weighted approaches.

The results indicate that the regression weighted approach encompass the results of the trade-weighted approach. The trade-weighted regressions are rejected against a joint model incorporating separate information on the UK and Germany (the test statistic of 4.72 exceeding the critical F(18,15) at the 1% level of 3.43), while the regression-weighted approach is not rejected against a joint model including trade-weighted information (the test statistic of 1.31 being below the 5% critical F(9,15) of 2.59). The reported statistics are based on the inclusion of three lags of each price and exchange rate variable, but similar results were obtained with more restricted specifications.

Specifications which use UK data alone to proxy foreign prices are also strongly rejected against specifications including German price data. Furthermore, the specifications involving the UK alone yield unstable and counterintuitive results, including rejection of long-run homogeneity, and a sign on the error correction term which would lead to Irish prices diverging from those in the UK.

There would seem to be two main reasons why the influence of German prices exceeds their trade weight. The first is that German prices may to some extent proxy prices for France, the Netherlands and other European countries not included in the analysis. It is doubtful, however, if this is the whole story. An alternative, or additional explanation, mentioned earlier, is that German prices also influence UK prices, and the analysis is "seeing through" this indirect mechanism. The institutional counterpart to this result could be that both Irish and UK firms effectively follow price leaders from Germany.

5. Review of Disaggregated Results.

This section presents the results obtained from applying the basic model 3.4 to thirteen different non-food sectors of Irish manufacturing industry as well as to the non-food sectors treated as an aggregate. Unless otherwise stated, the output price data for both Ireland and the other countries used are the wholesale price indices for the appropriate industrial sector. The domestic wage cost data are also those appropriate to the relevant sector. In each case data for prices and exchange rates in the UK Germany and the USA were tried together with wage rates. In the case of certain of the sectors examined price and exchange rate data for some other possibly relevant countries were tried. In each case the selection of data used in the equations presented in the paper was determined on statistical grounds. While the R-squared statistics reported for these disaggregated analyses are typically lower than that for the aggregate equation, they are all highly significant, and compare favourably with other time series analyses of dependent variables differenced in logarithms. The increasing importance of special factors, not captured by the regressors, at lower levels of aggregation, may account for the somewhat lower R-squared statistics reported.

5.1 Total Non-Food Manufacturing

While wholesale price indices were available for Ireland and the UK for non-food manufacturing prices similar data were not available for Germany. Wage cost data for Ireland were only available for total manufacturing. In these latter two cases the data used were the equivalent series for total manufacturing, including food. Possibly because of these

data problems, the results obtained for this category of manufacturing output were less satisfactory than those discussed in Section 4 for total manufacturing. As with total manufacturing, wage costs did not appear as a significant determinant of output prices indicating that the pure SOE model is most appropriate. The same two countries, Germany and the UK, proved the most satisfactory in explaining movements in Irish prices.

The best fit was obtained by Equation 5.1 with no lags on the foreign price variables in foreign currency terms and three lags each on the two exchange rate terms. The fit of the equation is worse than that for total manufacturing, and the diagnostic statistics are not as satisfactory. Only the intercept, the German price term and one each of the coefficients on the German and UK exchange rate terms are significantly different from zero. The value of the DFFITS statistic indicates that one observation in the sample was significantly affecting the results. However, when tested for a break in sample in the second quarter of 1979 the Chow test proved insignificant as did a set of dummies on the ECM terms. The sum of the short-run adjustment coefficients on prices in foreign currency terms at 1.34 implies an overadjustment to foreign inflation in the first quarter. The sum of the coefficients on the exchange rate terms at 0.62, on the other hand, implies that just under two thirds of a change in exchange rates feeds through into prices within one year. The ECM terms in this equation imply weights of 0.52 and 0.48 for German and UK prices respectively in determining Irish non-food output prices. These weights suggest a somewhat larger

role for UK prices than do those obtained from the equations for the price of total manufacturing.

Equation 5.1

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.835			
		(2.1)			
Δ Ln PW	Germany	0.893			
		(3.3)			
Δ Ln RX	Germany	0.100	0.146	0.063	0.086
		(2.0)	(2.7)	(1.2)	(1.7)
Δ Ln PW	UK	0.448			
		(1.9)			
Δ Ln RX	UK	-0.029	0.080	0.101	0.074
		(0.7)	(1.7)	(2.1)	(1.8)
ECM-4	Germany	0.075			
		(1.9)			
ECM-4	UK	0.068			
		(1.9)			
Seasonal	dummies	0.002	0.006	0.004	
		(0.4)	(1.4)	(1.0)	

R**2=	0.764	S.E.=	0.008	DW=	2.678
DFFITS=	4.160				

5.2 Non-Metal Mineral Products

Domestic wage costs and both Sterling and Deutschemark exchange rates proved insignificant when using data for the price of non-metallic mineral products. The best results were obtained using current German and UK prices in foreign currency terms, and an error correction mechanism lagged one period, instead of the four periods found preferable in other equations. Unrestricted estimation led to the coefficients on German and UK prices summing to greater than one; however, an F test did not reject the hypothesis that the coefficients sum to unity, so the restricted results are reported here. While the effect of foreign currency price changes is, therefore, quite rapid, the size of the estimated ECM coefficients suggests that the adjustment to exchange rate

changes is much slower. The fit of this equation suggests that other factors, not tested for, were having a significant effect on prices in this sector.

Equation 5.2

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.64905			
		(1.37)			
Δ Ln PW	Germany	0.39237			
		(1.12)			
Δ Ln PW	UK	0.60763			
		(1.74)			
ECM	Germany	0.03462			
		(0.68)			
ECM	UK	0.07121			
		(1.74)			
Seasonal		0.02320		0.00365	0.00139
		(3.15)		(0.44)	(0.18)

R^2 = 0.601 SER = 0.0179 F(6, 41) = 3.34
DW = 2.25 RSS = 0.0132
AR F(4, 37) = 1.03
CHOW TEST (12, 29) = 0.90

5.3 Chemicals

A combination of UK prices, the Sterling exchange rate and domestic wage costs gave the most satisfactory results for this sector. The results are shown below in Equation 5.3. The lagged short-run adjustment terms on domestic wage costs were omitted due to their insignificance. Even with this restriction, the coefficients on the current change in wage costs and on the ECM term for wages were not significant on their own. However, their joint inclusion in the equation did significantly improve the fit. In testing, neither the Chow test nor the inclusion of dummies suggested a significant change in pricing behaviour on entry to the EMS.

Equation 5.3

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.524			
		(3.1)			
Δ Ln PW	UK	0.254	-0.116	0.471	
		(1.9)	(1.0)	(5.1)	
Δ Ln RX	UK	0.098	0.215	0.087	0.181
		(1.6)	(3.8)	(1.6)	(3.7)
Δ Ln ULC		0.026			
		(1.5)			
ECM-4	UK	0.089			
		(2.3)			
ECM-4	ULC	0.026			
		(1.2)			
Seasonal	Dummies	0.023	0.007	-0.005	
		(3.8)	(1.2)	(0.6)	
R**2=	0.799	S.E.=	0.010	DW=	2.139
DFFITS=	1.613				

The sum of the short-run adjustment coefficients on UK prices and the Sterling exchange rate are very close at 0.61 and 0.58 respectively. The ECM terms imply that the UK price (and exchange rate) have a weight of just over 0.75 in the long-run determination of Irish prices with domestic wage costs having a weight of just under a quarter.

5.4 Metal Products

Domestic unit wage costs did not prove significant in estimating the basic model and were omitted from the final specification shown below as Equation 5.4. Once again the prices and exchange rates of Germany and the UK proved the best explanatory variables. A Chow test confirmed a change in behaviour on Ireland's entry into the EMS. The inclusion of dummies for EMS entry on the ECM terms did not prove significant indicating that the change in pricing behaviour apply more to the short term adjustment coefficients than to

the long term price determination model implied by the ECM terms. As a result Equation 5.4 was estimated only using data from the post EMS period (1979 quarter 2 to 1987 quarter 3).

Equation 5.4

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.864			
		(1.9)			
Δ Ln PW	Germany	0.555	-0.207	0.350	
		(1.6)	(0.6)	(1.3)	
Δ Ln RX	Germany	0.121	0.110	-0.095	-0.113
		(1.4)	(1.4)	(1.3)	(1.6)
Δ Ln PW	UK	0.775	-0.299		
		(3.3)	(0.9)		
Δ Ln RX	UK	0.074	0.161	0.051	0.062
		(2.0)	(4.2)	(1.4)	(1.8)
ECM_{-4}	Germany	0.073			
		(1.5)			
ECM_{-4}	UK	0.075			
		(1.7)			
Seasonal	dummies	0.006	0.007	0.007	
		(1.5)	(1.3)	(1.7)	

R**2=	0.826	S.E.=	0.006	DW=	1.115
DFFITS=	2.709				

This equation suggests a rapid adjustment to changes in foreign prices in foreign currency terms. The sum of these short-run adjustment coefficients is 1.17 indicating a slight overadjustment in the first year. The sum of the short term adjustment coefficients on the exchange rates is, however, only 0.36 indicating a much slower adjustment process. The ECM terms are not significant. However, their magnitudes are similar to the significant ECM terms estimated using the full data sample. They imply roughly equal weights for German and UK prices and exchange rates in determining Irish prices in the long term.

5.5 Mechanical Engineering

This sector was the only one of the 13 examined in which US prices proved a significant determinant of Irish prices. The inclusion of UK and German prices did not improve the results obtained. Domestic wage costs were also not a significant determinant of prices. The fact that US prices appear in Equation 5.5 as the major determinant of Irish output prices in mechanical engineering while playing no role in any other sector may appear somewhat surprising. However, while a larger share of the gross output in other sectors may be accounted for by US firms, it is still the case that US firms accounted for a half of gross output in this sector in 1985 (CSO Census of Industrial Production, 1985). Thus the results which we show suggest that US firms in this sector tend to set their output price in Dollars. (While this is widely believed to be the case in the electronics sector, as noted earlier, due to data problems, no wholesale price index is prepared for the output of the electronics sector.)

The fit of Equation 5.5 is at the lower end of the range of results reported here, and the Durbin Watson statistic indicates an autocorrelated error term. Only the coefficient on the current change in the Dollar exchange rate proved significant. All other coefficients, while correctly signed, are not significant. The ECM term is extremely small suggesting a very slow speed of adjustment. The sum of the short-run adjustment coefficients on US prices is slightly greater than one (1.13) indicating a full pass through of US Dollar price changes. However, the adjustment to changes in the dollar / Irish pound exchange rate is much slower.

Equation 5.5

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.189			
		(1.1)			
Δ Ln PW	USA	0.074	0.428	0.629	
		(0.2)	(1.3)	(1.8)	
Δ Ln RX	USA	0.320			
		(6.1)			
ECM-4	USA	0.032			
		(1.1)			
Seasonal	dummies	0.008	0.000	0.001	
		(1.3)	(0.0)	(0.1)	

R**2=	0.524	S.E.=	0.015	DW=	1.255
DFFITS=	2.042				

A Chow test for a change in pattern of behaviour at the beginning of 1979 (second quarter) proved significant. This was somewhat surprising as the relationship between the dollar and the Irish pound was unaffected by EMS membership. However, when the equation was estimated for the shorter period there was little change in the estimated coefficients though there was a big improvement in the fit of the equation. This may indicate that other factors, such as UK prices, which were important in determining Irish prices prior to EMS entry may not have shown up as significant due to limited degrees of freedom. In the case of this sector EMS entry may have resulted in a shift from sterling pricing to dollar pricing explaining the significant improvement in fit observed using the specification of Equation 5.5.

5.6 Electrical Engineering

Due to data problems the electronics sector is excluded from electrical engineering in the wholesale price

index. A combination of German and UK prices together with domestic wage rates provided the best explanation of output prices in the electrical engineering sector. Because the wage cost data were only available from the beginning of 1977 Equation 5.6 was estimated for the period 1978 Q1 to 1987 Q3.

Equation 5.6

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		1.072			
		(1.9)			
Δ Ln PW	Germany	0.444			
		(0.7)			
Δ Ln RX	Germany	0.002	0.133		
		(0.0)	(2.1)		
Δ Ln PW	UK	0.353			
		(2.3)			
Δ Ln RX	UK	0.069	0.105		
		(2.0)	(3.1)		
Δ Ln UWC		0.012	0.004	0.040	0.031
		(0.8)	(0.2)	(1.6)	(1.4)
ECM-4	Germany	0.108			
		(2.0)			
ECM-4	UK	0.049			
		(1.2)			
ECM-4	UWC	0.043			
		(2.4)			
Seasonal	dummies	-0.001	-0.004	0.000	
		(0.2)	(0.6)	(0.0)	
R**2=	0.724	S.E.	0.007	DW=	2.359
DFFITS=	1.774				

The fit of this equation, while not as good as that for total manufacturing, is quite satisfactory. The short-run adjustment coefficient on UK prices and one each of the coefficients on German and UK exchange rates are significant at the 95% level. None of the short-run adjustment coefficients on wage rates are significant at even the 90% level. However, the ECM term on wages is significantly different from zero at the 95% level as is the ECM term on German prices at the 96% level. These results suggest a rapid

adjustment to prices in foreign currency terms, a slower adjustment to exchange rates and an even slower adjustment to domestic wage costs. In the latter case the bulk of the adjustment will come in the second and later years. The long-run weights on German and UK prices (in Irish pounds) and on domestic wage costs are .54, .245, and .215 respectively. The inclusion of dummies for a change in the ECM terms on German and UK prices did not significantly improve the results though they did suggest a shift in influence from UK to German prices after EMS entry. However, due to the very limited degrees of freedom for the pre-EMS period, these results are in no way conclusive.

5.7 Motor Vehicles

The pure SOE model proved most satisfactory for the motor vehicle sector in Ireland with German and UK prices as the determinants of Irish prices. The sector underwent major structural change during the estimation period with the ending of all motor vehicle assembly in the country and, therefore, the increase in relative importance of firms producing components for the motor industry. However, testing did not suggest a significant change in behaviour on entry to the EMS.

The fit of this equation is quite good, and the two key ECM coefficients are well determined. Two of the coefficients on the DM exchange rate and one of the coefficients on the sterling exchange rate are significant. The results imply a fairly slow speed of adjustment in the first year, accelerating in the second year and declining thereafter. The ECM terms indicate long term weights for

German and UK prices (in Irish pound terms) of 0.54 and 0.46 respectively.

Equation 5.7

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		1.092			
		(4.7)			
Δ Ln PW	Germany	0.022			
		(0.1)			
Δ Ln RX	Germany	0.072	0.172	0.160	
		(1.4)	(3.3)	(2.8)	
Δ Ln PW	UK	0.326	-0.025		
		(1.5)	(0.1)		
Δ Ln RX	UK	-0.062	0.054	0.020	0.168
		(1.6)	(1.3)	(0.5)	(4.1)
ECM	Germany	0.098			
		(3.4)			
ECM	UK	0.083			
		(3.6)			
Seasonal	dummies	0.000	0.008	0.006	
		(0.0)	(1.5)	(1.5)	

R**2=	0.684	S.E.=	0.009	DW=	1.824
DFFITS=	2.378				

5.8 Textiles

The most satisfactory fit was obtained with Equation 5.8 where Irish textile prices are explained purely in terms of German prices. Domestic wage costs were not significant. No evidence of a break in sample at the beginning of 1979 was found in testing the data. The overall fit is satisfactory. One of the short-run adjustment coefficients on German prices is significant. Together the two coefficients on DM prices sum to 1.36, suggesting significant overadjustment to DM prices in the first six months. The coefficients on the DM Irish pound exchange rate, two of which are significant, sum to only 0.45, indicating a much slower adjustment to exchange rate changes. Long term purchasing power parity is accepted, as implied by the significance of the ECM term.

Equation 5.8

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.565			
		(4.6)			
Δ Ln PW	Germany	0.611	0.749		
		(1.9)	(2.3)		
Δ Ln RX	Germany	0.058	0.202	0.062	0.126
		(1.1)	(4.0)	(1.2)	(2.3)
ECM-4	Germany	0.087			
		(4.6)			
Seasonal	dummies	0.011	0.011	0.007	
		(2.4)	(2.7)	(1.7)	
R**2=	0.731	S.E.=	0.009	DW=	1.991
DFFITS=	1.826				

5.9 Leather and Footwear

Domestic wage costs did not prove significant. German and UK prices provided the best explanation of Irish output prices. In addition to US prices Italian prices were also tried as possible explanatory variables. The overall fit of Equation 5.9 was poor. The inclusion of dummies for a shift in the ECM coefficients significantly improved the fit of the equation, even though neither of the dummies on their own were significant. None of the short-run adjustment coefficients were significant, the coefficient on the instantaneous DM price change being negative.

Equation 5.9

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		2.114			
		(3.7)			
Δ Ln PW	Germany	-0.223			
		(0.2)			
Δ Ln RX	Germany	0.101	0.265	0.055	0.054
		(0.5)	(1.4)	(0.3)	(0.3)
Δ Ln PW	UK	0.060			
		(0.1)			
Δ Ln RX	UK	0.137	0.006	0.115	0.012
		(1.1)	(0.0)	(0.9)	(0.1)
ECM-4	Germany	0.113			
		(0.7)			
ECM-4*Dummy	Germany	0.213			
		(1.3)			
ECM-4	UK	0.251			
		(1.4)			
ECM-4*Dummy	UK	-0.255			
		(1.3)			
Seasonal	dummies	0.020	0.001	-0.001	
		(1.4)	(0.5)	(0.7)	

R**2=	0.476	S.E.=	0.026	DW=	1.602
DFFITS=	2.564				

As shown in Table 5.1, the dummies on the ECM term imply that while in the pre-EMS era UK prices had a substantial role in determining Irish prices, since 1979, Irish prices have, in the long-run, been totally determined by German prices. However, the overall poor fit of this equation suggests that there are other factors affecting Irish prices in this sector which were not covered by this investigation.

Table 5.1
Long Run Weights in Price Determination
Leather and Footwear

	Germany	UK
Pre EMS	0.31	0.69
Post EMS	1.00	0.00

5.10 Clothing

The results for this sector were not very satisfactory. Domestic wage costs, which might have been

expected to be important in such a labour intensive industry, proved insignificant. Data for Germany, the UK, the USA, Spain, Italy, and France were all tried. The most satisfactory explanation was achieved using prices for Spain and the UK. Testing using dummies on the ECM terms suggested that there was a significant change in pricing behaviour around the beginning of 1979.

Equation 5.10

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.315			
		(1.0)			
Δ Ln PW	Spain	0.117			
		(0.6)			
Δ Ln RX	Spain	-0.003	-0.026	0.087	0.037
		(0.1)	(0.9)	(2.4)	(1.1)
Δ Ln PW	UK	0.018	-0.103	-0.020	
		(0.1)	(0.6)	(0.1)	
Δ Ln RX	UK	0.122	0.057	0.090	0.087
		(3.1)	(1.5)	(2.4)	(2.2)
ECM-4	Spain	0.068			
		(1.6)			
ECM-4*Dummy	Spain	-0.054			
		(1.1)			
ECM-4	UK	-0.077			
		(0.9)			
ECM-4*Dummy	UK	0.107			
		(1.2)			
Seasonal	dummies	0.008	0.003	0.002	
		(1.9)	(0.7)	(0.5)	

R**2=	0.508	S.E.=	0.007	DW=	1.719
DFFITS=	2.597				

The overall fit of Equation 5.10 is unsatisfactory. Only 3 of the 4 terms on the change in the sterling rate of exchange and 1 of the coefficients on the peseta rate of exchange were significant. None of the ECM terms on their own were significant, though the inclusion of the two dummy terms were jointly significant. The short-run adjustment coefficients suggest a slow adjustment to external price changes in the current year. The pre-EMS ECM term for the UK

is negative implying divergence. The post-EMS ECM terms are very small implying a very slow adjustment. They imply a somewhat bigger weight for UK prices than for Spanish prices in determining Irish prices in the sector from 1979 onwards.

5.11 Timber and Furniture

The best results for this sector were obtained when domestic wage costs were included together with German and UK prices. Because of the inclusion of domestic wage costs it was necessary to restrict the data sample for the period 1978 Q1 to 1987 Q3. As a result there were very few observations prior to Irish entry into the EMS and the break in the sterling link. As a result, it is not surprising that the inclusion of dummy on the ECM term, testing for a change in long-run pricing behaviour, did not significantly improve the fit of the equation.

Equation 5.11

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.839			
		(2.3)			
Δ Ln PW	Germany	0.052	0.289	0.136	
		(0.1)	(0.5)	(0.2)	
Δ Ln RX	Germany	0.059			
		(0.6)			
Δ Ln PW	UK	0.573			
		(2.1)			
Δ Ln RX	UK	0.157	0.183		
		(3.2)	(4.1)		
Δ Ln UWC		-0.083	-0.090	0.104	0.027
		(1.8)	(1.8)	(2.2)	(0.5)
ECM-4	Germany	0.057			
		(1.4)			
ECM-4	UK	0.075			
		(1.7)			
ECM	UWC	0.020			
		(0.5)			
Seasonal	dummies	-0.018	0.002	-0.010	
		(1.3)	(0.1)	(0.9)	

R**2=	0.690	S.E.	0.008	DW=	2.148
DFFITS=	3.757				

The sum of the short-run adjustment coefficients on the prices terms is a little greater than 1 suggesting full adjustment to prices in the first year. However, the coefficients on the change in the exchange rate suggest a slower adjustment, especially to a change in the DM Irish pound rate. The coefficients on wage rates are not significant. The ECM coefficients imply weights in determining prices in the long-run of .375, .492, and .132 on German and UK prices and domestic wage costs.

5.12 Paper and Paper Products

In addition to the usual three countries' prices data for Sweden were tried as an explanatory variable of prices in this sector. However, only UK prices (and the sterling exchange rate) proved significant. Domestic wage costs were also found to be significant determinants of the Irish price. In estimating this equation the ECM term on UK prices consistently proved to have the wrong sign. More satisfactory results were obtained by imposing purchasing power parity within the first year and dropping the ECM term on UK prices. This implies that the effect of changes in UK prices and the sterling exchange rate come through within the first year.

The fit of the equation is satisfactory with six of the price and wage coefficients proving significant. These results suggest that prices react rapidly to changes in UK prices in sterling terms, slightly slower to changes in the sterling Irish pound exchange rate and even more slowly to changes in domestic wage costs. The results assign roughly equal weights to UK prices and domestic costs in the long-run

determination of Irish prices.

Equation 5.12

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.133			
		(1.6)			
Δ Ln PW	UK	0.344	0.172		
		(2.7)	(1.3)		
Δ Ln RX	UK	0.054	0.158	0.139	0.165
		(1.2)	(3.6)	(3.0)	
Δ Ln ULC		0.060	0.053	0.088	0.061
		(2.2)	(1.9)	(3.0)	(2.1)
ECM-4	ULC	0.035			
		(1.5)			
Seasonal	Dummies	-0.013	0.005	-0.004	
		(1.4)	(0.6)	(0.4)	
R**2=	0.787	S.E.=	0.009	DW=	1.327
DFFITS=	1.551				

5.13 Rubber Products.

The most satisfactory results were obtained for this sector using German prices and exchange rates on their own. However, the resulting equation, 5.12 shows a poor fit. Only one of the short-run adjustment terms is significant. However, the ECM term is well determined. The equation suggests that there is a rapid adjustment of prices in this sector to changes in DM prices. However, the adjustment to changes in the DM Irish pound exchange rate is much slower; the sum of the coefficients on the exchange rate terms is only 0.32, less than half that for changes in DM prices. The ECM term suggests that nearly 10 per cent of the remaining adjustment takes place each quarter beginning one year after the initial change in prices or exchange rates.

Equation 5.13

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.625			
		(3.6)			
Δ Ln PW	Germany	0.091	0.120	0.322	0.165
		(0.5)	(0.4)	(1.2)	(0.9)
Δ Ln RX	Germany	0.005	0.313	-0.234	0.241
		(0.0)	(2.7)	(2.0)	(2.0)
ECM-4	Germany	0.092			
		(3.6)			
Seasonal	dummies	-0.003	0.010	0.001	
		(0.3)	(1.1)	(0.1)	
R**2=	0.461	S.E.=	0.020	DW=	2.662
DFFITS=	1.623				

5.14 Processing of Plastics

Equation 5.14

Variable	Country	Current Period	Lagged 1 period	Lagged 2 periods	Lagged 3 periods
Intercept		0.696			
		(2.0)			
Δ Ln PW	Germany	0.518	0.371		
		(3.3)	(2.3)		
Δ Ln RX	Germany	0.034	0.453	0.270	
		((0.3)	(4.7)	(2.7)	
ECM-4	Germany	0.108			
		(2.0)			
Seasonal	dummies	-0.009	-0.003	0.000	
		(1.1)	(0.4)	(0.0)	
R**2=	0.531	S.E.=	0.017	DW=	1.255
DFFITS=	2.029				

The results for this sector were rather similar to those for the rubber products sector. German prices and the DM Irish pound exchange rate on their own provided the most satisfactory results. As measured by the adjusted R**2, the fit of Equation 5.13 was not very good. However, four of the five short-run adjustment terms were significant and the ECM term was significant at the 90% level. The results imply a rapid adjustment to changes in DM prices with only a slightly

slower adjustment to exchange rate changes. Over three quarters of the adjustment to changes in the world price, as measured by German prices, takes place within the year of the initial change. Thereafter 10% of any remaining difference is eliminated each quarter.

5.15 Comparison with Results for Total Manufacturing

The 13 equations for the different sectors of manufacturing cover the bulk of the non-food output of that sector (approximately 70% of net output). The major omission is the electronics sector which is also omitted from total non food index and the index covering total manufacturing. When the weights derived from the disaggregated equations for the role of foreign prices and domestic costs in determining domestic prices are aggregated, an overall set of weights for total non-food manufacturing is derived. (Net output is used to weight the sectoral results.) Table 5.2 compares the resulting set of weights with those derived from equation 5.1 for non-food manufacturing and equation 4.2 for total manufacturing. As can be seen from the table the major difference between the disaggregated results and those for total non-food manufacturing is the significant weight of 0.13 which the disaggregated results attribute to domestic costs. However, this weight is sufficiently small that the SOE model of price determination is clearly the dominant one in Irish manufacturing industry.

Otherwise the two approaches concur in giving equal weight to German and UK prices in determining Irish prices in the long term. They also concur in attributing very little

weight to prices of other countries, especially of the US, in determining Irish prices. The low weight of the US may well be due to the omission of the electronics sector from all the wholesale price series.

Table 5.2
Weights of Different Factors in Determining Irish Output Prices

	Germany	UK	USA	Spain	Domestic Wage Costs
Total Manufac. Equation 4.2	0.56	0.44			
Total Non-Food Equation 5.1	0.52	0.48			
Disaggregated Total Non-Food	0.40	0.40	0.06	0.01	0.13

The disaggregated equations show a number of other similarities to the results obtained from the more aggregate equations. Both approaches suggest a relatively slower speed of adjustment of Irish prices to exchange rate changes than to changes of prices denominated in foreign currency terms. Where domestic wage costs are significant, their effects on prices take even longer to work themselves through than do the changes in foreign prices and exchange rates. A large number of the ECM terms are significant in the disaggregated equations, which, taken together with the results on the short-run coefficients, indicates that the adjustment of Irish prices to world prices takes a number of years.

6. Conclusions

The results presented in this paper show that the SOE model of price determination is appropriate to Irish manufacturing output. Domestic wage costs play only a minor role in price determination, while foreign price influences

are dominant. In this respect, the results confirm the consensus of earlier research on this topic; but the results on the nature and timing of the foreign influence are a good deal more novel.

Long-run homogeneity (a relative version of the PPP hypothesis) is not rejected, but short-run homogeneity is rejected. Generally the effects of changes in exchange rates on prices are much slower to materialise than are the effects of changes in foreign currency prices. This difference in behaviour can be explained by the fact that firms are reluctant to change their output prices very frequently (Restrictive Practices Commission, 1988). As a result, they have to set future prices based on their expectations of the Irish pound price of foreign competitors. When foreign competitors raise their prices in foreign currency terms there is little likelihood that they will subsequently reduce them so domestic producers will be quick to follow suit. However, if foreign prices in Irish pound terms change because of exchange rate changes, especially a change in the sterling - Irish pound exchange rate, past experience suggests that there is quite a possibility that the exchange rate may be reversed in the immediate future. As a result, firms are likely to be slower to change their expectations about future values of the exchange rate as a result of a single quarter's figures. (See the case of Irish Distillers in the Report of the Restrictive Practices Commission, 1988).

There is no evidence of an asymmetric response to exchange rate devaluations and revaluations. However, the number of observations available for the post-EMS period are

still too few to properly test this hypothesis. In any event it may be more appropriate to a model of the formation of domestic consumer prices, as suggested by Baker *et al.*, 1986, than to output prices.

Germany has a stronger influence in determining Irish prices than the trade weights suggest. In the post-EMS period it plays at least as important a role in output price determination as does the UK. The pattern of response of Irish prices to foreign prices was significantly different from that suggested by an approach based on trade weights.

Because of a limited number of consistent observations for the pre-EMS period it is difficult to test for a change in pattern of behaviour following the break in the link with sterling consequent on EMS membership. However, the evidence from the aggregate price series and for certain of the disaggregated series does indicate a change in pricing behaviour in 1979 with an increase in the importance of German prices and a fall in the importance of UK prices. It is difficult to identify a change in short-run pricing behaviour. The differential response to exchange rate changes has also taken on added importance now that the sterling-Irish pound rate is flexible.

These results have a number of implications for public policy. In so far as the pricing behaviour of Irish firms reflects their views as to who their competitors are, these results suggest a change in the traditional trade weighted approach to measuring competitiveness. On the basis

of these results, EMS countries, proxied by Germany, should have a much bigger weight in competitiveness measures than would be suggested by traditional trade weights.

The slower response of domestic prices to changes in the exchange rate than to changes in foreign currency prices has implications for the Irish economy on the completion of the EC market in 1992. If the UK remains out of the EMS uncertainty about the bilateral sterling-Irish pound exchange rate will pose problems in price determination. Without any customs or fiscal barriers prices slow adjustment to exchange rate changes could give rise to large temporary trade flows. The alternative is that either prices in Ireland change more rapidly in the face of changes in the sterling-Irish pound exchange rate or, alternatively, the variability of Irish prices in sterling terms increases.

REFERENCES

Baker, T., 1985. "Trends in Manufacturing Output and Wage Costs 1980-1984", Appendix to *Quarterly Economic Commentary*, April, pp. 26-35.

Baker, T., S. Scott and T.Quinn, 1986. *Quarterly Economic Commentary*, April.

Bradley, J., 1977. "Lags in the Transmission of Inflation", *The Economic and Social Review*, Vol. 8, pp. 149-154.

Central Statistics Office, 1988. *Census of Industrial Production, 1985*. Dublin: CSO

Fisher, F.M., 1970. "Tests of Equality between Sets of Coefficients in Two Linear Regressions: An Expository Note", *Econometrica* Vol. 38, pp. 361-366.

Fitzgerald, J., 1983. "A Study of the Determinants of Irish Industrial Output Prices", ESRI seminar paper.

Frenkel, J. A., 1981. "The Collapse of Purchasing Power Parities during the 1970s", *European Economic Review*, Vol. 16, pp. 145-165.

Geary, P. T., 1976a. "Lags in the Transmission of Inflation: Some Preliminary Estimates", *The Economic and Social Review*, Vol. 7, pp. 383-389.

Geary, P. T., 1976b. "World Prices and the Inflationary Process in a Small Open Economy - The Case of Ireland", *The Economic and Social Review*, Vol. 7, pp. 391-400.

Geary, P. T. and C. McCarthy, (1976) "Wage and Price Determination in a Labour Exporting Economy: The Case of Ireland", *European Economic Review*, Vol. 8, pp. - .

Honohan, P. and J. Flynn, 1986. "Irish Inflation in EMS", *The Economic and Social Review*, Vol. 17, pp. 175-191.

Isard, P. 1977. "How Far Can We Push the Law of One Price?", *American Economic Review*, Vol. 67, pp. 942-948.

Krasker, W.S., E. Kuh and R.E. Welsch, 1983. "Estimation for Dirty Data and Flawed Models", in Z. Griliches and M. D. Intriligator (eds.), *Handbook of Econometrics, Vol. 1*. Amsterdam: North-Holland.

Leddin, A., 1988. "Interest and Price Parity and Foreign Exchange Market Efficiency: The Irish Experience in the European Monetary System", *The Economic and Social Review*, Vol. 19, pp. 215-231.

Restrictive Practices Commission, 1988. *Report of the Restrictive Practices Commission*, Dublin: Stationery Office.