

# TOWARDS A DEFINITION OF FULL EMPLOYMENT IN IRELAND

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## 1. INTRODUCTION

In Ireland as in many other countries commitment to a target of full employment has become a central feature of government economic policy and while recent years have seen a resurgence of interest in the literature there does not appear as yet to be agreement on a definition of full employment. The practice normally adopted (in for example the UK and the US) is to frame the definition in terms of the maximum pressure of demand (minimum unemployment rate) deemed consistent with other and possibly conflicting policy objectives such as reasonable wage and price stability and balance of payments equilibrium. To the extent that policy objectives are conflicting their attainment becomes an exercise in constrained optimisation: constraints may take the form of reducing the priority assigned to an objective or where an objective is considered of prime importance attainment may be constrained because at some point the opportunity cost (or trade-off) in terms of secondary objectives becomes unacceptably high.

Examination of the recent literature in Ireland (for example, The Report on Full Employment (1967), Henry (1974) and Walsh (1975)) reveals a variety of definitions involving unemployment rates and net emigration and only token acknowledgement of the possibility of policy conflict: in the first two studies for example it was assumed that any resulting inflationary pressures could be contained by a prices and incomes policy. This approach is unsatisfactory because it leaves unanswered the question of what happens when the prices and incomes policy lapses and because it ignores the impact of external inflationary influences which limit the scope for an Irish prices and incomes policy.

The purposes of the present paper are first to examine the nature of the inflation - pressure of demand trade-off in the Irish economy and second to use the trade-off to

essay a constrained definition of full employment in terms of the maximum pressure of demand consistent with reasonable wage/price stability. As noted above the usual practice is to use the aggregate unemployment rate as an indicator of the pressure of demand on the assumption that movements in the rate provide an accurate and sensitive measure of movements in the general level of activity. This is unlikely to be the case in Ireland which has a large agricultural sector and (during the period under consideration) large scale net emigration both of which serve to reduce the sensitivity of the aggregate unemployment rate. In the present study therefore it is proposed to use the non-agricultural unemployment rate and the rate of net emigration by persons of working age as joint indicators of the pressure of demand. The period covered which was determined by the availability of data at the time of writing is from 1953 to 1971 inclusive.

## 2. BACKGROUND

Much of the discussion on inflation — pressure of demand emanates from the work by Phillips (and later Lipsey) who suggested that in the UK the rate of change of money wages ( $\dot{W}$ ) could be largely explained in terms of the unemployment rate ( $U$ ) and the rate of change in unemployment ( $\dot{U}$ ) except during or immediately after periods of rapidly rising import prices. More recently attention has centred on inflationary expectations and on regional and industrial dispersion of unemployment as determinants of money wage changes. Particularly since the late 1960s the marked worldwide acceleration in the rate of inflation coupled with increasing unemployment have been suggested as evidence that the hypothesis that the rate of inflation is related to demand conditions in the commodity and labour markets of which the main indicator is the level of unemployment, no longer offers an adequate explanation. As a consequence recent studies have tended to stress the role of expectations arguing that current wage increases depend upon expectations about future wage and/or price increases as well as the level of unemployment.<sup>(5)</sup> It has also been argued however that this is not a variance with the Phillips' relation since during periods of mild inflation expectations may be regarded as unchanging and hence need not be introduced explicitly into a wage (or price) equation: it is only when expectations are changing (for example during rapid inflation) that they need be introduced explicitly, so that in general variations in the pressure of demand may be regarded as causing variations in the rate of inflation relative to its expected rate. On this line of argument the trade-off between wage inflation and unemployment is a short-term rather than a long-term phenomenon and this now seems to be the generally accepted view.<sup>(6)</sup>

Since the present study relates to a period during the greater part of which wage and price increases were mild relative to more recent experience it seemed reasonable to assume that inflationary expectations remained largely unaltered and would not play an important explicit role in the wage and price equations. On the question of the effect of unemployment dispersion on wage inflation there is as yet no clear answer. Lipsey's theoretical interpretation of the role of  $\dot{U}$  in a macro wage equation has been disputed by Archibald who argued that *a priori* analysis of the effect of a change in unemployment

dispersion on the macro rate of wage change is inconclusive and that the question can be resolved only by empirical examination at the micro level.<sup>00</sup>

In fact the results of empirical studies at the regional and industrial levels in the UK and the US are conflicting and the extent to which macro wage changes are influenced if at all by the dispersion of unemployment remains unresolved. A result to emerge from the UK regional studies is of particular interest to the present study. It has been found that while changes in the regional unemployment rate and in prices were significant the most important determinant of changes in regional earnings was changes in national earnings: that earnings' changes in high unemployment areas did not appear to be influenced (other than indirectly via the national level) by earnings' changes in low unemployment regions.<sup>(9)</sup>

The inflation - pressure of demand relation has as elsewhere attracted considerable attention in Ireland. Understandably in view of the open nature of the Irish economy particularly with regard to Great Britain many commentators have stressed the importance of external influences operating on Irish wages and prices. O'Mahony for example noted that, "As Ireland and Britain form what is virtually a common market for labour owing to the unrestricted access enjoyed by Irish people to the British labour market it is to be expected that rates and earnings in the two countries should be closely related.....Where the essential unity of the Anglo-Irish labour market shows itself most clearly is in the long-run tendency for wages in Ireland and Britain to change at very much the same rate and for the change in Irish wages to be more closely related to changes in British wages than to changes in output per head in Ireland"<sup>A\*O</sup>)

Similar views have been expressed about price movements: for example Geary and Pratschke reported that since about 1950 there has been a close similarity of trend - the authors stressed their concern was with trends rather than levels — in consumer prices in Ireland and the UK and stressed the close economic and social relations between the two countries.<sup>0\*)</sup>

More recently Geary stressed the role of world (rather than British) prices in the determination of Irish inflation but found that when world prices were measured by a composite OECD deflator the regression results were less satisfactory than those obtained using the UK retail price Index<sup>A1^)</sup> Geary also reported a weak relationship between domestic unemployment and wage/price inflation but this could reflect the fact that Geary's model excluded wages as a possible source of imported inflation.

An alternative approach to the problem of wage inflation in Ireland which purported to resolve the paradox of high unemployment and net emigration co-existing with wage inflation was put forward by Mulvey and Trevithick.<sup>O^)</sup> The hypothesis was one of wage leadership: because during the period considered - 1954-1969 - the occupational group electricians experienced a considerably lower than average unemployment rate, it was argued that unlike the labour force at large, there existed for this group a Phillips - type trade-off between wage increases and excess pressure of demand

for labour; wage increases obtained by this group would eventually be transmitted throughout the labour force through the widespread acceptance of comparability and relativity in collective bargaining./.

A rigorous empirical testing of this hypothesis requires that an occupational wage inflation — unemployment relation can be established and that a relation between macro-wage changes and wage changes in the leading occupational group can be established. However lack of appropriate data compelled the authors to devise a short-cut method which postulated a direct relation between macro-wage increases and the unemployment rate amongst electricians.

The analysis would seem to be deficient in that it does not set the problem in the context of an economy in which there is the possibility of external labour mobility. For example, even if the leadership hypothesis is correct, wage increases in the leading sector may themselves be influenced by events in the British labour market so that the sectoral unemployment rate may not be an adequate indicator of the upward pressure on wages — a possibility which was not explored because of the short-cut method used.

### 3.THE MODEL

There would appear to be a parallel between the concomitance of high unemployment, net emigration and wage and price inflation characteristic of the Irish economy and the emergence in other economies since the late 1960s of accelerated inflation coupled with demand deficiency. As noted earlier this phenomenon has been attributed to the influence of international demand pressures and so far as Ireland is concerned the main influences in this respect are likely to emanate from Britain with which Ireland constitutes an open market for labour, maintains a fixed exchange rate and which is the principal source of Irish imports and recipient of Irish exports.^) Consequently it is to be expected that to a large extent the underlying trend rate of price, and in particular of wage inflation in Ireland, will reflect the course of events in the much larger neighbouring country, and this is basically the approach adopted in the model.

Turning first to the wage equationO^) the hypothesis is that in the long-term the growth rate of Irish money wages is determined' by the growth of wages in Great Britain (WQB), changes in the cost of living and the long-term structural change in domestic employment. The direct effect of British wage changes reflects the common labour market argument cited earlier and possibly the operation of Irish trade unions, many of whom have British connections, to maintain relativities if not parities with Great Britain. In addition it was felt that external influences affecting import prices and operating indirectly through cost of living changes might also be an important determinant of the long-term growth of Irish wages. Ú 6) The cost of living may be taken into account by deflating money wages or by introducing prices (P) as an explanatory variable in the wage equation. The second alternative was adopted partly because it is less restrictive and partly because it seemed more consistent with the real world in which bargaining is in

terms of money wages.

An examination of employment data showed that the period was marked by a gradual redistribution of employment with the percentage of total employment accounted for by the agricultural sector falling from 39.9 per cent in 1953 to 26.3 per cent in 1971. To the extent that the redistribution represented a shift into higher-paid employment, wages would exhibit a tendency to increase even in the absence of other pressures. To allow for this, the percentage of total employment in the non-agricultural sectors ( $E^A$ ) was included as an explanatory variable in the wage equation<sup>17</sup>)

Some explanation of the short-term but persistent deviations from the long-term growth path must also be sought. The argument is that a wage change-pressure of demand for labour relation of a type similar to those observed in the UK and the US also exists in Ireland; that while in the long-term the relation is overshadowed by external influences and internal structural change, short-term variations in the growth rate of Irish wages relative to its long-term path may be explained in terms of short-term variations in the pressure of demand for labour, and that the rate of unemployment in conjunction with the rate of net emigration by persons of working age provides a reasonable indicator of demand conditions in the domestic labour market.

There is an apparent paradox here; it has been argued that Ireland has an endemic labour surplus which precludes the emergence of an excess pressure of labour demand. However it would appear that the argument is based on the premise that equilibrium between the demand for and supply of labour is invariably characterised by a low rate of unemployment. There are grounds for believing that this premise is unfounded and that the rate of unemployment consistent with equilibrium in the labour market may vary with time and circumstances. For example in Lipsey's analysis of the UK an excess supply of labour was identified with unemployment rates greater than that which represented purely frictional unemployment and conversely for an excess demand for labour. Using the Dow/Dicks-Mireaux index of excess demand for labour Dicks-Mireaux reported that changes in the index were broadly similar to changes in the unemployment rate and that during the period from 1946 to 1959 the average unemployment rate corresponding to a zero value of the index was about 1.6 per cent<sup>18</sup>)

However in attempting to draw conclusions from these results which might be applicable in other circumstances a number of issues must be borne in mind. First, the relation between the unemployment rate and the pressure of demand for labour for which it stands as proxy is not immutable. More recent British labour market studies have shown that since 1966 the relationship between unemployment and another proxy, for excess demand, vacancies, has altered with the unemployment rate rising relative to the vacancy rate, implying (if vacancies are regarded as the more reliable proxy) that the unemployment rate corresponding to any given pressure of demand has increased.<sup>19</sup>) In similar vein, it has been argued that the high level of unemployment and other benefits relative to average earnings, the narrow employment market and the open nature

of the Irish labour market, are factors tending to increase the rate of frictional unemployment in Ireland.(20)

Second, the wage-unemployment relation is essentially a short-term one involving cyclical changes. To the extent that workers who are structurally unemployed have a less dampening effect on money wage increases than a similar number of cyclically unemployed workers, spatial and temporal comparisons of total unemployment, in order to draw conclusions about the pressure of demand may be misleading. The same level of cyclical unemployment may occur with different levels of structural unemployment thus giving different totals which may, never the less, be associated with similar rates of wage increase; alternatively similar totals may consist of different proportions of cyclical and structural unemployment and be associated with different rates of wage increase.

A third and related point is the extent to which the unemployment rate which is regarded as indicative of the borderline of zero excess demand (supply) is conditioned by past experience. During the period studied by Dicks-Mireaux in which zero excess demand was associated with 1.6 per cent unemployment, the average unemployment rate was also 1.6 per cent. Taken in the context of the points raised earlier this suggests the possibility that the rate of unemployment which at any given time is generally regarded as consistent with zero excess demand may be a rate which has over time become accepted as the norm, that is a rate which both employees and employers regard as indicative of normal pressure of demand conditions. If for short periods unemployment were to fall below the norm this would be interpreted as an excess-relative to past experience — pressure of demand for labour and conversely if unemployment were to rise above the norm.

This is not intended to suggest that the normal unemployment rate is entirely composed of a hard-core of unemployment which is insensitive to changes in the pressure of demand. Rather the argument is that a prolonged period of higher pressure of demand for labour would cause the normal unemployment rate to fall by reducing structural unemployment and by inducing employers and employees to revise their expectations of normality.(21)

With these points in mind the experience in Ireland strongly suggests the possibility that zero excess demand (supply) of labour may be associated with an unemployment rate which by international standards is high because of higher frictional and structural unemployment and with a stream of net emigration. The problem then becomes that of attempting to remove the higher trend values to isolate the short-term cyclical variations. Two alternative methods were adopted, in the first of which an attempt was made to define the characteristics of normal conditions in the domestic labour market. During the period under consideration the unemployment rate displayed a tendency to fluctuate around an average of about 7 per cent and it was surmised therefore that normal conditions might be characterised by an unemployment rate in the region of 7 per cent. In the case of net emigration, the rate of which displayed a marked downward trend, the long-term trend was taken to indicate normal conditions.

The hypothesis is that over the long-term the net outflow of workers caused by socio-demographic factors (and identified with the long-term trend rate of net emigration) is just sufficient to syphon off excess labour supply resulting from population and long-term participation rate changes; that the historical, social and geographical background is such that an unemployment rate of 7 per cent among those workers who remain in Ireland is regarded as the norm. In these terms, periods of normal pressure of demand for labour - by which is meant an absence of short-term pressure on wages — would be characterised by an unemployment rate of 7 per cent and an on-trend rate of net emigration. Periods of high - relative to past experience or expectations — pressure of demand would be characterised by an unemployment rate of less than 7 per cent, a below trend rate of net emigration and an above trend growth of money wages, the converse being true during periods of relatively low pressure of demand. The corresponding cyclical variables to be used in the wage equation were therefore, the unemployment percentage less 7 and deviations of the net emigration rate about its long-term trend.

The second method adopted to measure short-term variations in the pressure of demand for labour was to use first differences in the unemployment and net emigration rates. As Bowen and Berry pointed out, "The typical annual change in total unemployment is, almost by definition, more likely to represent a change in the volume of cyclical unemployment than a change in the volume of structural unemployment (which is presumably of a more "chronic" long-run nature).....For long-period studies, changes in unemployment may well constitute a more reliable index of active labour market pressures than the level of unemployment which is more susceptible to inter-period variations in the amount of structural unemployment".(22) the authors went on to point out, that since absolute changes in the unemployment rate tend to be less influenced than are percentage changes by the amount of structural unemployment in the total, there is likely to be a more consistent relation between absolute changes and the rate of change of wages.

Two other factors were considered to be of possible relevance to the explanation of short-term variations in the growth of money wages. First, it was felt that changes in labour productivity ( $\dot{Y}$ ) might influence short-term variations in the growth rate of wages: unions may be more aggressive in pressing wage claims which they feel can be substantiated by increased output per head ( $X^{\wedge}$ )

Second, it has been suggested that wage rates tend to rise more sharply in years in which a wage round is initiated(24) and consequently a dummy (binary) variable  $D$ , taking the value unity in wage round initiation years and zero in all other years, was introduced into the wage equation.

For the price equation it was assumed that prices in general are determined on the

basis of variable costs (labour and material) per unit output by adding a percentage mark-up to cover other costs and profits.(25) While there is some evidence to suggest that the mark-up may be sensitive in the short-term to variations in the general level of activity on average, over the long-term it may be regarded as constant.(26)

Thus denoting variable costs per unit output as C, price per unit may be written as:

$$P = (1 + g_0)C = (1 + g_0)(g_1W + g_2M), g_0 > 0$$

where W is wages, M the price of materials,  $g_0$  the mark-up, and  $g_1$  and  $g_2$  represent respectively the labour and materials requirements per unit output. Since changes in the materials required per unit output are unlikely to be substantial, even over fairly long periods,  $g_2$  may be regarded as constant. However the interpretation of  $g_j$  depends on the assumptions made about pricing policy: if prices are continually adjusted to take account of short-term variations in labour productivity,  $g_1$  is the reciprocal of labour productivity; if prices are related to the costs incurred when operating at some target level of output,  $g_1$  will be constant or will vary only with long-term trends in productivity.^) There is the further possibility that the price response to changes in labour costs resulting from changes in wages may differ from the response to changes stemming from variations in productivity.

The latter was allowed for by introducing productivity as a separate element in some forms of the price equation. The question of whether prices respond to short-term or trend variations in productivity was left open at this stage, but in the empirical analysis actual and trend productivity were introduced as alternative variables.

Since the model relates to the economy as a whole and the price variable is the deflator of total final expenditure the appropriate costs of materials variable is the price index of imports of goods and services. In addition because the price variable is in market price terms it was necessary to introduce a net expenditure tax variable.(28) To maintain comparability with the wage equation, with which it was to be simultaneously estimated, the price equation was expressed in terms of annual percentage changes.(29)

On substitution for  $g_1$  and  $g_2$  and with the addition of the tax variable the mark-up equation may be rewritten as:

$$P = (1 + g_0) \left[ \frac{L}{Q} W + \frac{X}{Q} M \right] + \frac{T}{Q}$$

where L is numbers employed, Q units of output, X units of imports, T total net taxes on expenditure and other variables retain their previous meaning. Differentiating with respect to time, assuming as a general case that the labour requirement per unit output



\* is not constant over time, and dividing across by P, gives

$$\dot{P} = (1 + g_0) \left[ \frac{WL}{PQ} \dot{W} - \frac{WL}{PQ} \dot{Y} + \frac{MX}{PQ} \dot{M} \right] + \frac{T}{PQ} (\dot{T}/Q)$$

where Y is as before labour productivity. In this form constancy of the prime cost coefficients and the tax variable coefficient requires that the corresponding shares in total money output are constant. Examination of cost data for the period, indicated that this was broadly the case; while the respective shares in total costs exhibited slight year-to-year variations there was no evidence of a persistent shift. (60)

The wage-price sub-model may now be summarised in the form below:

$$\dot{W} = a_1 \dot{W}_{GB} + a_2 \dot{P} + a_3 \dot{Y} + a_4 \% + a_5 f(U) + a_6 f(X) + a_7 D + v$$

$$\dot{P} = b_1 \dot{W} + b_2 \dot{M} + b_3 \dot{Y} + b_4 \dot{T} + z$$

where the data are in annual terms, the a and b terms are coefficients to be estimated, v, z are random disturbance terms and for brevity T now represents net tax per unit output. The notation f(U) and f(X) denotes respectively functions of unemployment and net emigration and some experimentation was undertaken to determine the most appropriate forms. (61) The results are reported in the following section.

#### 4. EMPIRICAL RESULTS

The model specifies an interdependent relation between wage and price changes and the method proposed for simultaneous estimation of the coefficients was two-stage least squares (TSLS). However because of uncertainties regarding exact specification of the functions — choice of appropriate variables and their functional form — some preliminary investigation was undertaken using ordinary least squares (OLS) and stepwise regression. (62)

On this basis a wage and price equation were selected for simultaneous re-estimation using two-stage least squares. Table 1 below shows the OLS and TSLS results for the preferred wage and price equations. The estimated reduced forms are also shown. (More detailed information is available on request from the author.)

In presentation of results, estimated coefficients, the coefficient of multiple determination ( $R^2$ ) and the Durbin-Watson statistic (d) are shown. (63) The ratio of each regression coefficient to its estimated standard error (t-statistic) is also shown.

Table 1: Wage and Price Regression Results.^1954 to 1971\*

Equation number								$R^2$	d
<i>Wage Equation</i>									
1	OLS	$0.3648\dot{W}_{GB}$ (2.26)	+	$1.0898\dot{P}$ (4.41)	+	$1.4245\%$ (1.97)	-	$1.2251AU$ (2.28)	0.974 2.38
2	TSLS	$0.4369\dot{W}_{GB}$ (1.67)	+	$0.9303\dot{P}$ (2.02)	+	$1.5616\dot{E}_N$ (1.53)	-	$1.0731AU$ (1.36)	0.953 2.07
<i>Price Equation</i>									
3	OLS	$0.4850(\dot{W}-\bar{Y})$ (8.06)	+	$0.2261\dot{M}$ (2.61)	+	$0.1364\dot{T}$ (3.50)			0.958 2.42
4	TSLS	$0.519(\dot{W}-\bar{Y})$ (5.74)	+	$0.2078\dot{M}$ (1.79)	+	$0.1285\dot{T}$ (2.47)			0.929 2.01
<i>Reduced Form</i>									
		$\dot{W}_{GB}$	$\bar{Y}$	$\dot{T}$	$\dot{M}$	$\dot{E}_N$	$A \ U$		
5	wage equation	0.9785 (2.55)	-0.8090 (1.31)	0.1921 (1.44)	-0.0470 (0.18)	3.1897 (2.92)	-1.3028 (1.26)	0.955	1.99
6	price equation	0.3619 (1.68)	-0.5243 (1.51)	0.1936 (2.58)	0.1954 (1.30)	1.5699 (2.55)	-0.3698 (0.64)	0.941	2.42

\*The regression period starts in 1954 because data are in the form of annual changes. ^ U indicates first differences in the U and  $\bar{Y}$  the trend value of labour productivity.

The Durbin-Watson test indicated the absence of first-order autocorrelation in equations (1) to (4). All the estimated coefficients in these equations have algebraic signs in accordance with expectation and are significant on a one-tailed t-test at the 10 per cent level or better. While the explanatory power of each equation declines slightly when moving from OLS to TSLS, in each case the value of  $R^2$  is reassuringly high.

As noted earlier TSLS was adopted in preference to OLS as a method of estimation: estimates obtained by applying the latter to each equation in turn are subject to bias, while those obtained using the former have the large sample property of consistency. However comparison of corresponding OLS and TSLS estimated coefficients indicates only minor differences and this may be advanced as a partial validation of preliminary experimentation with OLS.

The similarity of coefficients may be due in part to the small sample size — consistency is a large, sample property — and in part to the existence of lags between cause and effect in the wage-price relation. While the duration of any lags is probably short relative to the temporal aggregation of the data, their existence would nevertheless tend to reduce the degree of wage/price interdependence.<sup>^</sup>)

As specified in equations (2) and (4) respectively, the wage and price relations are referred to as structural equations because each attempts to describe part of the structure of the economy. However, the reduced form of each relation provides a more convenient means of assessing the effect of a change in an exogenous variable because it incorporated the feedback effects due to the wage/price interdependence. In assessing the implications of the results it will be convenient therefore to refer to both structural and reduced forms.

Examination of the reduced forms (equations (5) and (6)) shows that with one exception each coefficient has a sign in accordance with expectation. The exception is the import price variable in equation (5) which has an unexpected negative coefficient but which is however numerically very small and not well defined on a t-test.<sup>(35)</sup>

The implications of the results in Table 1 for wages during the period from 1953 to 1971 may be summarised as follows:<sup>^</sup>)

- (i) when the feedback with domestic prices is taken into account each one per cent increase in British wages led on average to a similar increase in Irish wages (equation (5)). This is in accordance with the views expressed by O'Mahony (op. cit.).
- (ii) Increases in wages may have tended to be marginally less than increases in

domestic prices. However the price coefficient in equation (2) does not differ significantly from unity, so that it is probable that in the absence of other influences, wage increases would have fully compensated for price increases.

- (iii) Each one per cent increase in the proportion of the labour force in non-agricultural employment caused wages to rise on average by 3.2 per cent. This was offset to some extent however by productivity gains which tended to reduce price increases and therefore wage increases (equation (5)).
- (iv) A short-term variation of one percentage point in the rate of unemployment about its long-term level tended to produce an opposite variation of 1.3 per cent in the trend growth of domestic wages (equation (5)). The data did not support the hypothesis of a non-linear relation between wage changes and unemployment due possibly to the absence of unemployment rates of less than 5.5 per cent.<sup>(37)</sup> Similarly there was no evidence that variations in the rate of wage increase were sensitive to variations in the rate of net emigration in either linear or non-linear form.

The implications for prices during the same period are:

- (i) The price response to a change in labour costs resulting from a change in wages tended to be the same as, though opposite in direction to, the response to a change resulting from movements in the long-term trend growth of productivity (equation (4)). In general the results obtained using trend productivity were superior to those obtained using year-on-year productivity changes and the implication is therefore that prices were not adjusted to take account of short-term variations in productivity.<sup>(38)</sup> An increase of one per cent in wages would have resulted in an increase in prices of just over one-half per cent which is broadly consistent with the observed share of labour costs in total costs for the period.
- (ii) The effect of a one per cent increase in import prices was to increase domestic prices by about 0.2 per cent.<sup>(39)</sup> This seems rather low during the period under consideration when import costs valued at market prices accounted for something like 40 per cent of total costs (excluding profits and overheads). While a revaluation of imports to factor cost would reduce the percentage it would still be in excess of 20 per cent. The source of the underestimate may be the choice of import price index which relates only to goods. The assumption that import prices of services moved in line with import prices of goods may not adequately reflect reality.<sup>(40)</sup>
- (iii) The direct effect of a one per cent increase in net taxes per unit of total final

expenditure was to increase prices by 0.13 per cent (equation (4)). This is consistent with the observation that during the period under consideration net taxes on expenditure accounted for 14 per cent of total costs. When indirect effects on prices due to the interaction with wages are taken into account, the impact on prices is increased to 0.19 per cent (equation (6)).

- (iv) The sum of the cost coefficients in equation (4) is less than unity (at 0.85) indicating that prices did not rise in line with costs and that profit margins were being eroded. However to the extent that the import cost coefficient may be underestimated too much stress should not be placed on this finding.
- (v) Since wages, which are an element of costs, are sensitive in the short-term to variations in the level of unemployment, it is to be expected that this sensitivity will be reflected in prices. Short-term variations in labour costs may cause divergences between actual prices and prices calculated on a full-cost basis because entrepreneurs may accept variations in the percentage margin, which is added to variable costs or variations in the speed with which cost changes are passed on in prices. (\*) The estimated reduced form of the price relation indicates that on average a unit percentage point decline in unemployment resulted in an increase of a little over one-third per cent in prices.

## 5. SHORT-TERM TRADE-OFFS

The empirical results for the wage-price model may now be used to examine the nature of the trade-offs between wage and price changes on the one hand and the level of unemployment on the other. As was indicated earlier the reduced forms of the wage and price relations provide a convenient means of assessing the effects of changes in an exogenous variable, in this case unemployment. They also provide a useful means of differentiating long-term and short-term influences determining the behaviour of wages and prices. The hypothesis underlying the model is that short-term variations in  $\hat{W}$  and hence in  $\hat{P}$  reflect short-term variations in the pressure of demand for labour; in the absence of short-term pressure of demand changes, wages and prices would grow at their respective long-term rates as determined by the trend growth rates of the other exogenous variables.

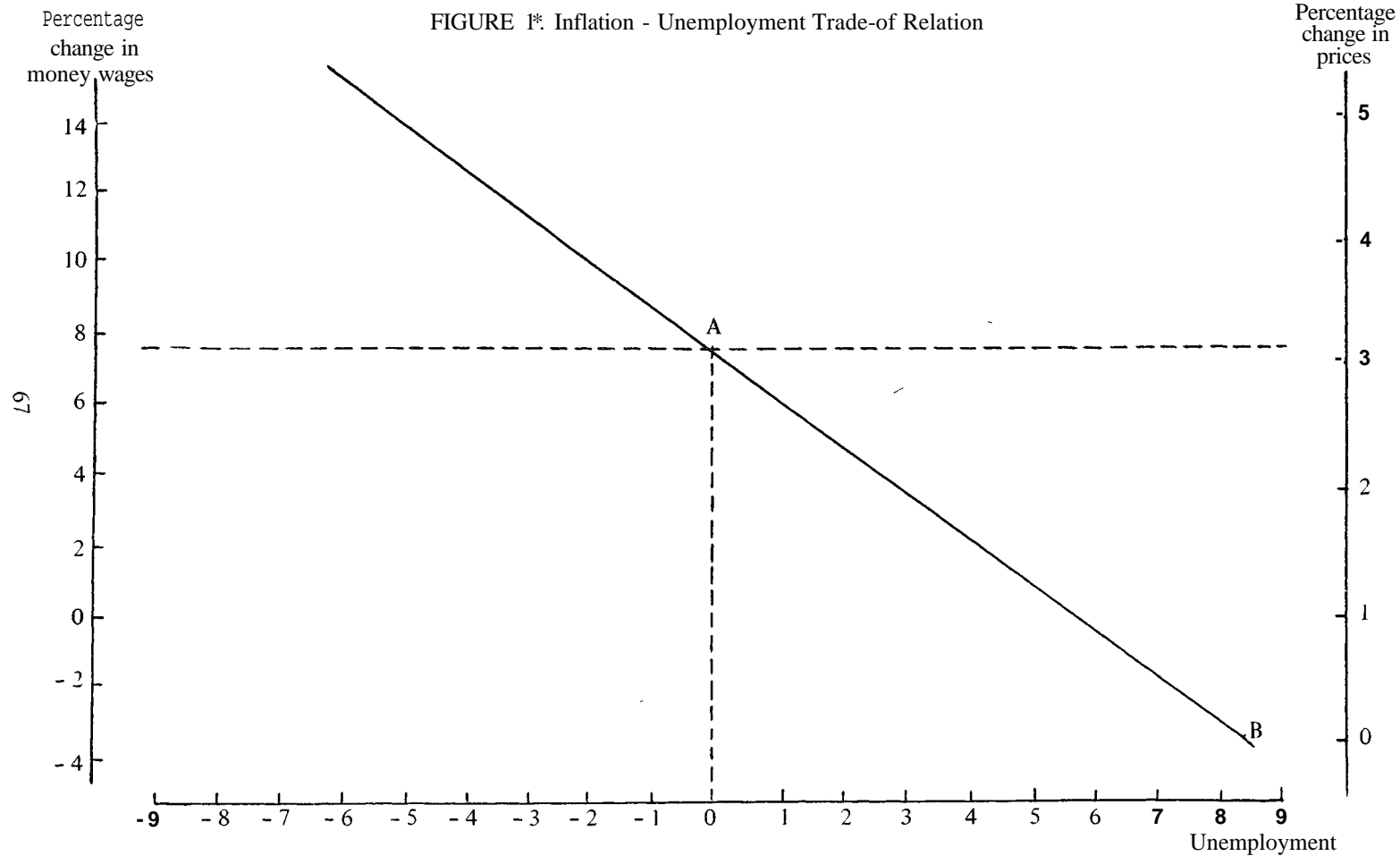
The reduced form relations (equations (5) and (6) of Table 1 ) may therefore be reduced to a trend and a short-term component by substitution of trend values for all exogenous variables except unemployment. Effecting the substitution yielded, ^)

$$\hat{W} = 7.35 - 1.30 A U \quad (7)$$

$$\hat{P} = 3.11 - 0.37 AU \quad (8)$$

The constant term in each equation represents an estimate of the trend rate of growth (per cent per year): calculated directly from the observed levels of wages and prices during the period from 1953 to 1971, the trends (per cent per year) were 7.7 for wages and 3.3 for prices which accord closely with the estimated values. For ease of exposition it is helpful to represent equations (7) and (8) graphically as in Figure 1 below in which the unemployment rate measured as deviations about the trend of 7 per cent is shown on the horizontal axis with the percentage rate of change of wages (W) on the left-hand vertical axis and the percentage rate of change of prices ( $\dot{P}$ ) on the right-hand vertical axis.(43) By a suitable choice of scales on the vertical axes both equations may be illustrated by a single line which will be referred to as the trade-off line.

The interpretation of Figure 1 is as follows. In the absence of short-term variations in unemployment, i.e., if unemployment were to remain at 7 per cent, then as indicated by the broken line, wages would increase at the (estimated) annual trend rate of 7.35 per cent and domestic prices at 3.11 per cent per year. Other unemployment-wage-price combinations may be read in similar fashion from the diagram and trade-offs may then be assessed by examining the changes which occur in the three variables when moving from one point to another on the trade-off line. For example a move from position A to position B which represents complete price stability would require unemployment to increase by some 8.5 percentage points to 15.5 per cent and wages to fall at an annual rate of about 3.5 per cent.



This result underlines the fact that due to the importance of factors other than wage changes exerting an upward pressure on domestic prices, it would be necessary to drive wages downward in order to achieve domestic price stability. The result also serves to illustrate differences between the comparatively small Irish economy which is also in the process of industrial re-organisation and for example the much larger and more stable US economy: Samuelson and Solow, and Perry for example were able to assume that domestic price stability in the US would be achieved if money wages were to grow at the same rate as labour productivity. <sup>(4)</sup>

While the example cited above illustrates the nature of the inflation — unemployment trade-off, it does so by using an extreme case since complete price stability is unlikely, in practice, to be a policy objective. Compromise among conflicting ideals plays an important role in the selection of a package of policy objectives so that a "reasonable" degree of inflation is generally regarded as tolerable in the interests of high employment.

The maximum rate of inflation deemed acceptable for an economy is usually determined by comparison with rates of inflation in other economies, particularly those of major trading partners and competitors because of possible effects on the competitiveness of exports and on the ability of home industries to compete with imports. However where such comparisons relate to domestic prices as a whole rather than to prices of specific commodities (or even to general export and import prices) they provide only a vague yardstick against which to measure an economy's performance: international comparisons have shown that for the most part changes in export prices bear little relation to changes in domestic prices as a whole. <sup>(5)</sup> This is scarcely surprising reflecting as it does, variations in industrial structures among countries and varying trends in costs per unit output among industries within the same country. <sup>(6)</sup> Consequently while the usual practice of comparing domestic inflation with that observed for other countries will be adopted here, this can only be regarded as meaningful in a very broad sense.

In terms of actual performance between 1953 and 1971, the average rate of price inflation in Ireland — some 3.3 per cent per year — compares favourably with that in other countries: for the OECD countries as a whole the average rate was 3.0 per cent; for the European members of OECD as a whole, 3.8 per cent; and for the UK, 3.4 per cent. However during this period unemployment in the UK for example averaged only 2.1 per cent and never exceeded 3.8 per cent. Thus while the Irish economy exhibited a rate of price inflation similar to that in the UK this was achieved in part at least by operating at a considerably lower pressure of demand for labour.

The estimated trade-off relation suggests that attempts to reduce unemployment in Ireland to a level comparable to that in the UK would have resulted in a rate of domestic inflation considerably greater than that experienced in most other western countries. The point at which the inflation gap might be deemed to be unacceptably wide is as much a political decision as it is an economic one but if in the light of



international experience during the period from 1953 to 1971 it may be suggested that a rate of domestic inflation in excess of 4.5 per cent per year would have been unacceptable then the model indicates that a consistent target for unemployment could not have been lower than 3 per cent.

It must be stressed that the inflation-unemployment trade-off on which this target is based is conditional. The relations embody trend rates of growth of other economic variables and estimates of their effects on wages and prices. Alterations in either of these sets of background conditions would cause a shift in the trade-off line. For example, part of the long-term growth of domestic prices is attributable to increasing (3.9 per cent per year) net taxation per unit of total final demand. Had taxation policy been designed to ensure no increase in net tax per unit the trend growth of prices would have been lower and the new trade-off line would lie to the left of the existing line, i.e. a lower rate of inflation would be associated with each unemployment level.

It will be apparent therefore that in identifying an unemployment rate of 3 per cent as consistent with full employment, the implicit assumption is made that no other policy changes were involved other than a commitment to stimulate aggregate demand to a level which would ensure that unemployment fell to 3 per cent. The analysis is intended therefore to explore in a limited fashion the consequences of pursuing one particular line of action, drawn from a potentially large number, each of which would represent a different policy combination.<sup>7)</sup> In practice, if the object were to present a range of alternatives on which policy decisions were to be based, it would be necessary to repeat the analysis for each potential policy combination.

## 6. CONCLUDING REMARKS AND LONG-TERM IMPLICATIONS

A number of qualifications should now be recorded. The first relates to the particular model adopted. Issue was taken earlier with the theoretical framework underlying a number of previous Irish studies and an alternative and hopefully more appropriate framework developed and empirically analysed. The fact that such dissimilar models can find empirical support inevitably suggests however that the data may be capable of even further differences of interpretation. While this is characteristic of most econometric studies it is perhaps nowhere so prevalent as in inflation — unemployment analysis. The position was summed up by Rees and Hamilton<sup>8)</sup> when they stated,

"... we have been astounded by how many very different Phillips' Curves can be constructed on reasonable assumptions from the same body of data..... For this reason, the authors of Phillips' Curves would do well to label them conspicuously, 'Unstable. Apply with extreme care'."

Second, even if the model is accepted the target for full employment was obtained from empirical relations by extrapolation beyond the range of observed data. This

procedure is valid only if it can be assumed that the relations remain unaltered and the indications are that this would not be the case. In particular it would appear that the inflation — unemployment relation is likely to become non-linear at lower levels of unemployment. To the extent that this would occur the target selected for unemployment will err on the side of optimism and must be regarded therefore as indicative of an order of magnitude rather than as a precise numerical target. In this context it may also be noted that the full employment target is to a considerable extent conditional on influences external to the Irish economy during the period from 1953 to 1971 so that extension beyond that period would require that consideration be given to movements in the external factors.

Third, the discussion of the trade-off has been in terms of the short-run. It has been argued that cyclical variations in the level of unemployment result in cyclical variations in the growth rate of wages and indirectly of prices; that the level of unemployment about which these short-term variations occur depends upon the level of structural unemployment and possibly upon expectations of what constitutes a long-term normal unemployment level. If however, the economy were to operate for a prolonged period at substantially lower levels of unemployment, then it is likely that structural unemployment would be reduced and expectations regarding normal unemployment would be revised downward.<sup>(49)</sup> As a result policies designed to achieve a full-employment target selected on the basis of an inflation — unemployment relation may well have the effect of altering that relation. <sup>(50)</sup>

While these are serious qualifications and serve to counteract any spurious impression of numerical precision it is hoped that the present paper will serve in some small way to clarify the definition of full employment in Ireland.

#### FOOTNOTES

1. See Report on "Full Employment", *NIEC Report No. 18*, Stationery Office, (Dublin) 1967; Henry, E. W., *Irish Full Employment Structures, 1968 and 1975*, ESRI (Dublin) Paper No. 74, 1974; Walsh, B. M., "Population and Employment Projections: 1971-86", *NESC Paper No. 5*, Prl. 4193, Stationery Office (Dublin) 1975.
2. In what follows a dot superscript will denote percentage rate of change. In the empirical analysis annual percentage rates of change were aligned at the start of each year with the unemployment level by adopting the Bowen and Berry format for rates of change and using the average of the July to following June figures for the unemployment level. Unemployment first differences were calculated from the January-December averages. Because of the crudity of the net emigration data a similar fine tuning was not undertaken. Details of the data are available on request from the author.
3. Phillips, A. W., "The Relationship between Unemployment and the Rate of Change of Money Wage Rates in the UK 1861-1957", *Economica N.S.* vol. 25 (1958); Lipsey, R. G., "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the UK 1862-1957: A Further Analysis", *Economica N.S.* vol. 27 (1960).

4. Hines, A. G., "Trade Unions and Wage Inflation in the UK, 1893-1961", *Review of Economic Studies*, vol. 31 (1964) reported results which seemed to show that trade union strength played an important part in determining wage changes. However Marin, A., "The Phillips Curve (Born 1958 — Died?)", *Three Banks Review*, no. 96, (Dec. 1972) argued that since only part of the labour force is unionised this approach would require an explanation of how wage increases in unionised sectors are transmitted to non-unionised sectors.
5. See for example, Friedman, M. "The Role of Monetary Policy", *American Economic Review*, vol. 58 (1968).
6. See for example Laidler, D., "The Current Inflation — Expectations and Policies", *National Westminster Bank Review* (Nov. 1972). In this sense the effect of changing expectations is a transitory one, important (i.e. requiring explicit consideration) only in particular circumstances. See also Marin (1972) *op. cit.* for a highly critical review of expectations hypotheses.
7. Since the (short-run) trade-off between inflation and excess demand relates to the domestic economy, augmenting the wage equation by including expectations variables resolves the problem of concurrent wage explosion and domestic excess labour supply only in the instance of a fixed exchange rate economy and only if the pressure of external excess demand is sufficient to outweigh the pressure of internal excess supply. Otherwise there remains the logical problem of explaining the origin of the inflationary expectations variables which are apparently generated by inflation resulting from a non-existent domestic excess demand. For a fuller discussion of these points see Parkin, J. M., "The Causes of Inflation: Recent Contributions and Current Controversies", *University of Manchester Inflation Workshop Discussion Paper no. 7405*; Trevithick, J. A. and Mulvey, C., *The Economics of Inflation*, Glasgow Social and Economic Research Studies 3, Martin Robertson (1975).
8. See Archibald, G. C., "The Phillips Curve and the Distribution of Unemployment", *American Economic Review Supplement*, vol. 59 (1969).
9. See Webb, A. E., *Unemployment, Vacancies and the Rate of Change of Earnings: A Regional Analysis*, NIESR Regional Papers III, Cambridge University Press (1974). Similar results were reported by Metcalf, D., "The Determinants of Earnings Changes: A Regional Analysis for the UK 1960-1968", *International Economic Review*, vol. 12 (1971).
10. See O'Mahony, D., *Economic Aspects of Industrial Relations*, ESRI (Dublin) paper No. 24 (1965).
11. Geary, R.C. and Pratschke, J.L., *Some Aspects of Price Inflation in Ireland*, ESRI Paper no. 40 (1968).
12. Geary, P. T., "World Prices and the Inflationary Process in a Small Open Economy — the Case of Ireland", *Economic and Social Review*, vol. 7 (July 1976). See also Geary, P. T. and Jones, R., "The Appropriate Measure of Unemployment in an Irish Phillips Curve", *Economic and Social Review*, vol. 7 (Oct. 1975).
13. Mulvey, C. and Trevithick, J. A., "Wage Inflation: Causes and Cures", *Central Bank of Ireland, Quarterly Bulletin* (Winter 1970).
14. During the period under consideration Britain's share of Irish imports and exports declined though by the end of the period Great Britain still accounted for about 50 per cent of Irish imports and over 60 per cent of Irish exports.
15. In keeping with the macro level of discussion wages is wages and salaries per head employees in employment and prices is the market price deflator of total final expenditure on goods and services (at market prices).
16. To some extent this may be regarded as an extension of the argument put forward by Webb *op. cit.* that a major factor determining the growth of UK regional earnings is the growth of wages at the national level, (in neither case is it argued that the national and regional growth

rates are necessarily equal since other factors enter in.) Because of restrictions in the form of work permits on entry into the N. Ireland labour force, Great Britain (i.e. the United Kingdom excluding N. Ireland) seemed more appropriate.

17. More appropriately  $E_N$  should measure the percentage of employees in employment accounted for by the non-agricultural sectors. However an industrial disaggregation of employees is available only for those years in which a Census of Population was taken whereas a similar disaggregation of the labour force is available for each year.
18. Dow, J. C. R. and Dicks-Mireaux, L. A., "Excess Demand for Labour", *Oxford Economic Papers*, vol. 10 (1958); Dicks-Mireaux, L. A., "The Inter-relationship Between Cost and Price Changes 1946-1959", *Oxford Economic Papers* vol. 13 (1961).
19. A number of reasons — the introduction of redundancy payments and earnings-related unemployment benefit — may be advanced to explain the shift in the relation: see Bowers, J. K., Cheshire, P. C. and Webb, A. E., "The Changes in the Relationship Between Unemployment and Earnings' Increases: A Review of Possible Explanations", *NIER* no. 54 (1970). However see also Bowers, Cheshire, Webb and Weeden, R., "Some Aspects of Unemployment and the Labour Market, 1966-1971", *NIER* no. 62 (1972) in which the shift was partly attributed to an increase in the ratio of recorded to true vacancies.
20. Walsh, B. M., *The Structure of Unemployment in Ireland, 1954-1972*, ESRI (Dublin) paper no. 77 (1974). See also Cheshire, P. C., *Regional Unemployment Differences in Great Britain*, in *Regional Papers II*, Cambridge University Press (1973) who found some evidence of higher levels of structural and frictional unemployment in the high unemployment regions.
21. This point is supported by results reported in Walsh (1974) *op. cit.*, pp. 27 ff. Regression analysis indicated that there was a statistically significant relationship between long-term unemployment and the pressure of aggregate demand such that when demand rose (fell), long-term unemployment fell (rose). Long-term unemployment was measured as urban males on the Live Register in September with no employment in the previous twelve months.
22. The authors suggested this as a possible explanation of their empirical finding that the relation between first differences in  $U$  and money wage increases was more stable than that between unemployment levels and wage increases. Bowen, W. G. and Berry, R. A., "Unemployment Conditions and Movements of the Money Wage Level", *Review of Economics and Statistics*, vol. 45 (1963).
23. Productivity was measured as real GNP per head of the labour force at work rather than per head employees in employment. The number of employees has grown considerably as a percentage of the labour force so that a productivity measure based on employees would tend to understate the overall growth rate. Sargan, J.D., "Wages and Prices in the UK, A Study in Econometric Methodology", in Hart, P. E., Mills, G. and Whitaker, J. K. (eds.) *Econometric Analysis for National Economic Planning*, Butterworths (London) 1964, used labour productivity as an alternative to a profits variable in the wage equation to indicate trade union aggressiveness. For a general discussion of indicators of trade union aggressiveness and their shortcomings — the authors concluded that the empirical evidence of the effect of trade union militancy on wage inflation was "a somewhat confusing mixture" — see Trevithick and Mulvey (1975) *op. cit.*, Ch. 6.
24. See for example, O'Mahon<sup>^</sup> *op. cit.*
25. Variable and overhead labour costs were not distinguished, all labour costs being regarded as variable. There is considerable support from direct enquiries into business pricing policy for the view that prices are fixed on the basis of costs. See for example for the UK, Hall, R. L. Hitch, C. J., "Price Theory and Business Behaviour", *Oxford Economic Papers*, no. 2 (1939) and more recently, Pearce, I. F., "A Study in Price Policy", *Economica N.S.* vol. 23 (1956); for the US, Kaplan, A.D.H., Dirlam, J. B., and Lanzilotti, R. F., *Pricing in Big Business*,

Brookings Institution (Washington) 1958. At the present level of aggregation the mark-up must be regarded as the net result of mark-ups at various levels of production and in different industries. There is the further problem that government services are not subject to a profit mark-up but since depreciation on government buildings is included in GDP it may be argued that this constitutes a form of mark-up.

26. See Black W., Simpson, J. V., and Slattery, D. G., *Costs and Prices in Transportable Goods Industries*, ESRI paper no. 51 (1969).
27. See for example, Neild, R. P., "Pricing and Employment in the Trade Cycle", *National Institute Economic and Social Research* (London), Occasional Papers 21 (1963).
28. Taxes on expenditure less subsidies divided by total final expenditure at constant market prices.
29. Furthermore as is the case with wages, external influences appear to affect the growth rate rather than the level of Irish prices.
30. Where total cost equals labour costs (wages and salaries) plus import costs plus total net taxes on expenditure. The data sources are *National Income and Expenditure* (1972) and earlier years, Table A. 1 for wages and salaries; Table A. 5 for imports of goods and services; Table A. 3 for taxes on expenditure less subsidies. The comparison is not exact because imports of goods and services are measured at market prices. While the shares in total final expenditure remained reasonably constant the same is not true of GDP at factor cost in which the share of wages has shown a tendency to increase.
31. Some experimentation was also undertaken to explore the possibility of time-lags in the specifications and of changing expectations in the wage relation. To the extent that the normal pressure of demand argument developed earlier embodies the hypothesis that expectations were subject to a long-term gradual change further expectationa! variables are required only if it is considered that expectations also underwent short-term changes. While annual data are unlikely to be sufficiently sensitive to pick up such effects (if they exist) some allowance was made by introducing first differences in the about-trend variations of the net emigration rate as an additional variable in some specifications of the wage equation. Not surprisingly neither the time-lags nor the expectations variable produced satisfactory results.
32. This practice which substantially reduces the computational burden and cost is widely adopted in empirical studies. As originally specified the model consisted of four equations (relating to wages, prices, net emigration rate and activity rate) in which in addition to the wage/price interdependence, wages and net emigration were also interdependent. However, the preliminary analysis indicated that net emigration was not a significant factor in the wage equation and it was considered appropriate to restrict the present analysis to the wage/price sub-model. Net emigration still remains relevant in the context of full employment since the net numbers emigrating are to some extent sensitive to variations in the domestic pressure of demand. It is hoped to report further details on this point at a later date.
33. Values of  $R^2$  were calculated using moments about zero rather than about means because in the absence of a constant term the mean of the least-squares residuals is not in general zero. See Theil, H., *Principles of Econometrics*, Wiley (London) 1971, Chapter IV. Similarly the Durbin-Watson test does not apply directly to least-squares residuals where regression is performed without a constant term. To obtain a valid test the regressions were re-estimated with a constant term added and the resulting Durbin-Watson statistics are those shown. See Durbin, J., and Watson, G. S., "Testing for Serial Correlation in Least Squares Regression II", *Biometrika*, vol. 38 (1951).
34. See for example, Black, Simpson and Slattery *op. cit.* p. 16 who found that while the major part of the effect on output prices in transportable goods industries due to a change in wages was concentrated in the current quarter, some small part of the effect was still in evidence nine months later.

35. An alternative specification of the model based on semi-annual observations "manufactured" from the annual data suggested that the modal effect of a change in import prices on domestic prices and hence on wages might be subject to a lag of about six months. When six-month-lagged import prices were used the coefficient in the reduced form wage equation had a positive sign. However, in other respects the alternative specification was less satisfactory.
  36. In each case *ceteris paribus* is assumed. While the following interpretation of regression coefficients is commonly adopted, Geary, R. C., "Some Remarks About Relations Between Stochastic Variables: A Discussion Document", *Review of the International Statistical Institute* vol. 31 (1963) would argue that it is strictly valid only if the regressors are mutually uncorrelated.
  37. A similar absence of curvature has been observed in the US wage change-unemployment relation and attributed to the absence of unemployment levels less than 3 per cent. See for example Archibald *op. cit.* and Bowen and Berry, *op. cit.* In general the results obtained using first differences in unemployment were superior to those obtained using the percentage unemployment level less seven.
  38. Similar findings were reported in the empirical study of UK data by Neild (1963) *op. cit.* and in the direct enquiries by Hall and Hitch *op. cit.*, Pearce *op. cit.*, and Kaplan, Dirlam and Lanzilotti *op. at.*
  39. The coefficient of the import price variable in the reduced form is marginally less than that in the structural form due to the unexpected negative coefficient for import prices in the reduced form wage equation.,
  40. The underestimate may also be due to the shape of the distributed lag of import prices even though the total length of the lag is subsumed in annual data. In their study of prices in the transportable goods industries Black, Simpson and Slattery found that the raw materials price distributed lag had its modal point after a lapse of from three to six months.
  41. For a fuller discussion see for example, Black, Simpson, and Slattery, *op. cit*
  42. The trend growth rates in per cent per year for the period 1953 to 1971 for each variable are shown below.
- | variable    | $W_{QB}$ | Y   | T   | M   | $E_N$ |
|-------------|----------|-----|-----|-----|-------|
| growth rate | 6.2      | 3.6 | 3.9 | 1.4 | 1.1   |
43. While the empirical analysis did not provide a conclusive answer about the "normal" level of unemployment it may still be argued that the trend level of 7 per cent represents a fairly stable combination of structural and cyclical unemployment and is therefore a useful yardstick from which to measure short-term variations.
  44. Samuelson, P. A., and Solow, R. M., "Analytical Aspects of Anti-Inflation Policy", *American Economic Review* (Papers and Proceedings Supp.) vol. 50 (1960); Perry, G. L., "The Determinants of Wage Rate Changes and the Inflation-Unemployment Trade-off for the US, *Review of Economic Studies*, vol. 31 (1964). The comparison in the text is not a precise one: the price variable in the present study relates to market prices the growth of which is partly attributable to increasing net taxation on expenditure.
  45. See *The Growth of Output 1960-1980*, OECD (Paris) 1970, Chapter III.
  46. It may also reflect differences in profit margins between goods sold on the home market and goods sold in the export market.
  47. For example "The Report on Inflation", NESC report no. 9, Prl. 4576, Stationery Office (Dublin) 1975 noted (*vide* P. 26) that revaluation against the pound sterling would be a powerful once-for-all means of moderating the effect on the economy of price increases emanating from abroad.

48. Rees, A. and Hamilton, M. T. "The Wage-Price-Productivity Perplex," *Journal of Political Economy*, vol. 75 (1967). See also Henry, S.G.B., Sawyer, M. C, and Smith, P. "Models of inflation in the UK", *NIER* no. 77 (1976).
49. For a discussion of policy actions which might be undertaken to alter the inflation-unemployment relation see for example Archibald (1969) *op. cit.*, and Holt, C. C, "Improving the Labour Market Trade-off Between Inflation and Unemployment", *American Economic Review*, Supplement, vol. 59 (1969).
50. Indeed a development of the argument put forward by Friedman (1968) *op. cit.* that there is always a temporary trade-off between inflation and unemployment but no permanent trade-off and that the temporary trade-off is a result not of inflation *per se* but of unanticipated inflation is the so called vertical Phillips curve theory. The theory predicts that in the long-term the curve relating changes in money wages to the unemployment rate is a vertical straight line cutting the unemployment axis at the 'natural' rate of unemployment (the rate at which any increase in real wages is equal to the productivity change) because the natural rate is compatible not only with zero price inflation but with any *constant* rate of inflation. The argument is that if a price increase of  $x$  per cent is anticipated,  $x$  per cent will be added to a money wage increase which would otherwise have led to no change in prices and this in turn will cause prices to rise by  $x$  per cent. As a result of expectations being fulfilled they will remain unchanged so that a long-term equilibrium of a steady  $x$  per cent price inflation will be established. Since the argument holds for any value of  $x$  plotting the percentage change in money wages against unemployment, produces a vertical line at the natural rate of unemployment. However the theory has been disputed (see for example Mann (1972) *op. cit.*) on the grounds that empirical tests using UK and US data have failed to support the argument that workers fully compensate for expected price increases; that logically it is implausible since if unemployment remains above the natural rate for prolonged periods then prices should fall at an increasing rate which did not happen in the high unemployment period of the 1930s.