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by

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I. INTRODUCTION

The problem of inflation is central to the contemporary economic scene in Ireland as in Britain. A knowledge of the factors determining the rate of change in the price level is a prerequisite for effective action aimed at reducing the rate of inflation. This paper will be concerned with one facet of the total problem—that of wage inflation. Obviously wage and price inflation are interlinked phenomenon, and indeed the impact of changing retail prices on wage inflation will be analysed, but an explanation of changes in product prices will not be attempted.

A sustained period of economic growth has recently been held up by a worsening balance of payments situation. To improve her export performance and to reduce the rapid inflow of imports Ireland must (1) resort to more controls, (2) reduce the rate of economic expansion, thereby increasing the already high rate of unemployment, or (3) increase her international competitiveness (or adopt some combination of these possible courses of action). Either of the first two courses of action will result in a loss of real income. The third possibility can be achieved through a more rapid rate of increase of productivity *vis-à-vis* competitor nations—a situation which can only be achieved over the long term by raising the rate of investment and through a reorganisation of industry—or by moderating wage and price increases. Thus we arrive at the justification for a prices and incomes policy. This paper aims at providing some background information relevant to the wages part of an incomes policy, with sideward glances at prices and profits. The study aims at providing quantitative information on the determinants of the rate of change of money wage rates and wage earnings. Thus the magnitude of the task of limiting wage rate increases to productivity increases will be indicated. The second major objective is to identify whether the problem of wage drift (measuring the divergence between wages and earnings) is likely to render an incomes policy which works on wage rates of limited usefulness.

The problem is analysed at two levels: industry and aggregate. First an estimate is made of the underlying relations at the individual industry level, the usual level of wage bargaining in Ireland. A group of seventeen major industries will be analysed over the post-war period. They have been chosen on the basis of having relatively large labour forces and the continuity of relevant statistics back to 1949. The determinants of wage inflation are estimated using time series data for each of the seventeen industries separately, and then the data for all the industries is combined in order to identify inter-industry differences in wage adjustment.

Variables to be examined at the industry level include the level of unemployment (at industry, industry group and aggregate level) the rate of change of the consumer price index, the level of profits, profit rates and the rate of change of profits at the industry level and a measure of the degree of union organisation in the different industries. Unemployment is intended as a proxy variable for the level of excess demand (or supply) of labour—the gap between the quantity of labour desired by employers and the quantity of labour offered at the prevailing wage rate. Thus relatively low levels of unemployment are indicative of a relatively tight labour market resulting in relatively large increases in wages. The rate of change of the consumer price index is an indication of changes in the cost of living which encourage unions to press for adjustments in wages. The various measures of profit are intended to represent the relative prosperity of a particular industry in a particular period. We might expect relatively high profit levels to be associated with vigorous wage demands and a relative willingness of employers to grant them. In the inter-industry relationship industries are ranked according to a

*The author of this paper was associated with The Economic Research Institute while on vacation from the University of Manchester. The paper has been accepted for publication by the Institute. The author is responsible for the contents of the paper including the views expressed therein.

subjective estimate of the degree of union organisation. The only quantitative estimate of union pushfulness that can be made at the industry level is in the case of agriculture where industry level estimates of union membership are available over the post-war period.

The second part of the study is concerned with analysing the process of wage inflation in aggregate. OHerlihy[13] experimented with a wide range of explanatory variables (unemployment, retail prices, productivity, wage rounds, trend and various British labour market variables) in his study of aggregate wage earnings and found only Irish unemployment and retail prices to be consistently significant. This study seeks to establish the relevance to aggregate wage inflation of two additional sets of variables—profits and trade union pushfulness that have been found to be of importance in studies of wage inflation in the U.S. and U.K. (Perry[15]; Hines[6]). The rate of change of money wage earnings will therefore be related to demand, price, profit and union variables. Union pushfulness is measured in aggregate by the level and rate of change of unionisation.

To examine the problem of wage drift some estimate will be made of the determinants of the rate of change of money wage rates as well as wage earnings. This will form part of the process of breaking down wage inflation into its component parts. The process will be completed by setting up and estimating a model to explain the rapidly increasing difference between standard rates and actual earnings in Ireland—the earnings gap. An important point to resolve is whether demand for labour is largely reflected through rates or through labour's earnings above standard rates. If the former, then there is at least some basis for saying that an incomes policy based on wage rates will have some effect on the rate of wage inflation, whereas if the latter is true (demand reflected through the earnings gap), then we can expect control over wage rates to be dissipated by the local bidding up of the price of relatively scarce labour in excess of standard rates. Some quantitative work by Dicks-Mireaux and Shepherd[4] leads to the conclusion that changes in wage earnings can largely be explained by changes in wage rates (previously explained by demand and price variables) and are not affected by excess demand for labour.

The paper is organised in three major sections (II, III and IV) followed by a summary and conclusions (V). Section II of the paper will give the theoretical background to the wage adjustment process, analyse previous empirical work and develop a model of wage inflation. The empirical content will follow in Section III with the industry level analysis and in Section IV with the aggregative analysis of wage rates, earnings and earnings gap. Section V, the last part of the paper consisting of summary and conclusions examines some of the implications of the results for an incomes policy and suggests further areas for research. The data, data sources, definition of variables and correlation matrices will be included as appendices.

II. MODELS OF WAGE ADJUSTMENT

Static price theory suggests that in equilibrium supply and demand are equated at the existing market price. In the labour market the supply and demand for labour determines the going wage rate. We are concerned with the rate of change of wages and we therefore require a dynamic model of wage adjustment which allows for the existence of disequilibria between supply and demand. In equilibrium supply equals demand for labour, excess demand equals zero and wage rate is stationary. With a shift in supply or demand, excess demand takes on some non-zero value (positive or negative) and wage rates will begin to adjust up or down toward a new equilibrium where supply and demand are equated at a new wage rate.

Consider an individual labour market with supply and demand relationships for labour:

$$(1)\quad S=f(W/X)$$
$$(2)\quad D=g(W/Y)$$

X and Y are sets of exogenous variables causing shifts in the supply and demand curves. In disequilibrium (caused by a shift in demand or supply curves) excess demand (or excess supply) will bring about a wage adjustment which will tend to restore a new equilibrium.[1] We may write this reaction function down as:

$$(3)\quad \Delta W=h\left(\frac{D-S}{S}\Big/ Z\right)$$

such that the speed of adjustment is a function of the level of excess demand (expressed here as a proportion of the labour force) and a vector of exogenous factors (Z). If we think of labour supply as employed plus unemployed, and demand as employed plus unfilled vacancies, then excess demand will be unfilled vacancies (U.V.) minus unemployment (U). Usually we will not have a reliable measure of U.V. so we take U as a proxy

[1]Assuming the demand and supply curves have the usual slopes. We are not investigating the possibility of an unstable situation.

variable for excess demand. The vector Z consists of variables whose influence is independent of the shift variables in the supply and demand equations. The influence of X and Y, the shifters of supply and demand, on the wage adjustment process is exerted via U, whose level they determine.

Relation between Excess Demand, Unemployment and Wage Adjustment

Consider the relationship between excess demand and the rate of change of money wages (ΔW).[2] When excess demand $\left(\frac{D-S}{S}\right)$ is zero then we would expect ΔW to equal zero (in the absence of cost push). As excess demand increases so we would expect ΔW to increase, and as excess demand becomes negative so we might expect ΔW to become negative. The simplest formulation of this relationship would be a linear ray through the origin, as in Figure 1. Figure 2 shows the relation of $\frac{D-S}{S}$ and U where a positive level of U, corresponding to frictional unemployment, is equal to zero excess demand. As excess demand approaches infinity so U must approach zero (or some small value greater than zero) asymptotically. In the phase of excess supply we might simply suggest a linear relation between the negative value of $\frac{D-S}{S}$ and U. Figure 3 simply substitutes ΔW for $\frac{D-S}{S}$, leaving the shape of the relation unchanged.

It seems reasonable to conceive of the shape of the adjustment relation as depending upon union activity. Success of the union is equated with bending upwards the adjustment relation in the phase of excess demand so that any given level is associated with a higher rate of change of money wages, and with pivoting the relation towards the horizontal axis, in the phase of excess supply, and therefore reducing the rate of negative change of money wages for any given level of unemployment. Thus the relation in Figure 1 would be modified by union activity to give a steeper slope in the first quadrant and a lesser slope in the third quadrant with a discrete change in slope at the origin. The relation in Figure 3 would show a steeper curve in the first quadrant and a flattened curve in the fourth quadrant.

Shifters of the Wage Adjustment Relationship

We are now concerned with identifying the variables in vector Z of Equation (3). These variables cause the wage adjustment relation to shift to the left or to the right so that any given level of excess demand (taken from now on to be U) may correspond to different values of ΔW depending on the values of the variables in vector Z. These shift variables are those whose influence is independent of the shift variables in the demand and supply equations (X and Y), whose separate effect is picked up by the level of excess demand which is created in the system. Variables which have been suggested as relevant are the rate of change of unemployment (ΔU); the rate of change of retail prices (ΔP); the level and rate of change of profits (D and ΔD); and the level and rate of change of unionisation (T and ΔT). Productivity and output variables will obviously figure in the labour demand equation. Their presence in the wage adjustment relationship must be justified by their influence on wages independent of the demand for labour.[3] Some explanation of the relationship of the above mentioned variables to wage inflation is attempted below. The empirical problems generated by attempting to incorporate these variables into a

[2]The relationships described here are set out in detail in Lipsey [9].

[3]Productivity may indeed be relevant for the wage adjustment relation in at least two cases: (1) where productivity forms the basis of union demands for higher wages, and (2) in piece work conditions where increased productivity will lead directly to higher wage *earnings*.

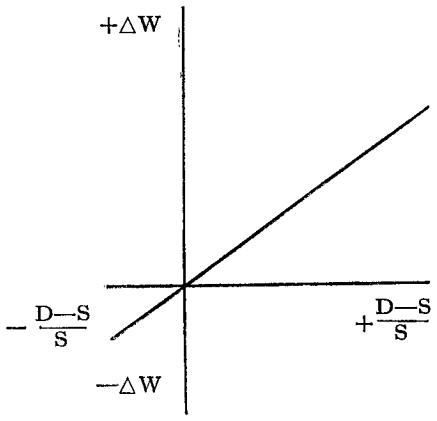

FIG. 1

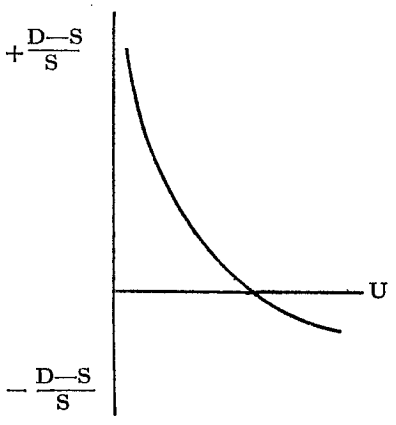

FIG. 2

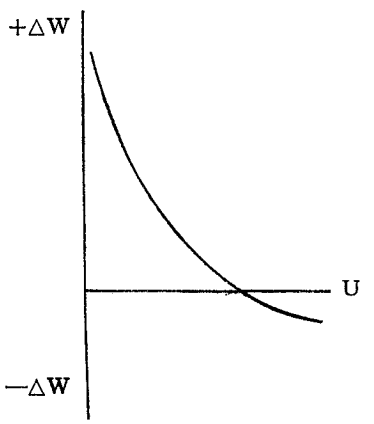

FIG. 3

study of wage inflation will be discussed in later relevant sections of the paper.

Rate of Change of Unemployment ($\triangle U$)

This variable was probably, in chronological order, the first factor to be identified as a possible shifter of the wage adjustment relation. Phillips [16] in fitting a long-term relation between the rate of change of money wage-rates and unemployment in the U.K. observed loops in his scatter diagrams suggesting that the rate of change, as well as the level of unemployment was an important determinant of ΔW. Thus with U constant, ΔW will be higher when ΔU is negative than when it is positive. Considered as an expectations variable a negative value of ΔU will be indicative of tightening labour market conditions and therefore employers will be encouraged to bid up the price of labour in expectation of an even higher price in the future. With rising levels of unemployment the converse will hold true. However, empirical work since Phillips (e.g. Lipsey [9]) has tended to indicate that ΔU is statistically non-significant, at least in the recent history of wage inflation.[4]

Rate of Change of Retail Prices ($\triangle P$)

This variable is included as relevant because of observed union demands for adjustments in money wages when the cost of living rises so as to at least maintain the purchasing power of wages. Wage increases are also often taken to be sufficient justification for price increases and this immediately poses the statistical problem of simultaneity. If wage increases are an important determinant of price increases (and similarly in reverse), and if there are only minimum lags in the process then estimating each relationship separately will result in biased parameter estimates. However, it seems reasonable to suppose that there will be lags both in wage adjustment and in price adjustment. Empirical work comparing simultaneous estimates with single equation estimates generally show little difference in the wage equation (Dicks-Mireaux [2]). Obviously in industry-level studies we would not expect an important feedback on retail prices as each industry's price policy has only a very limited impact upon the retail price index.

Phillips [16] has suggested that cost of living would have a threshold effect. If labour supply and demand conditions did *not* generate an increase in wages sufficient to cover the change in cost of living then ΔP would have a threshold effect on ΔW, otherwise ΔP would have no effect. This would seem an interesting hypothesis,[5] but the variable ΔP has usually been added on in the normal way. Post-war studies in the U.K. (e.g. Dicks-Mireaux, Dow [3]) have suggested a coefficient around 0·5 which have caused some surprise in the literature. However, this sort of coefficient would not seem to be unreasonable when the equation includes an excess demand variable during a period of very low unemployment when one might expect the labour market to generate wage increases more than sufficient to cover price increases. Compared with this situation we might expect a bigger coefficient in Ireland where a much higher level of unemployment has persisted throughout the post-war period. A coefficient greater than 0·5 but less than 1·0 would still suggest only a damped wage/price spiral.

Level and Rate of Change of Profits (D and $\triangle D$)

It has been suggested that wage inflation is closely related to industrial prosperity. Kaldor states the position thus, ". . . the rise in money wages depends on the bargaining strength of labour : and bargaining strength in turn, is closely related to the prosperity of the industry, which determines both the eagerness of labour unions to demand higher wages and the willingness of employers to grant them." Thus when profits are high we would be led to expect that wage inflation would proceed at a fast rate. The problem is one of defining the relevant profit variable : Lipsey and Steuer [10] in examining the relation between the rate of change of money wage earnings and profit for some British industries experimented, rather unsuccessfully, with money profits, real profits and rate of change of profits. It would seem that profit rate would be a more relevant variable than profit level. This would be especially true over a long time period with the possibility of large changes in capital stock and it would certainly be necessary in any evaluation of inter-industry differences in prosperity and rate of change of wages. Perry [15] found his profit rate variable (Earnings after Taxes ÷ Stockholders Equity) to be an important and significant variable in determining the rate of wage adjustment in U.S. manufacturing.

The level of profits or profit rates and not their rates of change would be the variables relevant to a bargaining strength hypothesis. So long as profits or profit rates remain high so the bargaining strength of labour should remain unimpaired despite the

[4]Lipsey [9] sets out an explanation of the loops observed by Phillips in terms of the differing values of U in the different labour markets included within the aggregate non-linear relation.

[5]A test of this hypothesis would require comparing the residuals from a wage adjustment relation ($\triangle W_a - \triangle W_c$), with excess demand as the only explanatory variable, with the difference between $\triangle W_c$ and $\triangle P$. If $\triangle W_c < \triangle P$ then the hypothesis indicates that $\triangle W_a > \triangle W_c$ Lipsey [9] tested, and rejected, a different hypothesis by comparing $\triangle W_a$ and $\triangle P$.

fact that they remain unchanged so that $\triangle D=0$. Perry [15], however, has found that $\triangle D$ is a better expectatious variable than $\triangle U$, so that it is relevant to wage adjustment relations on other grounds.

An alternative hypothesis relating wages to profits would be that of constancy of income shares. Some tabulations by Mary Boland (research student at The Economic Research Institute) have shown quite different labour shares in different industries with, at the same time, a tendency for long run stability in these shares within industries. Lipsey and Steuer [10] have examined, empirically, the relation between profit per employee (and profit per unit of output), and the rate of change of money earnings and found it to be insignificant for U.K. industries in the post-war period.

The practical questions of the lag-structure in the relation between profits and the rate of change of wages will be discussed in detail in Sections (III) and (IV) of the paper but the inclusion of the current value of profit or profit rate in a wage adjustment relationship again raises the problem of simultaneous equation bias—profits affect wages and wages affect profits. The accounting relation is obvious and a more complete model of the economy would be required to accurately measure the parameters if *current* profits were considered relevant. It seems more likely, however, that management and labour attitudes will be coloured by their knowledge of the profitability of the firm or industry in a previous period, and both sides will be in some doubt about the current situation.

Level and Rate of Change of Unionisation (T and $\triangle T$)

Although it is commonly held that labour unions cannot influence wage rates, independently of the state of demand for labour, some recent empirical work casts some doubt on this premise (Hines[6]). Hines' results for the U.K. suggest that ". . . one measure of trade union pushfulness, namely the rate of change of the percentage of the labour force unionised ($\triangle T$), a measure which is uncorrelated with the demand for labour, makes a statistically significant contribution to the explanation of the total variation in wage rates. Indeed, in the inter-war and post-war years, it is the most powerful of all the explanatory variables". In fact Hines is testing Kaldor's hypothesis using a two-step method. First he lets the rate of change of unionisation ($\triangle T_t$) be determined by the level of profits lagged six months ($D_{t-\frac{1}{2}}$) and other factors, and then he substitutes $\triangle T$ directly into the wage adjustment relation. The level of unionisation (T) is found to be an important shift variable when combining data from inter-war and post-war periods. This observation suggests that T may be an important shift variable between industries which have widely different degrees of union organisation.

Hines' observation of the relation between $\triangle W$ and $\triangle T$ is, as he himself admits, capable of several interpretations. The basic question of which way the cause-effect relation runs he discusses by examining the lag structure of the relationship. Having accepted that there is a meaningful relation then the correct interpretation can only be inferred by examining the relation on an industry basis and by investigating union behaviour in recruiting and wage bargaining. The aggregate relationship could be explained by unions seeking to maintain inter-industry wage differentials in face of a rise in wages in a lead industry caused by either a rise in demand for labour in that industry or via union pressure in that industry due to its relative prosperity.

Wages, Earnings and Earnings Gap

Most of the previous studies in the U.K. have related to wage rates fixed by centralised negotiations when the more relevant variable in inflation economics is wage earnings. There is an important theoretical point here which concerns whether wage rates are fixed by institutional or economic forces. The work of Dicks-Mireaux and Dow [3] would suggest very strongly that wage rates *are* determined by excess demand for labour, although the general climate of the labour market seems more relevant to the outcome of specific industry-level bargaining than is the level of excess demand in that industry. In a later study of the rate of change of earnings they find that the rate of change of wage rates explains most of the variation in the dependent variable. Klein and Ball [8] follow a similar conceptual approach to the problem by estimating a behavioural relation for wage rates and another one for the earnings gap (wage earnings minus wage rates). Hansen and Rehn [5] follow a basically different course by assuming that wage rates are fixed purely by institutional factors with the size of the earnings gap or wage drift (rate of change of earnings gap) being determined by labour market forces. This assumption is partly borne out for the agricultural sector in Great Britain where excess demand for labour appears as a more consistently significant variable in the earnings equation than in the wage rate Equation (1). This may be explained by the existence of a Wages Board in which decisions are made by independent members who may not reflect the relevant forces operating in the labour market.

Models of Industry Level Wage Adjustment

Time Series Analysis : The model of wage adjustment in each industry is a single equation one with variables deriving from the preceding dis-

cussion. For the i th industry the general equation will be

$$\Delta W_{it}=a_{io}+a_{i1}U_{it}^{-1}+a_{i2}\Delta P_t+a_{i3}D_{it-1}+a_{i4}\Delta D_{it}+u_{it}$$

$$a_{i1}>0\ ;\ a_{i2}>0\ ;\ a_{i3}>0\ ;\ a_{i4}>0.$$

A direct measure of union pushfulness is not included because there is no estimate of union membership over time on an industry basis. This is not an important omission if we consider that D_{it-1} determines the strength of union pressure in the current period (t), in which case its effect on wage adjustment will be implicit in the estimate of a_{i3}. Variants of the basic model will (1) compare U_i with more general measures of unemployment, (2) experiment with alternative definitions of the profit variable and (3) test out different lag structures.

Cross Sectional Analysis : The inter-industry model postulates that industry differences in the rate of wage inflation are related to industry differences in U_i, D_i, ΔD_i, and T_i. The cost of living variable (ΔP) now drops out as it is common to all industries. The profit variable (D_i) must be expressed as profit rate D_i/K_i as it would obviously not be plausible to include simply the level of profits in industries of quite dissimilar size. An estimate of the levels of unionisation (T_i) in the different industries is included. The general model will be :

$$\Delta W_{it}=\beta_{io}+\beta_{i1}U_{it}^{-1}+\beta_{i2}(D_i/K_i)_{t-1}+\beta_{i3}\Delta D_{it}+\beta_{i4}T_i+u_{it}^{1}$$

$$\beta_{i1}>0\ ;\ \beta_{i2}>0\ ;\ \beta_{i3}>0\ ;\ \beta_{i4}>0.$$

The variation in ΔW_{it} to be explained will be between industries and not over time (in contrast to the Time Series Analysis).

Covariance Analysis : This approach utilises variation over space and time simultaneously. This pooling of information on industries through time means that the number of observations is substantially increased. Allowance can be made for cross-sectional differences in the wage adjustment relationship by including zero-one, or dummy variables, to represent the different industries. These variables will take on the value one for all observations through time for that specific industry, and the value zero for all other observations. This merely allows for the shift, up or down, in the adjustment relation for each industry. It is also possible to allow for shifts between time periods in the adjustment relation. If we want to explore possible different adjustment relations for the different industries then we have to add on interaction variables (i.e., the product of the industry dummy and the associated level of unemployment).

Only the inter-industry shifters will be considered in this study. The coefficients associated with these industry variables will indicate the magnitude of remaining inter-industry differences in wage adjustment *after accounting for* inter-industry differences in the measured variables. This is important where we have only poor indicators of some of the relevant variables, as is the case with relative prosperity and union-pushfulness. The approach is more important in raising questions than in answering them, and should be viewed as a generator of hypothesis for further study rather than an end in itself. The general model may be written down as :

$$\Delta W_{it}=\alpha_{io}+\alpha_{i1}U_{it}^{-1}+\alpha_{i2}\Delta D_{it}+\alpha_{i3}T+\alpha_{i4}I_i+U_{it}$$

$$\alpha_{i1}>0\ ;\ \alpha_{i2}>0\ ;\ \alpha_{i3}>0\ ;\ \alpha_{i4}\text{ is undefined}$$

D_i/K_i must be dropped because of lack of data. T_i is unionisation ranking for industry i and does not alter through time. I_i takes on the value zero for all industries except the i th when it takes on the value one. This will allow for different, but parallel, relations in the different industries. A similar variable for time could be incorporated but would substantially increase the number of coefficients to be estimated. Similarly interaction terms, between say U_i^{-1} and I_i, may be added to allow for differences in the slope of the relation for different industries.

Models of Aggregate Wage Adjustment

Wage Earnings : This model is essentially an extension of OHerlihy's designed to test out the impact of profit and union variables. The general model will be identical to the Industry Level Time Series Analysis Model with the addition of T and ΔT, and defining all variables on an aggregate basis.

Wage Rates : A model explaining the rate of change of money wage rates will also be estimated. The general form will be as for wage earnings the aim being to see how far wage rates are determined by market forces and how far they are set institutionally.

Earnings Gap : The previous two models explaining aggregate wage rates and wage earnings will throw some light on the determinants of this earnings gap and wage drift but it was felt that the importance of the subject warranted a model which directly attempted to measure the effect of variables peculiarly relevant to the earnings gap.

Llydal [11] indicated that an earnings gap can result from : (*a*) shifts in the composition of the labour force, (*b*) shifts in occupational structure, (*c*) changes in hours worked, (*d*) changes in piece-work

earnings, and (*e*) premium payments (above national negotiated rates). Hansen and Rehn [5] and Klein and Ball [8] have attempted time series analyses of the determinants of earnings gap. Both studies found excess demand for labour to be significant. Hansen and Rehn also examined the influence of "excess" profits and productivity and found neither variables significant. Klein and Ball also tested out productivity and found the level significant, but the rate of change non-significant. They also found that hours worked was a sensitive indicator of economic activity and they therefore did not include an additional variable for labour demand.

The general model of aggregate earnings gap in Ireland will attempt to incorporate Llydal's factors (*c*), (*d*) and (*e*) in the form of average hours worked per week (H), the level of productivity (X) and the level of unemployment (U). Earnings gap will be measured on an hourly basis without correcting for factors (*a*) and (*b*) relating to changes in the labour force :

$$E_{ht}-W_{ht}=\alpha_o+\alpha_1 H_t+\alpha_2 X_t+\alpha_3 U_t+u_t$$
$$\alpha_1>O:\ \alpha_2>O:\ \alpha_3>O.$$

It is also important to know, in relation to incomes policy, whether or not earnings gap is simply additive with respect to the current wage award. This can be examined by relating the residuals from the earnings gap model to residuals from a simple wage rate adjustment model where ΔW_t is a simple function of U_t Government pressure to moderate wage claims would be equivalent to negative residuals in the wage adjustment relation. If these negative residuals are closely related to positive residuals in the earnings gap relation then there is less hope for an incomes policy ; i.e. the model suggests the gains in wage rate negotiations will be dissipated through a relatively bigger earnings gap.

III. EMPIRICAL ANALYSIS : INDUSTRY LEVEL

Theories of wage adjustment, whether based on dynamic price adjustment to varying levels of excess demand or on the prosperity/bargaining strength thesis, are formulated at the level of a specific labour market and relate to the outcome of a specific bargaining process. Since in Ireland wage bargaining usually takes place at the industry level this would seem to be the most relevant place to test out these theories.

Lipsey [9] has outlined the relationship existing between micro-adjustment functions and the macro-adjustment function estimated directly from aggregate data on wage change and unemployment. Even if the micro-relations are identical changing relative levels of unemployment in the different markets must be taken account of in the prediction phase. It is also important to investigate for possible differences in the adjustment relations in different industries and to identify the impact of inter-industry differences in the shift variables, if we are to be able to make some predictions of wage inflation under specified conditions when conditions of growth and change in industrial structure prevail. When conditions are stable then aggregate estimates of wage determinants may suffice—disaggregation is increasingly required when stability in industrial structure cannot be expected.

Time Series Analysis ; 16 C.I.P. Industries

Time series wage adjustment relationships (as developed in Section II) will be estimated over the period 1949–1961 for 17 industries : (1) Mining, Quarrying and Turf, (2) Bacon Factories, (3) Grain Milling and Animal Feeding Stuffs, (4) Bread, Biscuit and Flour Confectionery, (5) Brewing, (6) Woollen and Worsted, (7) Linen and Cotton Spinning, (8) Hosiery, (9) Boot and Shoe (Wholesale Factories), (10) Clothing : Men's and Boys', (11) Clothing : Women's and Girls', (12) Manufacture of Paper and Paper Products, (13) Printing, Publishing and Allied Trades, (14) Vehicle Assembly, (15) Building and Construction, (16) Electricity, (17) Agriculture. The first sixteen represent industrial classifications taken from the Census of Industrial Production. The data on agriculture is from a different source and the variables are defined differently so the whole empirical analysis is described in a section following this section which concentrates on the 16 C.I.P. industries. These particular industries have been chosen because of their relative importance in the Irish economy.[6]

The Data : A full description of the data is given in Appendix I under (A) definitions of variables, (B) sources of data and (C) tables of the industry variables : ΔE_{wi} (rate of change of weekly earnings in i th industry): U_i (percentage unemployed in i th industry) : D_i (deflated profit level in i th industry) and ΔD_i (rate of change of profit level in i th industry). The actual data used was in most cases dictated by that available at the industry level. A

[6]Several other industries of equal importance were excluded because of data problems. There was a break in the statistics in 1953 and it is not possible to follow through some industries from the published data.

major limitation is the shortness of the series and the resulting scarcity of degrees of freedom for estimating a relationship where a fairly large set of explanatory variables need to be tested. Conceptually, there are two ways in which degrees of freedom could be increased: (1) by taking a longer time-period for estimating the relationship, and (2) by using quarterly rather than annual data. The first possibility is ruled out as it would mean either (1) adding on war, or early-post-war, observations which are almost certainly not relevant to present policy, or (2) running the analysis past 1961 which is at present not possible with published data. The second alternative, the use of quarterly data, is impossible if we want to include profit variables. We are therefore limited to a short period of observations on annual data. It may be argued that this is more appropriate than quarterly observations because of the dominance of annual rounds of wage bargaining in the labour market, especially when our unit of analysis refers to a specific bargaining process.

Results

Wages in different industries are generally thought to move in some relation to each other. Nevin [12] did, however, show that wage movements in different industries were sufficient to alter substantially the ranking of some industries, although there is a general tendency to maintain the pattern of rankings. Table I shows the 17 industries included in this study ranked according to the average percentage increase in wage earnings for adult males in those industries over the period 1949–1962. The numbers are actually the means of the dependent variable (ΔE) used in the industry time series regressions.

TABLE 1: AVERAGE ANNUAL PERCENTAGE INCREASES IN WEEKLY WAGE EARNINGS ($\triangle E_w$) AND RANKINGS FOR 17 INDUSTRIES (1949–62)

Industry*	$\triangle E_w$	Rank
Mining	6·508	1
Brewing	6·158	2
Paper	5·934	3
Printing	5·830	4
Woollen	5·799	5
Boot and Shoe	5·679	6
Milling	5·397	7
Vehicles	5·396	8
Electricity	5·354	9
Linen	5·340	10
Agriculture	5·254	11
Clothing (Men)	5·213	12
Bacon	5·075	13
Building	5·042	14
Bread	5·008	15
Hosiery	4·890	16
Clothing (Women)	4·307	17

*The reduced industry descriptions will be generally used throughout the paper for reasons of convenience. The industries here are identical to the 17 specified earlier.

Although the inter-industry differences may appear small on an annual basis some of the extreme values result in considerable changes in relative wages over the period considered. Further confirmation of important inter-industry differences in the process of wage adjustment is evidenced by the correlation matrix (Appendix (I.E)) relating to the rate of change of money earnings for the different industries. We would expect positive correlations but in general they are not high and leave plenty of room for independent explanations of the process of wage inflation in the different industries.[7]

Regression results: Table 2 gives the results for a regression model in which the explanatory variables are the current level of unemployment in the specific industry (U_{it}^{-1}), the current rate of change in the consumer price index ($\Delta P''_t$), the deflated level of profits in the specific industry in the preceding year ($\overline{D}_{it-1}$) and the current rate of change of profits in the specific industry (ΔD_{it}). The dependent variable is the current rate of change of weekly wage earnings for adult males in the specific industry (ΔE_{iwt}).

Generally the model shows up rather poorly in attempting to explain variation in ΔE_{iw}. The squared correlation coefficients vary from 0·11 for Building and Construction up to 0·70 for Hosiery. The von Neumann statistic δ^2/S^2 gives no indication of the presence of autocorrelation except for Electricity. The demand variable (U_{it}^{-1}) appears significant[8] for only three of the sixteen industries, Mining, Brewing and Clothing (Women). Similarly the price variable ($\Delta P''_t$) appears non-significant in thirteen of the sixteen industries. Experiments with an alternative price variable ($\Delta P'_t$) with a built-in lag of six months proved unsuccessful. The industries appearing to make wage adjustments to price change are Hosiery and Electricity, both with a coefficient of nearly unity, and Printing with a coefficient of about one half. The Boot and Shoe, Printing, Vehicle and Electricity industries show a significant impact of profits on wage earnings, with the Boot and Shoe industry being particularly sensitive with a coefficient of about 15, indicating that an increase in profits of £100,000 would give an additional increase of wage earnings of 1·5%, given the existing values of the other variables. ΔD_t proved to be non-significant for all industries.

[7]There remains the possibility of higher degrees of lagged correlation with "lead" industries stimulating adjustment in other industries in the following period. The definition of $\triangle E_t$ does however cover changes from the year t−1 to t+1, centring the rate of change on the year t. There is therefore less reason to suspect high lagged correlations.

[8]We will take as an arbitrary rule that when the coefficient is double, or more than double, its own standard error then we will refer to it as significant. This roughly corresponds to the 5% probability level with the degrees of freedom available.

The poor showing of the "local" demand variable (U_{it}^{-1}) prompts us to ask whether this is the relevant demand variable. The work of Dicks-Mireaux and Dow [3] with U.K. industry groups and Perry [15] with durable and non-durable manufacturing in the U.S., suggests that the general level of demand for labour may give better results than the specific industry or "local" level. Simple regressions were therefore run with alternatively U_{it} (industry unemployment), U_{gt} (industry group unemployment) and U_{at} (average level of unemployment in all C.I.P. industries). The U_{it} regressions show no significant regression coefficients and low correlation coefficients. The U_{gt} and U_{at} regressions show considerable improvement and similar results. This may reflect, not only the possibility that the general level of demand is more appropriate than the local level, but that U_{gt} and U_{at} are better specified unemployment percentages. Both these variables are published series and represent percentages of people insured whereas the U_i variable is the average of unemployment in January and August divided by average numbers engaged in the industry (including proprietors as well as employees). The results for the regression of ΔE_{wt} on U_{at} are reported in Table 3 for 15 industries. Of the 8 industries in which U_{at} appears to be unrelated to ΔE_{wt} four are industries in which profits and/or price have been shown to be important determinants (Hosiery, Boot and Shoe, Printing and Vehicles). Three are industries in which none of the explanatory variables appears to be important; Clothing (Men), Paper and Building. Woollen and Worsted will later be shown to be in the demand group.

It seems very likely that the general explanatory power of the model with demand, price and profit variables would be substantially improved if U_{gt} or U_{at} were substituted for U_{it}. However, it appears that in those industries in which profit and price variables appeared important in the results in Table 2, the demand variable remains generally non-significant (electricity excepted). For the other industries the demand variable now assumes some significance in explaining the rate of change of earnings (this is not true for Paper, Clothing (Men) and Building)—but it is in these industries that the other variables (ΔP; $\overline{D}_{it-1}$ and ΔD_{it}) appear unimportant in the Table 1 results. It therefore seems more important to check how a better defined

TABLE 2: $\Delta E_{wt} = a + b_1 U_{it}^{-1} + b_2 \Delta P_t'' + b_3 D_{t-1} + b_4 \Delta D_t + e_t$

Industry	a	b_1	b_2	b_3	b_4	R^2	$\frac{\delta^2}{S^2}$
1. Mining, Quarrying and Turf ..	3·711†	40·328*	−·318	−2·333	−·040	·58	1·40
	(2·382)	(19·345)	(·556)	(1·362)	(·020)		
2. Bacon Factories	4·660	23·990	·008	−2·928	·016	·27	1·90
	(9·554)	(22·906)	(·461)	(5·862)	(·065)		
3. Grain Milling and Animal Feedingstuffs.	−4·818	64·763	·404	−·983	−·008	·32	2·42
	(9·850)	(53·050)	(·476)	(5·255)	(·084)		
4. Bread, Biscuit and Flour Confectionery.	5·758	20·503	−·093	−1·966	·061	·24	1·36
	(4·281)	(23·561)	(·274)	(2·457)	(·066)		
5. Brewing	−31·648	92·649	−1·141	4·733	·069	·59	2·31
	(15·124)	(39·503)	(·477)	(2·706)	(·123)		
6. Woollen and Worsted	9·489	−2·342	·208	−3·033	−·016	·21	1·55
	(6·182)	(24·729)	(·528)	(3·238)	(·033)		
7. Linen and Cotton Spinning, etc.	5·311	23·279	·088	−3·696	−·033	·21	1·68
	(4·861)	(18·584)	(·379)	(4·917)	(·036)		
8. Hosiery	2·605	−20·817	·947	1·528	·049	·70	1·75
	(4·653)	(18·345)	(·267)	(4·038)	(·061)		
9. Boot and Shoe	−6·508	−24·515	·122	14·982	·054	·54	2·43
	(4·962)	(20·238)	(·354)	(6·893)	(·062)		
10. Clothing: Men's and Boys' ..	−6·899	−7·617*	−·666	9·376	−·030	·50	1·40
	(9·594)	(5·232)	(·389)	(5·566)	(·070)		
11. Clothing: Women's and Girls' ..	5·640	26·931*	·193	1·723	·060	·51	2·32
	(9·539)	(11·919)	(·227)	(3·565)	(·046)		
12. Manufacture of Paper and Paper Products.	5·090	13·113	·066	−2·559	·004	·31	1·20
	(4·756)	(12·031)	(·333)	(4·639)	(·043)		
13. Printing, Publishing and Allied Trades.	−4·385	−4·457	·445	4·744	·106	·66	2·55
	(3·479)	(6·620)	(·184)	(1·664)	(·060)		
14. Vehicle Assembly	2·019	−27·844*	·327	5·172	·026	·43	1·34
	(3·912)	(19·374)	(·377)	(2·383)	(·031)		
15. Building and Construction ..	3·031	61·411	−·255	−·349	−·035	·11	1·62
	(6·176)	(80·698)	(·476)	(1·907)	(·055)		
16. Electricity‡	−3·075	7·100	·917	·811	−·956	·65	·91
	(4·043)	(9·988)	(·399)	(·242)	(1·634)		

*U_{it} for these industries is equivalent to U_{gt}: i.e., unemployment is a percentage of insured labour force in these industries which are the relevant industry groups as defined by *Trends of Employment and Unemployment*.

†The figures in parenthesis are the standard errors of the associated coefficient.

‡An important change in the profit series for the Electricity Supply Board was made in 1954. The coefficients b_3 and b_4 for Electricity should therefore be interpreted with caution.

TABLE 3: $\Delta E_{wt} = a + b\, U_{at} + e_t$

Industry	a	b	R^2	$\frac{\delta^2}{S^2}$
1. Mining, Quarrying and Turf.	—	—	—	—
2. Bacon Factories ..	17·535 (4·474)	−1·586 (·564)	·44	1·32
3. Grain Milling and Animal Feedingstuffs	16·817 (5·737)	−1·453 (·723)	·29	1·93
4. Bread, Biscuit and Flour Confectionery.	13·093 (2·537)	−1·029 (·320)	·51	·83
5. Brewing	21·083 (3·795)	−1·899 (·478)	·61	1·34
6. Woollen and Worsted.	12·852 (5·938)	−·898 (·748)	·13	1·90
7. Linen and Cotton spinning etc.	15·986 (4·105)	−1·355 (·517)	·41	1·60
8. Hosiery	1·035 (5·872)	·491 (·740)	·04	1·25
9. Boot and Shoe ..	9·248 (5·191)	−·454 (·654)	·05	1·62
10. Clothing: Men's and Boys'.	8·174 (6·394)	−·377 (·806)	·02	1·38
11. Clothing: Women's and Girls'.	1·133 (3·304)	−·893 (·416)	·32	2·09
12. Manufacture of Paper and Paper Products.	11·675 (3·428)	−·731 (·432)	·22	·85
13. Printing, Publishing and Allied Trades.	11·574 (3·339)	−·731 (·421)	·23	1·43
14. Vehicle Assembly	10·475 (5·035)	−·646 (·635)	·09	1·53
15. Building and Construction.	8·139 (4·447)	−·394 (·560)	·05	1·79
16. Electricity	17·454 (6·165)	−1·540 (·777)	·28	·95

measure of local demand turns out in the presence of price and profit variables. Some regressions were therefore run substituting U_{gt} for U_{it} for a few industries. Results for four industries are summarised in Table 4. These results indicate a considerable improvement as compared with the same industries in Table 2. The demand coefficient is now significant for Bacon Factories and Woollen, and for Milling and Brewing somewhat improved. Brewing, which in Table 2 showed profits to be almost significant, now has a significant profit coefficient. The Woollen industry now has a price coefficient close to being significant but is otherwise peculiar in having negative profits coefficients. This can be explained by the disruption caused in this industry (and in the other textile industries) by the Korean War. Profits slumped while wage earnings increased sharply in adjusting to the big increase in the cost of living.

Experiments were also made at this stage with the demand variable lagged one year. The results in general were very poor as compared with regressions with current values of U_{gt}. The Milling industry was an exception giving a parameter estimate four times as big as its standard error and increasing the explained variance to over 60 per cent.

Conclusions : Inspection of the inter-industry correlation of wage earnings has shown a substantial amount of independent variation within particular industries. At the same time it is difficult to identify factors unique to a particular industry. We are dealing with quite small units in which random shocks might be expected to be more severe than in the aggregate, where negative covariance of errors is often observed. Aggregating to industry groups would have probably given a better statistical fit, but perhaps for the wrong reasons.

Of the total of sixteen C.I.P. industries, eight are characterised by the demand variable (unemployment) being an important determinant of the rate of change of money wage earnings over the period 1950 to 1961. In all cases the "local" demand variable is inferior to a more general measure of demand. This would concur with some previous results for U.K. and U.S. although in the case of Ireland this may be due to the different specification of the general demand variable. This result suggests the possibility that the industry demand variable is too narrowly defined and does not allow for mobility between industries or, alternatively, the general level of demand for labour is the factor which is dominant in wage bargaining in specific industries, even though mobility between industries may be limited.

The second major result of the industry analysis is that the industries considered appear to fall into two groups (with a residual) : (1) a group where the rate of change of money wage earnings seems to be

TABLE 4 : $\Delta E_{iwt} = a + b_1 U_{gt}^{-1} + b_2 \Delta P_t'' + b_3 \bar{D}_{it-1} + b_4 \Delta D_{it} + e_t$

Industry	a	b_1	b_2	b_3	b_4	R^2	δ^2/S^2
1. Bacon Factories ..	−1·403 (4·550)	55·170 (22·555)	−0·238 (0·312)	−2·658 (2·065)	0·025 (0·030)	0·52	2·53
2. Milling	−7·256 (7·374)	57·001 (34·339)	0·207 (0·384)	0·588 (3·724)	0·018 (0·058)	0·42	2·23
3. Brewing	−32·180 (13·450)	66·401 (23·748)	−0·902 (0·352)	5·145 (2·353)	0·111 (0·110)	0·62	1·96
4. Woollen	0·540 (3·697)	58·804 (19·889)	0·598 (0·305)	−4·957 (2·185)	−0·047 (0·022)	0·61	1·60

affected by the level of unemployment and not by price or profit variables and (2) where the rate of change of money wage earnings is related to changes in the cost of living and the "prosperity" of the industry. Explanations can only be tentative but Group (1) generally represents industries [food processing, textiles, mining (and agriculture—see later)] in which labour is poorly organised and therefore where there is limited interference with purely market (supply and demand) determinants of the price of labour. Perhaps also, Group (1) also represents industries in which profits are relatively low. Although there is no real basis for comparison it seems evident that some industries are declining or relatively slow growing and/or have relatively low returns on capital. Therefore any year-to-year changes in profits are deviations around a low average level of profitability such that upward deviations do not encourage employers to go out and bid up the price of labour, and they are faced with limited organised pressure by labour to push wages above the level dictated by supply and demand. Cost of living adjustments will not be capable of being effected under these conditions.

Group (2) (Hosiery, Printing, Boot and Shoe, Vehicles and Electricity) characteristics in wage adjustment may conceivably be explained in terms of relatively prosperous and/or expanding industries with, possibly, well organised labour forces. As a result of prosperity a particularly good year will give rise to vigorous, well organised, labour demands for a share of the bigger cake, and employers will not be so averse to accede to these demands. This is a situation in which fluctuations in the general labour market will not cause a symmetric response. If labour gets tighter then employers may bid up the price of labour but with a slackening in demand we might not expect the converse, because of high profits in the previous year, cost of living changes or continuous union pressure. This would explain the lack of significance of the unemployment variable and the significance of the cost of living (in some cases) and profit variables.

There remain three industries, Paper, Building and Clothing (Men) in which neither demand nor profit and price variables appear important in wage changes. The Paper industry has the most highly union organised labour force in Ireland which may be able to push through wage increases without reference to these factors. Building has a highly mobile labour force with Britain and Ireland as its relevant market. Prospective emigrants may register as unemployed in conditions of full demand and therefore rule out a clear relationship between wages and demand in Ireland. The position for Clothing (Men) is difficult to understand although the profit coefficient is almost significant.

Time Series Analysis : Agriculture

In the case of agriculture the dependent variable is the rate of change of the minimum wage rates negotiated by the Agricultural Wages Board. The data is described in detail in Appendix I (D) but it should be stressed here that the level of unemployment here refers to hired workers unemployed as a percentage of the hired work force in agriculture. Farmers and relatives who register as unemployed are not included.

Results : The results are summarised in Table 4 and the zero-order correlation matrix of the variables is in Appendix I (E). The percentage level of unemployment in the previous year (U_{t-1}) appears to be more relevant to the current rate of change of wages than does current percentage unemployment (U_t). However, the actual volume of unemployment ($\bar{U}_{t-1}$) seems a better variable than U_{t-1}, Equation (4) having an R^2 value of 0·51. With the prevailing decline in the agricultural work force a given value of $\bar{U}$ is equivalent to an increasing value of U through time. ΔW seems to be more closely related to $\bar{U}$, suggesting that U is having a declining influence.

The importance of the lag in the relation between unemployment and rate of change of money wages is more likely to be reflected in wage rates than in earnings. This is due to the interval between negotiations which is likely to pass in the case of earnings. This may partly explain the different results for industry in general where lagged unemployment appears much less significant than the current value. It may also reflect the slower speed of communication and weaker organisation of hired labour in agriculture.

Similarly, a lagged rate of change of the consumer price index ($\Delta P'$) seems superior to the rate of change of consumer prices centred at the mid-point of the current year ($\Delta P''$). $\Delta P'$ is centred with a 6 months lag. In Equation (5) the price coefficient is about 0·5 and statistically significant. The current price variable coefficient in Equations (1) to (4) is never significant.

Equation (6) includes two additional variables the level of deflated profits ($\bar{D}$) and the level of unionisation (T), both lagged one year. The coefficient of the profit variable is non-significant but this may be due to the poor description of profit. A large percentage of its value represents wages accruing to the labour of the farmer and his family. To really test this relationship a true profit variable would have to be synthesised referring only to commercial farmers employing paid labour.

The level of unionisation (T) interpreted as a measure of union pushfulness has the right sign and

TABLE 5: REGRESSION EQUATIONS EXPLAINING RATE OF CHANGE OF WEEKLY WAGE RATES (ΔW_t): IRISH AGRICULTURE 1947–1963

Equation	Constant	U_t	U_{t-1}	$\bar{U}_t$	$\bar{U}_{t-1}$	$\bar{U}^{-1}_{t-1}$	$\Delta P''_t$	$\Delta P'_t$	$\bar{D}_{t-1}$	T_{t-1}	R^2	δ^2/S^2
1	8·45	−0·85 (0·50)					0·25 (0·21)				0·31	2·01
2	8·94		−1·00 (0·46)				0·22 (0·20)				0·38	1·69
3	12·45			−1·86 (0·71)			0·15 (0·19)				0·44	2·57
4	12·32				−1·88 (0·61)		0·16 (0·18)				0·51	1·95
5	−1·221					18·919 (5·447)		0·492 (0·236)			0·55	1·92
6	2·594				−1·673 (0·803)			0·425 (0·281)	0·043 (0·061)	0·587 (0·304)	0·60	2·55

is almost significant.[9] The level of union membership as a proportion of the hired work force in agriculture is low but has grown considerably over the post-war period. In 1947 only 3·4 per cent of the permanent hired work force was unionised. By 1962 this had grown to 11·5 per cent. To the extent that the unions represent all workers in wage bargaining it seems reasonable to suspect that their increasing strength over this period will be partly reflected in improved settlements. This is only a tentative hypothesis that would require detailed investigation of union behaviour and of the workings of the Wages Board. Alternative formulations of union pushfulness (e.g., ΔT) do not appear important.

It is interesting to compare these results for Irish agriculture with others obtained for England and Wales and Scotland. Assuming a non-linear relation between U and ΔW, linear relations corresponding to different segments of the overall relation will be expected to have different slopes. England and Wales with unemployment in agriculture averaging 1 per cent over this period is expected to have a bigger negative coefficient than Ireland with unemployment averaging 4 per cent. Scottish agriculture lies intermediate with 2·5 per cent. For a similar relation to Equation (2) Cowling and Metcalf [1] have estimated a coefficient of −2·06 for England and Wales and −1·04 for Scotland. These results compare with −1·00 for Ireland. Thus the relative magnitudes are as might be expected and there is evidence that the curve is flattening out at unemployment levels in excess of about 2 per cent.

The profit and price variables have similar coefficients in the three countries, and the level of unionisation in England and Wales has a similar impact on W. The British study indicated that the general model (i.e., with explanatory variables, U_t, $\bar{D}_{t-1}$, ΔP_{t-1} and d_1 (a dummy variable representing wage freeze years)) gave a much better explanation of wage earnings, but data is not available for Irish agriculture.

[9] In an alternative equation, not reported here, this coefficient is both clearly significant and bigger (0.88).

Cross-Sectional Analysis

This cross-sectional, inter-industry analysis was intended to make some evaluation of an alternative profit variable found to be important in explaining wage inflation in the U.S. earnings after taxes as a percentage of stockholders equity, see Perry [15]. From empirical work on the relation between profits and wages in the U.S. and U.K., this profit rate variable would appear to be the most relevant. The problem was that very limited data is readily available in Ireland. Public companies have only been compelled to provide profit data to the Registrar of Public Companies since 1963. It was subsequently found that this was the only year in which some estimate of this variable could be made for 13 manufacturing industries. The limitations are obvious—abstracting just one year from a series and trying to relate the change in wage earnings to profit rates across industries is of limited usefulness. What is wanted is at least three years of profits data for each industry. The second limitation is the limited number of firms which are assumed to be "representative" of the particular industry. Private companies and foreign subsidies are not included. The data and sources are outlined in Appendix II.

Incident to the data limitations, the conceptual model as outlined in Section II is modified to a non-parametric test of the relation between profit rate (D/K)* in 1963 and the rate of change of wage earnings (ΔE_w) in 1963 and in subsequent quarters. The demand, union and expectations variables will be tested out in the covariance analysis where the inter-industry relationship over the period 1950–1961 will be estimated.

Results: The profit rate variable (D/K) as calculated is centred on December 31st, 1963. It is

*K is defined as stockholders equity net of preference shares, D is profit net of taxes and payments to preference shareholders.

derived by interpolation from 1963 and 1964 data for firms with different accounting years. The correlation of D/K with ΔE_w (change in weekly earnings) centred on the same month is 0·24. Assuming a lag between the realisation of a particular level of profitability and the subsequent wage adjustment gives negative correlations. This assumption therefore would seem unrealistic. Alternatively we might consider that interim statements and management's general knowledge of how the company is progressing may affect wage rates and earnings during the course of the financial year. This seems to be borne out by a correlation of 0·46 between D/K and ΔE_w centred at mid-year 1963.

Comparing the ranking of the values of the two variables for the 13 manufacturing industries shows some relationship, but only a weak one (Table 6). Clothing (Men), Linen, Hosiery, Bacon and Bread stand out as misfits. However, these can be explained to some extent by reference to the corresponding change in wage earnings the previous year. We might expect compensating movements from one year to the next because of the different timing of wage awards. Thus an unexpectedly high ranking in the wage column in 1963 (Linen and Clothing (Men)) may be explained by a relatively low ranking in 1962, and a lower than expected ranking in 1963 (Bacon, Bread and Hosiery) may be explained by a relatively high ranking the previous year. This seems to be the case: for ΔE_w 1962 Linen was ranked 13 (−0·92 per cent) and Clothing (Men) 9 (2·60 per cent), while Bacon, Bread and Hosiery were ranked 2 (8·60 per cent), 5 (4·87 per cent) and 4 (6·03 per cent) respectively.

TABLE 6: INDUSTRY RANKINGS OF $\triangle E_w$ AND D/K (1963)

Industry	$\triangle E_{wt}$	D/K	$[\triangle E_{wt-1}]$
Boot and Shoe ..	1	1	
Vehicles	2	4	
Linen	3	9	[13]
Clothing (Men) ..	4	12	[9]
Paper	5	3	
Printing	6	8	
Brewing	7	7	
Woollen	8	11	
Bacon	9	2	[2]
Bread	10	6	[5]
Clothing (Women) ..	11	13	
Milling	12	10	
Hosiery	13	5	[4]

Data described in detail in Appendix

Covariance Analysis:

As described in Section II this analysis extends the inter-industry relation through time. Data on the 16 C.I.P. industries and agriculture are included for the period 1950–1961 giving a total of 204 observations. Dummy variables are included for $n-1$ industries[10] with Mining, Quarrying and Turf as the base industry. Thus the coefficients associated with the industrial dummy variables are to be interpreted as deviations from the relation for the Mining industry. The dummies allow for shifts in the relation between U_i and ΔE but assume the slope is the same in all industries. The other explanatory variables included in this analysis are two alternative price variables (ΔP_t and $\Delta P_{t-\frac{1}{2}}$), two alternative expectations variables (ΔD_t and $\Delta \overline{D}_t$—a dummy indicating negative change), an indicator of the degree of union organisation in the different industries (T: a rank variable).

The union variable is a subjective one largely because of a lack of data on union membership for individual manufacturing industries. Two sources have been used in ranking industries according to estimated degree of union organisation but there is still a large element of my own interpretation of the general description of conditions in different industries. Table 7 refers to part of Table 10 in D. O'Mahony.[14] The second source is Appendix II of the same paper under the title *Survey of Industrial Relations in the Main Industrial Groups*. This gives an account of the type of labour organisation in the different industries and usually includes some assessment of the degree of organisation. This material and a tentative ranking are reported in Appendix III. Most of the extreme ranking can probably be made without debate. Paper and Printing are obviously industries in which labour is highly organised, similarly Clothing, Linen and Agriculture are sectors of very rudimentary organisation. Some of the rankings in the middle are not clearcut and obviously involve a large subjective element.

TABLE 7: UNIONISATION (INDUSTRIAL ESTIMATE, 1961)

	%
Agriculture, Fishing, Forestry	3
Mining, Quarrying and Turf	40
Manufacturing	70
Building and Construction	36
Electricity, Gas and Water	82

The industry variables themselves can be interpreted as an attempt to reduce the specification error in the relation as specified without their inclusion. If we consider our basic model as being fully specified (i.e. no relevant systematic variables

[10]This is done for reasons of estimation. Including dummy variables for n industries would produce a singular matrix and render a solution indeterminate, unless other constraints are included. The use of dummy variables in this type of analysis is outlined by D. B. Suits in an introduction to Lewis Schipper, *Consumer Discretionary Behaviour: A Comparative Study in Alternative Methods of Research*, North-Holland Publishing Company, Amsterdam 1964.

remain excluded), then the industry variables are indicators of inter-industry differences in prosperity (profitability) and union pushfulness. Conceptually, Kaldor [7] considers these as interdependent factors operating in two steps, prosperity generating union pushfulness and this in turn generating wage increases. Hines [6] has looked at the problem this way in his empirical analysis, and if this is relevant to the Irish scene, then it is reasonable to interpret the industry coefficients as reflecting both these factors. However, to allow for a differential response, and to evaluate the union ranking variable (T) it will be included in addition to the industrials in one formulation of the relationship. This would also be consistent with Hines' interpretation of the level of unionisation (T) being a shift variable, moving the response curve of ΔW with respect to ΔT. We will interpret T as a shifter of the relation between ΔE and U across industries, rather than over time.

It is important to stress that this pooling of information from 17 industries is not intended as an estimate of the macro-relation between wage inflation and demand for labour. This is not so because equal weights have been assumed to hold for all the industries included, and secondly we have already observed inter-industry differences in the slope of the relation which are not allowed for in this model. It is merely intended to indicate whether there are important economic or institutional shifters of the relationship as between industries.

Results : The general evidence of the results is to show inter-industry differences in the position (or intercept) of the relationship between demand and wage adjustment to be statistically non-significant, after taking account of inter-industry differences in the rate of change of profits (ΔD). When the union ranking variable (T) is included, this also appears non-significant as a shifter of the relationship.

Out of the 16 industries for which dummy variables are included the only coefficients approaching significance are those for (1) Boot and Shoe, indicating a deviation of +1·5 per cent, (2) Clothing (Women), −1·2 per cent, (3) Electricity, −1·7 per cent and (4) Agriculture, −1·6 per cent. These deviations are relative to the intercept for Mining (2·2 per cent). Thus any given level of unemployment will result in a higher rate of wage inflation in the Boot and Shoe industry than in Mining or any of the other industries whose coefficients indicate no significant difference from Mining. These coefficients are derived from a relationship including unionisation so they may be regarded, within the model of wage adjustment specified, as indicating different average levels of profitability in these industries over the period 1950 to 1961. Boot and Shoe being above average with Clothing (Women), Electricity and Agriculture being below average.

These findings are extremely tenuous, the general interpretation must be that of little evidence for inter-industry differences in factors causing shifts in the inflation-unemployment relation. This does not imply the absence of different slopes for the relation in different industries.

IV. EMPIRICAL ANALYSIS : AGGREGATE LEVEL

This section deals with relationships between wages, unemployment, prices and profits at the aggregate level in the period 1949–1963. Also, at this aggregate level, we can make some cardinal estimate of union pushfulness over time. The first part is concerned with estimating the determinants of the rate of change of average hourly wage earnings, and is a postscript to the OHerlihy study [13] the main difference is that the impact of profit and union variables is assessed, as well as the effect of those variables, unemployment and price, which appeared consistently significant in the previous paper. The next part of this section tests out the effect of the same set of variables on average hourly wage rates and the third and final part of the aggregate level analysis seeks to estimate the determinants of the earnings gap, the difference between actual labour earnings and negotiated rates. Variables and data are described in detail in Appendix IV.

Aggregate Wage Earnings

The zero-order correlation matrix (Table 8) shows a high degree of association among the explanatory variables. Thus the separate effects of these different variables on wage earnings will be difficult to estimate. This situation at the aggregate level emphasises the importance of disaggregation to the industry level where the inter-correlation among the explanatory variables is relatively low (see Appendix I (E), for the correlation matrices for the different industries considered in this study).

Deflated profits ($\overline{D}_{t-1}$), the rate of change of unionisation (ΔT_{t-1}) and the rate of change of profits (ΔD_t) are all closely related to the level of unemployment $\overline{U}_t$. There is also a close and interesting relation between the level of unionisation (T) and the two profit level variables (D and $\overline{D}$) which would seem to support the assumption in the Kaldor-Hines hypothesis that profits determine the level of unionisation.

TABLE 8: ZERO-ORDER CORRELATION MATRIX (1949–1963)

	$\bar{U}_t$	$\Delta P''_t$	D_{t-1}	$\bar{D}_{t-1}$	T_{t-1}	ΔT_{t-1}	ΔD_t
ΔE_t	−0·42	0·51	0·30	0·39	0·38	0·25	0·32
$\bar{U}_t$		0·23	−0·51	−0·61	−0·33	−0·58	−0·66
$\Delta P''_t$			−0·16	−0·07	0·09	0·06	−0·47
D_{t-1}				0·98	0·94	−0·16	0·29
$\bar{D}_{t-1}$					0·91	−0·03	0·37
T_{t-1}						−0·28	0·07
ΔT_{t-1}							0·36

With the fairly high collinearity in mind, simple regressions between the rate of change of average hourly earnings (ΔE) and the union and profit variables were run initially. Equation (4.1) shows that the level of unionisation (T) and its rate of change (ΔT), both lagged one year, explain 28 per cent of the variance in ΔE_t. The coefficient associated with T_{t-1} is not quite double its standard error, while the ΔT_{t-1} coefficient is about one-and-a-half times as big as its corresponding standard error. Both coefficients are of the expected sign.

$$(4.1)\quad \Delta E_t = -1{\cdot}321 + 0{\cdot}452 T_{t-1} + 1{\cdot}238 \Delta T_{t-1}$$
$$(9{\cdot}469)\quad (0{\cdot}237)\quad (0{\cdot}822)$$
$$R^2 = 0{\cdot}28$$
$$\delta^2/S^2 = 2{\cdot}70$$

The deflated level of profits ($\bar{D}_{t-1}$) also has a non-significant coefficient (Equation (4.2)). Together with a trend term (to allow for capital accumulation over time) it explains only 19 per cent of the variance in ΔE_t.

$$(4.2)\quad \Delta E_t = -2{\cdot}562 + {\cdot}226 \bar{D}_{t-1} - {\cdot}245t$$
$$(5{\cdot}100)\quad ({\cdot}161)\quad ({\cdot}330)$$
$$R^2 = 0{\cdot}19$$
$$\delta^2/S^2 = 2{\cdot}44$$

The union and profit variables also give non-significant parameter estimates in models including $\bar{U}$ and $\Delta P''$. An alternative profit variable was synthesised by using an estimate of capital stock (see E. Nevin, *The Capital Stock of Irish Industry*, Paper No. 17, The Economic Research Institute, Dublin, November 1963) as denominator. This is more akin to Perry's profit rate variable and the one used in the cross-sectional analysis in Section III. The results again show profits to be only weakly related to ΔE with coefficients about one-and-a-half times as big as their associated standard errors. It is noticeable, however, that the unemployment variable often appeared insignificant when appearing in the same equation as the profit and union variables, with the price variable having a bigger coefficient and smaller standard error.

One positive and important result does emerge and that is the significance of the rate of change of profits (ΔD). Equation (4·3) suggests that a 10 per cent increase in aggregate profits causes a 2 per cent increase in average wage earnings. The unemployment and union variables are non-significant while the price variable approaches close to a coefficient of 1·0, indicating a near one to one price-wage relationship. Almost three-quarters of the variation in ΔE is explained by the four explanatory variables.

$$(4.3)\quad \Delta E_t = 9{\cdot}020 - 0{\cdot}232 \bar{U}_t + 0{\cdot}915 \Delta P''$$
$$(5{\cdot}206)\quad (0{\cdot}154)\quad (0{\cdot}203)$$
$$- 0{\cdot}747 \Delta T_{t-1} + 0{\cdot}212 \Delta \bar{D}_{t-1}$$
$$(0{\cdot}676)\quad (0{\cdot}092)$$
$$R^2 = 0{\cdot}73$$
$$\delta^2/S^2 = 2{\cdot}47$$

This result is in line with Perry's observation [15] that ΔD is a more relevant expectatious variable than ΔU (previously found to be non-significant by OHerlihy). However, care in interpretation is required. ΔD may simply reflect the changing share in aggregate profits of those industries where the profit level is an important determinant of ΔE. This interpretation would make the aggregate and industrial results consistent on this point.

Aggregate Wage Rates

This section is concerned with explaining the rate of change of aggregate money wage rates. This is justified as part of the process of separating out the determinants of rates and earnings. Subsequently, in the next section, a direct estimate will be made of the determinants of the difference between rates and earnings and the rate of change of that difference. The same set of explanatory variables are used here as were used in testing out the wage-earnings relationships. Similarly, the same reservations and difficulties apply. The wage rate variable itself is a 23 industry average, and is measured as rate per hour.

The simple correlation between the rate of change of hourly wage rates (ΔW_{ht}) and $\bar{U}_t$ is reduced as

compared with the correlation for ΔE_{ht}, whereas the correlations of ΔW_{ht} with the two union variables (T_{t-1} and ΔT_{t-1}) is rather higher. Correlations with the other variables (profits and price) are similar except for ΔD_t which is reduced.

The relationship between ΔW_{ht} and the level of unionisation and its rate of change (T_{t-1} and ΔT_{t-1}) is rather stranger than the similar relationship for earnings (Equation (4.4)). The coefficient for unionisation level is significant and the coefficient for the rate of change of unionisation is quite close to significance (1·9 times its standard error). This simple hypothesis explains 38 per cent of the variation in ΔW_{ht} compared with 28 per cent for ΔE_{ht}.

$$(4.4)\quad \Delta W_{ht} = -15{\cdot}860 + 0{\cdot}495 T_{t-1} + 1{\cdot}414 \Delta T_{t-1}$$
$$(8{\cdot}454)\quad (0{\cdot}211)\quad (0{\cdot}734)$$
$$R^2 = 0{\cdot}38$$
$$\delta^2/S^2 = 2{\cdot}27$$

As with wage earnings, the level of profits or profit rates, in their various forms, do not appear as significant determinants of the rate of change in wage rates. Equation (4.5) shows that the rate of change of retail prices is the only significant variable of three, including unemployment (U_t) and the deflated level of profits ($\overline{D}_{t-1}$). The price coefficient indicates that a 1 per cent increase in price will generate an increase in hourly wage rates of 0·6 per cent.

$$(4.5)\quad \Delta W_{ht} = 4{\cdot}467 - 0{\cdot}179 \overline{U}_t + 0{\cdot}603 \Delta P''$$
$$(7{\cdot}379)\quad (0{\cdot}160)\quad (0{\cdot}217)$$
$$+ 0{\cdot}080 \overline{D}_{t-1}$$
$$(0{\cdot}080)$$
$$R^2 = 0{\cdot}52$$
$$\delta^2/S^2 = 2{\cdot}45$$

The indication of the non-significance of the coefficient of $\overline{U}_t$ is an important finding and is supported in Equation (4·6) where we include T_{t-1} as an alternative to the direct inclusion of profits. This time the union variable is non-significant. Again ΔW_{ht} seems to be importantly affected by price only.

$$(4.6)\quad \Delta W_{ht} = 0{\cdot}745 - 0{\cdot}222 \overline{U}_t + 0{\cdot}580 \Delta P''$$
$$(9{\cdot}730)\quad (0{\cdot}134)\quad (0{\cdot}217)$$
$$+ 0{\cdot}223 T_{t-1}$$
$$(0{\cdot}199)$$
$$R^2 = 0{\cdot}53$$
$$\delta^2/S^2 = 2{\cdot}45$$

Again we have evidence for the lack of significance of the demand variable at the aggregate level. The analysis for wage earnings tended to indicate that in the presence of variables representing the degree of prosperity and resultant union pushfulness, the unemployment coefficient loses its apparent significance. Thus earnings were found to be closely related to prices and change in profits. Similarly rates are now found to have only price as a significant determinant, although there is some evidence that one measure of union pushfulness may have something to do with the outcome. The level of unemployment is more decisively rejected in the case of wage rates—for earnings the relationship is questioned but not rejected. It is important now to valuate its impact on the earnings gap. The weak relationship of unemployment with earnings may be due to the wage rate component while a significant relationship remains with the quantity in excess of the standard rate.

Earnings Gap

The analysis in this section seeks to explain the gap between average hourly earnings and average hourly wage rates for the transportable goods industries over the period 1949–1962. The model used is that outlined in Section II and the data and variables are described in Appendix V. The earnings gap seems to be widening fairly rapidly in Ireland so that wage costs are becoming less related to wage rates than was previously the case. Insofar as this is due to increasing productivity this is of no great concern to the policy maker concerned with controlling inflation. But if it is caused by demand conditions with employers bidding up the price of labour in short supply then this phenomenon will lead to inflationary conditions.

Two limitations of the data should be mentioned. It would be relevant to know how far the substitution of overtime hours for normal hours has contributed to the phenomenon of earnings gap. No published data on this point is readily available. The hours variable (H_t) included is average total weekly working hours per man and is of limited relevance to changes in hourly earnings gap. Secondly previous studies in U.K. and Sweden have indicated the importance of unfilled vacancy statistics as an indicator of excess demand for labour. Data available on vacancies notified and vacancies filled are available for Ireland only back to 1951 and seem, on inspection, to be of dubious value. This may not be an important limitation in the case of Ireland because this country has not had the continuously very low unemployment rates as have characterised most of Western Europe in recent years.

Results : The correlation matrix in Appendix V indicates that the levels of productivity (X_t), profits (D_t) and unionisation (T_t) are all closely associated with the size of the hourly earnings gap ($E_{ht} - W_{ht}$). In all three cases the simple correlation is over 0·9. The level of unemployment (U_t) is also a closely associated variable with a correlation coefficient of

$-0{\cdot}77$. The problem in the regression model is to separately identify the impact of closely related explanatory variables for the correlation matrix also shows X_t, D_t, and T_t to be very closely related to one another. It was decided to exclude D_t and T_t from further analysis by assuming their influence to be totally felt in the wage rate bargain.[11] Thus we are left with those variables which appear, *a priori*, to be most closely identified with the earnings gap : U reflecting the demand for labour and therefore determining premium payments (and overtime), X giving higher earnings in piece-work and H with its direct accounting content in the earnings gap. Equation (4.7) shows productivity to have a very significant coefficient indicating that a 10 point rise in the productivity index will give a close to 5 point rise in the earnings gap. The level of unemployment has a coefficient which is not quite significant (i.e. not quite double its standard error). This is contrary to what other experimental regressions indicated when either U_t was taken alone or along with all the other explanatory variables. In both cases U_t appeared to be a significant variable with a coefficient of about 2·2. This inconsistency may be ascribed to the high correlation between X_t and U_t (0·68). H_t gives no indication of being a significant variable.

$$(4.7)\quad E_{ht}-W_{ht}=133{\cdot}657-1{\cdot}377U_t+0{\cdot}485X_t-1{\cdot}670H_t$$
$$(118{\cdot}233)\quad(0{\cdot}716)\quad(0{\cdot}078)\quad(1{\cdot}195)$$
$$R^2=0{\cdot}92$$
$$\delta^2/S^2=2{\cdot}44$$

Equation (4·8) does not include X_t and now U_t appears with a bigger coefficient, of the right (negative) sign, four times as big as its standard error. H_t again appears non-significant.

$$(4.8)\quad E_{ht}-W_{ht}=79{\cdot}668-4{\cdot}404U_t-0{\cdot}379H_t$$
$$(248{\cdot}073)\quad(1{\cdot}105)\quad(2{\cdot}477)$$
$$R^2=0{\cdot}59$$
$$\delta^2/S^2=0{\cdot}68$$

The von Neumann ratio indicates the presence of auto-correlation in the equation so normal tests of significance are inapplicable. To resolve this problem and to estimate the determinants of wage drift first differences of the variables were taken. As shown in Equation (4.9) the demand variable (ΔU_t) now comes out much better than the productivity variable (ΔX_t) and tends to support the findings of Klein and Ball, [8] and Hansen and Rehn [5].

[11]Their effect on the earnings gap would largely be felt through their impact on reducing hours in the normal working week and thus enabling more hours to be worked at overtime rates. Their effect in this direction will be partly picked up by the hours variable (H_t).

$$(4.9)\quad \Delta(E_{ht}-W_{ht})=2{\cdot}564-2{\cdot}590\Delta U_t-0{\cdot}566\Delta X_t-1{\cdot}296\Delta H_t$$
$$(1{\cdot}424)\quad(0{\cdot}847)\quad(0{\cdot}370)\quad(1{\cdot}371)$$
$$R^2=0{\cdot}52$$
$$\delta^2/S^2=2{\cdot}78$$

In other experiments ΔD_t was found to have a positive but non-significant coefficient.

It is now important to try and make some rough check as to whether the earnings gap is additive with respect to the wages award, or whether moderating wage claims merely means enlarging the earnings gap. We have estimated wage rate relationships and earnings gap relationships. To test the above hypothesis we need to relate residuals in the wage equation to residuals in the earnings gap relation. A residual in any particular year is simply the difference between the value of the dependent variable predicted by the explanatory variables and the actual value generated by the real world. Moderating wage claims is equivalent to negative residuals in the wage equation, i.e., the actual value of wage increase in less than would be predicted by determinants of ΔW. If this means that the earnings gap is enlarged as a direct result then the outcome would be a positive residual in the earnings gap equation, i.e., the actual value of the earnings gap would be in excess of the predicted value. If the two processes are additive and independent then we would expect no correlation. If the reverse is true then we would expect a high negative correlation between the two sets of residuals. If there is complete compensatory adjustment then the residuals will sum to zero each year (assuming wage and gap are measured in the same units). Table 9 gives a comparison of the signs of the five sets of residuals. For the 10 years up to 1959 in only one year (1954)

TABLE 9: SIGNS OF RESIDUALS FROM WAGE AND EARNINGS GAP RELATIONSHIPS*

Year	Wage Residual	Earnings Gap Residual
1949	+	−
1950	−	O
1951	−	+
1952	+	−
1953	O	O
1954	−	−
1955	−	+
1956	O	−
1957	−	+
1958	−	+
1959	+	+
1960	−	−
1961	+	+
1962	−	−

*Wage residuals from Equation (4·6) and earnings gap residuals from Equation (4·7). Pattern of signs is almost identical for other equations, where residual $>0{\cdot}5$, zero (O) has been included rather + or −.

were the signs for wage and earnings gap residuals the same. From 1959 on the signs for the two sets of residuals are the same in all four years. Thus there is an indication of compensatory adjustments in earnings when wages are set relatively low but in recent years this relationship has discontinued.

Summary of Aggregate Results

1. Demand ($\overline{U}_t$) does not seem to be a significant determinant of wage rates and its effect on wage earnings was indeterminate in the presence of alternative variables. It appears more strongly as a determinant of the earnings gap.

2. The price variable ($\Delta P'_t$) appears consistently significant as a determinant of wage rates and earnings as in OHerlihy's study.

3. Profits ($\overline{D}_{t-1}$) do not appear as a significant determinant of wage rates or earnings, but the rate of change of profits (ΔD_t) is significant as a determinant of earnings.

4. Unionisation (T_{t-1}) and the rate of change of unionisation (ΔT_{t-1}) appear to be most significant in the wage rate equations, but the relationship does not appear strong in the face of demand and price variables.

5. The level of productivity (X_t) is closely related to the earnings gap. Productivity (X), profits (D) and the level of unionisation (T_t) are closely related variables at the aggregate level.

V. SUMMARY AND CONCLUSIONS

This paper has been concerned with estimating the determinants of wage inflation at the industry and aggregate level. It has attempted to do this by studying the year-to-year changes in wages over the post-war period in seventeen individual industries and for the Transportable Goods Industries in aggregate. Wage earnings have been analysed at the industry level, while at the aggregate level wage rates, earnings and the gap between rates and earnings, have been separately examined.

Time series analysis of seventeen industries has shown that they fall into two groups with respect to the determinants of wage change: one group being demand oriented the other being profit and/or price oriented. The first group consists of nine industries (Agriculture, Bacon Factories, Bread, Brewing, Clothing (Women), Linen, Milling, Mining and Woollen-Worsted) in which the level of unemployment is a statistically significant determinant of the rate of change of money wage earnings. The second group consists of five industries (Boot and Shoe, Electricity, Hosiery, Printing, Vehicles) where the level of profits, and/or the rate of change in the consumer price index, appear as important factors in determining wage earnings. The first group of industries generally have a relatively poorly organised labour force such that the forces of supply and demand in the labour market are capable of being reflected in the price of labour. This is not so in the second group where labour is generally highly organised. Here the prosperity/bargaining power hypothesis seems to be important in wage determination and is capable of obscuring the impact of supply and demand. Some industries do not fit comfortably into these sub-divisions—Brewing gives some indication of being both demand and profit oriented, while Agriculture, though belonging to the demand group, is also influenced by the lagged change in the cost of living. Wage changes in the Building, Paper and Clothing (Men) industries do not seem closely related to demand, profit or price variables.

The other major outcome of the industry time series work was the appearance of the general level of demand for labour as a more relevant variable than the specific industry demand. This may be partly due to the inadequate definition of the industry unemployment percentage based on total persons engaged rather than persons insured. Unemployment, as a percentage of insured, at the industry group level appeared to be strongly related to wage inflation among the industries in the demand group. Generally, the current level of unemployment appeared relevant, but in at least two cases (Agriculture and Woollen-Worsted), the lagged value proved to be an improvement.

An examination of the inter-industry relationship between earnings on equity capital and wage inflation was frustrated through lack of data on company profits. A limited test showed some weak relation to wage inflation. Extending the inter-industry comparison through time, using covariance analysis, failed to reveal any important industry shifters of the wage/unemployment relationship.

The estimated regressions have only shown broad relations at the industry level. Substantial variability in the year-to-year rate of change of wages remains to be explained. Such explanation will require a detailed industry-by-industry investigation of the peculiar institutional and economic forces impinging on the wage adjustment process in each industry. Similarly, improved inter-industry analysis will

require company profit rate data over an extended time span. An important conclusion is the absence of one single cause of wage inflation common to all industries. Controlling wage inflation must, at the very least, take account of demand factors, profit levels and changes in the cost of living, and these factors will influence wages to a different extent in different industries.

The aggregate study relates to the question of the determinants of wage rates and wage drift (the lack of readily available wage rate data at the industry level precluded an investigation of the disaggregated relationships), OHerlihy [13] found unemployment and the rate of change of the consumer price index to be important determinants of aggregate wage earnings. However, when profit or unionisation variables are included in the relation the unemployment variable does not appear so consistently important while the price variable appears more so. The rate of change of profits appears as a statistically significant variable. This can be interpreted as a relevant and important expectation variable or looking back at the industrial analysis, as reflecting the improved profit positions of those industries in which profit level is an important determinant of wage earnings.

Substituting wage rates for wage earnings, the level of unemployment is even less significant. In fact wage rates appear to be largely adjustments to changes in the cost of living. Such adjustments may be induced by union action, and indeed unionisation variables themselves explain 40 per cent of the variability in wage rates. The results for earnings and wages suggest that the effect of demand for labour is chiefly reflected in the difference between rates and earnings. A direct analysis of the determinates of earnings gap and the rate of change of earnings gap (wage drift) tends to confirm this. The level of productivity also appears as an important determinant of the spread between rates and earnings. The level of productivity is itself closely related to the level of profits and the degree of unionisation; all three variables being conceptually relevant to the earnings gap. Taking first differences (wage drift) indicates the continued significance of unemployment whereas productivity loses its dominant position and becomes statistically non-significant.

These tentative conclusions regarding the determinants of wages and wage drift require to be put on to a more solid base by an examination of the relationships at the industry level. This will require the synthesis of average yearly wage rates, in the post-war period, for individual industries. It is an important task because of the central importance of such results to the working of an incomes policy. Such a policy normally refers to rates whereas demand seems to be reflected in wage earnings above rates. It also appears that up to 1959 adjustments in earnings gap were compensatory with respect to wage rates. Thus wage rates below the value predicted by the labour market conditions simply led to a bigger earnings gap. From 1959 onwards the mechanism seems to have broken down—a change that justifies detailed study.

IMPLICATIONS OF RESULTS FOR A PRICES AND INCOMES POLICY

The industry analysis indicates that at least two broad processes of wage adjustment are present in Ireland. For those industries in which labour supply and demand factors emerge as significant determinants some estimate is available of the size of the shift required to bring increases in wage into line with assumed increases in productivity at predicted unemployment levels. For the other group of industries profit levels and changes in prices appear as important determinants of wages and reinforce the arguments for an incomes, as opposed to a wages policy. In some industries it appears that labour is successfully getting wage adjustments as a result of profit and price movements. There seems a good case for the Government to encourage price cutting in industries where productivity and profits are high and growing fast. This will serve the dual ends in anti-inflation policy of moderating the increase in money profits and stabilising the consumer price index. With respect to wage adjustments in response to price changes, it is important here to investigate the presence of escalator clauses. The British Prices and Incomes Board found highly developed price-wage and wage-price escalator clauses in the Printing industry (the Printing industry in Ireland is one in which the price coefficient in the wage equation is significant). This situation would seem to leave out of reckoning the possibility of productivity adjustments and gives a built-in inflationary mechanism in the economy.

The important finding in the aggregative analysis is that demand conditions are reflected more importantly in the spread between wage earnings and rates than in the rates themselves. Thus an incomes policy moderating rates may not in fact moderate

wage inflation. If rates and earnings gap are independent then there would be more chance of policy measures being felt in wage costs—if compensating, then part or all the gain may be lost. The evidence for Ireland on this point is conflicting, but on the more general point it does seem that during economic expansion as unemployment falls, so the earnings gap will increase and this is the segment of total wage income which is difficult to control. Probably the most effective way of preventing the local bidding-up of wages would be to make product price increases more difficult to obtain. In this way premium payments to labour would be restricted to plants making relatively high productivity advances, thus giving rise to no increase in wage costs per unit of output.

The main outcome of this broad, quantitative analysis of the determinants of wage inflation must be to generate hypotheses for further, detailed investigation. Macro-quantitative work of this nature offers some measurements, uncovers relations which have to be explained and focusses attention on problems relevant to policy. Detailed descriptive and institutional work on the process of wage determination in individual industries must be viewed as complementary, rather than competitive, to the examination of relationships between statistical aggregates.

APPENDIX

I. Industry Time-Series Analysis

(A) Definitions of Variables

1. Earnings

E_{wt}: Average weekly earnings (during a week in October) of males 18 years and over (shillings).

$\Delta E'_{wt}$: $\frac{E_{t+1}-E_{t-1}}{2E_t}$. 100 = the percentage rate of change of E_t

2. Unemployment

U_{it}: Unemployed ($\bar{U}_{it}$) as percentage of total persons engaged (including proprietors and salaried employees but excluding outside piece workers) plus unemployed in that industry. Numbers unemployed is average of January and August figures.

U_{gt}: Percentage of insured persons on live register in certain industry groups, (annual average from monthly data).

N.B.

1. $\bar{U}$ for Brewing is 75 per cent of Malting, Brewing and Distilling (based on employment).
2. $\bar{U}$ for Turf cannot be separated out prior to 1954.

3. Profits

D_t: Remainder of Net Output (i.e. Gross Output minus material, fuel salary, wage and other costs). The data is recorded in October.

$\bar{D}_t$: D_t deflated by consumer price index.

ΔD_t: $\frac{D_t-D_{t-1}}{\frac{1}{2}(D_t+D_{t-1})}$ (i.e. centred at t minus 6 months).

4. Retail Prices

$\Delta P'_t$: $\frac{P_{t+1}-P_{t-1}}{2P_t}$. 100 = the percentage rate of change of an index of P_t where P is the consumer price index (=100 in mid-year 1953).

$\Delta P''_t$: $\frac{P_t-P_{t-1}}{\frac{1}{2}(P_t+P_{t-1})}$. 100 = similar; index centred on t−6 months.

$\Delta P'''$: OHerlihy data [13].

(B) Sources

1. Earnings

1949–1961 Census of Industrial Production (C.I.P.) data in *Statistical Abstract of Ireland* (Annual), Central Statistics Office, Dublin.

2. Unemployment

1949–1961 *The Trend of Employment and Unemployment* Annual Reports, Central Statistics Office, Dublin.

3. Profits

1949–1961 Census of Industrial Production data in *Statistical Abstract of Ireland.*

(D) Data

Value of E_t

	Industry	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1	Mining	7·88	9·39	11·09	9·55	2·43	0·39	7·04	5·05	4·50	7·72	5·29	6·51	9·07
2	Bacon Factories ..	5·99	9·80	7·50	1·96	4·72	3·57	4·06	2·75	2·59	3·21	3·60	8·41	8·73
3	Milling	2·55	4·64	5·00	5·91	7·23	1·86	5·90	8·00	2·82	—·09	3·55	9·20	10·74
4	Bread	1·19	5·95	6·84	3·76	2·32	3·25	3·92	3·96	4·78	5·19	5·69	6·32	8·12
5	Brewing	6·82	9·09	7·83	4·00	2·74	5·40	5·79	2·32	4·41	4·44	7·52	9·04	11·32
6	Woollen	3·49	5·13	6·56	9·75	7·39	0·67	6·72	6·25	1·68	2·61	5·98	6·70	10·15
7	Linen	2·17	7·60	6·95	3·50	0·41	2·53	7·94	3·15	4·50	6·78	7·58	6·29	6·85
8	Hosiery	6·61	3·88	8·74	9·38	6·46	4·33	5·99	5·94	4·56	2·26	2·03	—·29	5·40
9	Boot and Shoe ..	3·06	5·65	9·96	8·02	3·22	2·99	2·34	4·85	5·74	3·36	8·36	6·02	7·64
10	Clothing (Men) ..	3·91	3·43	3·75	8·35	6·12	9·57	3·31	0·39	3·36	2·24	4·96	8·02	9·05
11	Clothing (Women) ..	1·26	4·18	4·05	4·24	3·63	3·85	5·08	3·64	3·42	4·85	2·00	3·19	9·55
12	Paper	2·09	7·31	7·16	6·06	6·99	6·02	5·06	3·19	3·07	5·37	4·62	7·22	9·14
13	Printing	2·97	5·81	9·14	5·45	3·93	3·78	4·19	4·71	5·56	7·12	5·03	6·64	8·61
14	Vehicles	2·38	5·31	6·17	5·63	6·58	2·77	1·65	4·97	6·11	2·48	4·36	9·08	9·64
15	Building	2·73	5·06	3·62	5·84	6·74	5·66	4·51	1·21	5·00	3·51	2·91	8·45	7·99
16	Electricity	1·19	7·42	8·93	3·13	—·71	—·72	4·03	6·53	7·30	6·01	5·56	9·16	7·61

Value of U_{it}

	Industry	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1	Mining	8·8	5·6	3·1	5·3	9·8	6·3	4·0	5·4	6·1	7·6	7·1	5·0	4·0
2	Bacon Factories ..	—	8·50	10·83	5·91	8·16	8·21	6·57	7·04	7·50	6·70	5·44	4·65	4·11
3	Milling	—	6·31	7·60	6·19	7·48	5·84	4·33	5·28	6·25	6·25	5·80	5·28	4·33
4	Bread	—	3·86	4·59	4·55	5·82	4·80	4·09	6·05	7·19	6·95	5·89	5·46	4·81
5	Brewing	—	5·15	4·67	5·05	6·50	6·64	5·81	6·56	7·84	7·26	7·44	6·88	5·43
6	Woollen	—	5·81	12·48	21·31	5·43	6·35	7·35	4·15	7·99	4·46	7·69	6·12	5·82
7	Linen	—	7·56	6·25	17·86	9·09	7·69	7·25	5·17	9·79	8·85	6·80	4·87	4·33
8	Hosiery	—	4·59	5·76	13·49	6·04	6·83	6·20	5·60	11·07	6·85	5·97	4·84	4·45
9	Boot and Shoe ..	—	5·52	12·57	18·08	6·94	9·48	14·21	9·23	14·33	9·25	9·70	10·52	4·76
10	Clothing (Men) ..	8·3	5·6	9·5	12·9	8·7	9·9	7·7	7·4	8·9	7·7	7·4	5·8	4·5
11	Clothing (Women) ..	8·3	5·6	9·5	12·9	8·7	9·9	7·7	7·4	8·9	7·7	7·4	5·8	4·5
12	Paper	—	3·31	2·74	5·00	5·53	4·05	2·89	2·64	4·47	4·17	3·03	2·30	2·03
13	Printing	—	2·17	2·21	3·11	3·49	2·94	1·93	1·80	2·44	2·39	2·47	2·11	1·98
14	Vehicles	5·0	4·4	3·9	5·4	5·6	4·1	3·7	6·6	7·1	5·6	5·8	4·8	4·1
15	Building	14·8	12·3	11·2	14·0	19·6	15·1	13·6	15·7	19·5	19·0	17·9	15·0	13·0
16	Electricity	—	2·11	2·13	2·74	2·99	2·47	2·15	2·41	4·47	3·95	3·43	2·56	2·47

Value of $\bar{D}_{t-1}$

	Industry	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1	Mining	·229	·275	·469	·569	·459	·585	1·551	1·874	1·715	1·785	·682	3·003	1·747
2	Bacon Factories ..	·431	·372	·908	1·024	1·428	1·632	1·510	1·308	1·086	1·131	1·233	1·239	1·465
3	Milling	1·468	1·248	1·672	1·678	1·722	1·842	2·088	1·971	2·417	1·948	2·157	2·128	1·792
4	Bread	2·434	2·505	2·517	2·491	2·731	2·624	2·580	2·202	1·943	2·216	2·266	2·388	2·519
5	Brewing	4·525	5·948	5·484	5·560	5·455	4·900	5·437	5·844	5·932	5·088	5·537	5·712	6·017
6	Woollen	1·042	·833	1·227	1·058	·406	1·382	1·441	1·473	1·735	1·251	1·349	1·592	1·386
7	Linen	·723	1·265	1·236	·982	·719	1·536	·654	·683	·920	·766	·774	·903	1·017
8	Hosiery	·529	·710	1·148	1·061	1·033	1·164	1·204	1·338	1·260	1·106	1·102	1·470	1·479
9	Boot and Shoe ..	·943	·939	1·189	·943	·873	·926	·834	·876	·816	·864	·862	·956	1·220
10	Clothing (Men) ..	1·647	1·761	1·978	1·779	1·467	1·801	1·490	1·598	1·714	1·638	1·670	1·854	1·945
11	Clothing (Women) ..	1·647	1·761	1·978	1·779	1·467	1·801	1·490	1·598	1·714	1·745	1·838	1·962	2·038
12	Paper	·843	·835	1·231	1·405	·747	1·248	1·513	1·715	1·282	1·441	1·484	1·607	1·984
13	Printing	2·027	1·946	1·996	2·117	1·823	1·790	1·872	2·100	2·127	2·017	2·053	2·604	2·588
14	Vehicles	1·395	1·726	1·800	1·581	·924	1·135	1·665	1·347	·777	1·014	1·500	1·868	1·814
15	Building	3·415	3·539	4·048	3·920	3·652	3·549	3·306	3·089	3·097	2·213	2·891	2·903	2·453
16	Electricity*	—·137	—·130	·149	—·489	—·907	—·503	5·404	5·251	5·789	6·257	6·880	6·913	7·921

*Commencing in 1954 the value of capital works carried out by the Electricity Supply Board was included in the Gross Output of the Electricity Industry.

(C) Data (*continued*)

Value of $\triangle D_t$

	Industry	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1	Mining	19·40	53·33	26·26	−12·66	29·16	90·45	21·77	−5·04	8·56	−88·37	125·46	−52·10	30·33
2	Bacon Factories ..	−13·46	84·72	19·04	41·46	18·39	−7·77	−11·34	14·73	7·69	13·85	−·35	17·51	−20·17
3	Milling	15·01	30·27	7·53	11·37	11·85	12·52	−2·82	24·09	−16·95	14·53	−2·24	−16·30	64·69
4	Bread	4·12	17·31	6·09	17·93	1·15	−·17	−12·87	−8·69	13·54	10·73	4·39	6·19	10·02
5	Brewing	28·39	−6·87	8·51	6·89	−5·59	10·39	10·16	5·30	−10·77	12·81	2·26	6·06	3·68
6	Woollen	−21·07	39·52	−7·73	−81·78	112·67	4·18	5·14	20·09	27·93	11·88	15·70	13·03	17·25
7	Linen	55·68	−1·09	−15·84	−26·97	76·85	−80·55	7·36	−33·68	−13·68	5·44	14·53	12·69	17·62
8	Hosiery	30·43	48·33	−·76	6·09	17·05	3·38	13·48	−2·20	−8·42	3·96	27·99	1·46	28·63
9	Boot and Shoe ..	·80	24·74	−16·03	1·09	11·05	−10·45	7·83	−3·27	10·31	4·15	9·44	25·08	18·79
10	Clothing (Men) ..	7·97	12·82	−3·43	−10·47	25·47	−18·89	9·95	10·80	6·34	9·55	5·69	4·64	21·65
11	Clothing (Women) ..	7·97	12·82	−3·43	−10·47	25·47	−18·89	9·95	10·80	6·34	9·55	5·69	4·64	21·65
12	Paper	0·30	39·50	20·27	−53·00	54·95	19·19	15·43	−25·11	16·21	7·28	7·11	21·83	0·34
13	Printing	−2·79	3·78	13·01	−6·16	3·29	4·48	14·42	5·09	−·75	6·13	22·82	0·23	10·99
14	Vehicles	22·46	5·42	−5·86	−44·10	25·52	37·86	−18·22	−50·14	31·00	42·81	21·23	−2·10	7·27
15	Building	4·81	14·66	3·92	1·72	2·28	−7·09	−3·82	4·06	−28·87	30·88	−·47	−15·93	20·93
16	Electricity*	4·00	200·00	−300·00	−60·00	−60·00	241·00	−2·57	16·18	12·33	13·84	−·39	14·44	1·31

*Important change in the series in 1954.

Value of U_{gt}

	Industry	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1	Food	6·3	5·4	5·4	5·4	7·1	6·4	4·7	5·7	6·2	5·9	5·4	4·8	3·9
2	Drink	4·9	4·5	4·2	4·5	5·4	5·4	5·0	6·3	7·0	6·8	6·4	6·0	4·5
3	Textiles	7·1	5·2	8·1	13·6	5·5	7·5	5·1	4·8	7·1	6·6	5·7	4·4	4·5
4	Clothing	8·3	5·6	9·5	12·9	8·7	9·9	7·7	7·4	8·9	7·7	7·4	5·8	4·5
5	Metals	7·1	5·8	5·3	7·2	8·4	6·0	5·0	6·4	8·7	6·5	6·0	5·0	3·7
6	Vehicles	5·0	4·4	3·9	5·4	5·6	4·1	3·7	6·6	7·1	5·6	5·8	4·8	4·1
7	Paper and Printing ..	2·9	2·7	2·7	3·7	4·0	3·7	2·3	2·5	3·1	3·2	2·8	2·1	2·0
8	Mining and Quarrying	8·8	5·6	3·1	5·3	9·8	6·3	4·0	5·4	6·1	7·6	7·2	5·0	4·0
9	Building and Construction ..	14·8	12·3	11·2	14·0	19·6	15·1	13·6	15·7	19·5	19·0	17·9	15·0	13·0
10	Gas, Electricity and Water	4·5	4·1	3·8	4·5	5·7	4·8	3·8	5·1	5·8	5·5	5·3	4·2	3·8
11	Total (excluding Agr. Fish for Domestic (U_{at}))	9·0	7·5	7·3	9·1	9·6	8·1	6·8	7·7	9·2	8·6	8·0	6·7	5·7

(D) Agriculture

1. Wages

W_t: Index of average minimum weekly wage rates of permanent adult male agricultural workers without free house or allowance of any kind, in July, (July 1953 = 100).

ΔW_t: $\frac{W_{t+1} - W_{t-1}}{2W_t}$. 100 = percentage rate of change of W_t.

2. Unemployment

$\bar{U}_t$: Unemployed workers (agricultural and forestry)—mean of January and August figures.

U_t: $\bar{U}_t$ as a percentage of total hired male workers engaged in farm work on June 1st.

3. Profits

D_t: Net output—land annuities—wages and salaries. (Revised figures have been used where they are available).

4. Union Membership

T_t: Trade union members as a percentage of the permanent hired labour force in agriculture.

N.B. All data is available in *Statistical Abstract of Ireland* except unemployment, to be found in *The Trend of Employment and Unemployment.*

Data: Irish Agriculture

Year	ΔW_t	U_{t-1}	$\bar{U}_{t-1}$	$\bar{D}_{t-1}$	T_{t-1}
1947	10·73	1·65	2·302	—	—
1948	8·91	1·37	1·873	—	3·38
1949	4·12	2·05	2·784	99·750	4·31
1950	6·12	2·61	3·258	102·716	4·40
1951	9·24	2·67	3·143	100·000	4·14
1952	8·59	2·35	2·528	101·474	5·58
1953	7·05	2·38	2·536	111·000	5·25
1954	2·34	5·03	4·857	121·400	4·91
1955	6·58	3·73	3·883	109·709	5·58
1956	5·81	3·91	4·024	101·215	5·02
1957	0·00	4·77	4·548	86·429	6·04
1958	3·18	4·76	4·523	93·761	6·35
1959	4·88	5·08	4·709	84·483	6·38
1960	3·28	5·14	4·617	93·419	6·69
1961	7·16	4·90	4·337	93·167	7·58
1962	5·19	4·81	3·889	95·040	8·78
1963	9·28	5·14	3·897	95·703	11·45

(E) i Correlation Matrix of $\triangle E_{wt}$ (1949-1961) among 17 Industries

Industry	Bacon	Milling	Bread	Brewing	Woollen	Linen	Hosiery	Boot and Shoe	Men's Clothing	Women's Clothing	Paper	Printing	Vehicles	Building	Electricity	Agriculture
Mining ..	0·55	0·35	0·54	0·57	0·53	0·64	0·44	0·62	0·02	0·44	0·44	0·67	0·38	0·28	0·38	0·63
Bacon ..		0·59	0·62	0·81	0·34	0·60	0·37	0·49	0·36	0·51	0·69	0·59	0·64	0·62	0·13	0·49
Milling ..			0·63	0·54	0·79	0·41	0·47	0·56	0·48	0·68	0·70	0·53	0·84	0·71	0·04	0·63
Bread ..				0·82	0·46	0·84	0·39	0·82	0·45	0·87	0·87	0·91	0·81	0·77	0·22	0·45
Brewing ..					0·40	0·75	0·23	0·66	0·54	0·69	0·76	0·72	0·68	0·69	0·19	0·36
Woollen ..						0·31	0·34	0·56	0·38	0·53	0·56	0·47	0·61	0·45	0·12	0·75
Linen ..							0·35	0·65	0·18	0·65	0·66	0·74	0·48	0·55	0·29	0·43
Hosiery ..								0·52	0·26	0·51	0·51	0·36	0·40	0·50	—0·45	0·76
Boot and Shoe									0·42	0·60	0·69	0·81	0·77	0·58	0·23	0·59
Men's Clothing										0·53	0·67	0·35	0·59	0·77	—0·35	0·26
Women's Clothing											0·88	0·78	0·74	0·81	—0·07	0·51
Paper ..												0·79	0·82	0·91	—0·11	0·62
Printing ..													0·76	0·63	0·39	0·48
Vehicles ..														0·84	0·14	0·45
Building ..															—0·23	0·42
Electricity																—0·17

(E) ii Zero Order Correlation Matrices

1. *Mining*

	U_{gt}^{-1}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	0·56	−0·05	−0·31
U_{gt}^{-1}		0·18	−0·03
$\bar{D}_{t-1}$			−0·59

2. *Bacon*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	0·02	−0·49	−0·66	−0·39	0·35
U_{it}		0·56	0·34	−0·36	0·33
U_{gt}			0·87	0·03	0·15
U_{at}				−0·10	0·27
$\bar{D}_{t-1}$					−0·87

3. *Milling*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	−0·38	−0·52	−0·54	−0·11	0·36
U_{it}		0·71	0·66	−0·33	−0·23
U_{gt}			0·87	0·00	−0·34
U_{at}				0·07	−0·40
$\bar{D}_{t-1}$					−0·59

4. *Bread*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	−0·14	−0·74	−0·71	0·06	0·38
U_{it}		0·44	0·49	−0·22	0·06
U_{gt}			0·87	0·25	−0·03
U_{at}				0·11	0·23
$\bar{D}_{t-1}$					0·39

5. *Brewing*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	−0·34	−0·42	−0·78	0·36	0·01
U_{it}		0·96	0·37	−0·17	−0·19
U_{gt}			0·38	−0·10	−0·13
U_{at}				−0·32	−0·34
$\bar{D}_{t-1}$					−0·62

6. *Woollen*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	0·39	0·10	−0·35	−0·29	−0·18
U_{it}		0·91	0·26	−0·09	−0·75
U_{gt}			0·50	−0·13	−0·71
U_{at}				−0·39	0·13
$\bar{D}_{t-1}$					−0·41

7. *Linen*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	−0·35	−0·27	−0·64	−0·02	−0·09
U_{it}		0·89	0·69	0·01	−0·25
U_{gt}			0·50	0·27	−0·50
U_{at}				−0·13	0·03
$\bar{D}_{t-1}$					−0·76

8. *Hosiery*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	0·42	0·59	0·21	−0·19	−0·14
U_{it}		0·85	0·64	−0·11	−0·44
U_{gt}			0·50	−0·27	−0·30
U_{at}				−0·46	−0·29
$\bar{D}_{t-1}$					−0·51

9. *Boot and Shoe*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	0·16	0·07	−0·21	0·63	−0·08
U_{it}		0·75	0·33	−0·26	−0·39
U_{gt}			0·68	−0·21	−0·67
U_{at}				−0·60	−0·25
$\bar{D}_{t-1}$					−0·11

10. *Clothing (Men)*

	U_{it} U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	0·13	−0·15	0·45	−0·31
U_{it}		} 0·68	−0·08	−0·66
U_{gt}				
U_{at}			−0·47	−0·15
$\bar{D}_{t-1}$				−0·38

11. *Clothing (Women)*

	U_{it} U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	−0·38	−0·56	0·30	0·35
U_{it}		} 0·68	−0·08	−0·66
U_{gt}				
U_{at}			−0·47	−0·15
$\bar{D}_{t-1}$				−0·38

12. *Paper*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	−0·22	−0·16	−0·47	−0·05	0·29
U_{it}		0·94	0·93	−0·65	0·06
U_{gt}			0·89	−0·64	−0·05
U_{at}				−0·61	−0·00
$\bar{D}_{t-1}$					−0·60

13. *Printing*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	−0·42	−0·48	−0·48	0·57	0·14
U_{it}		0·92	0·77	−0·43	−0·37
U_{gt}			0·89	−0·64	−0·40
U_{at}				−0·56	−0·43
$\bar{D}_{t-1}$					−0·12

14. *Vehicles*

	U_{it} U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E_t'$	0·03	−0·31	0·48	−0·12
U_{it}		} 0·63	−0·56	0·02
U_{gt}				
U_{at}			−0·44	0·24
$\bar{D}_{t-1}$				−0·36

15. *Building*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E'_t$	−0·12		−0·22	−0·02	−0·15
U_{it}			0·68	−0·39	−0·20
U_{gt}					
U_{at}				0·30	−0·21
$\bar{D}_{t-1}$					−0·32

16. *Electricity*

	U_{it}	U_{gt}	U_{at}	$\bar{D}_{t-1}$	ΔD_t
$\Delta E'_t$	0·00	−0·36	−0·53	0·54	0·01
U_{it}		0·81	0·60	0·35	−0·21
U_{gt}			0·80	0·04	−0·34
U_{at}				−0·46	−0·04
$\bar{D}_{t-1}$					−0·12

17. *Agriculture* (1949–63)

	$\bar{U}^{-1}_{t-1}$	$\bar{D}_{t-1}$	T_{t-1}	ΔT_{t-1}	$\Delta P'_t$	$\Delta P'_t$
ΔW_t	0·52	0·15	0·20	0·13	0·41	0·57
$\bar{U}^{-1}_{t-1}$		0·32	−0·34	−0·04	0·56	0·41
$\bar{D}_{t-1}$			−0·39	−0·39	0·03	0·05
T_{t-1}				0·74	−0·10	−0·05
ΔT_{t-1}					0·03	0·11
$\Delta P''_t$						0·78

II. Cross Sectional Analysis

Earnings

Calculated rate of change of average earnings using quarterly data (*Irish Trade Journal and Statistical Bulletin*):

ΔE_{wt}: $\dfrac{E_{June\ 1965} - E_{June\ 1963}}{2E_{December\ 1963}}$ i.e. centred on December 1963

$\Delta E_{wt+\frac{1}{4}}$: $\dfrac{E_{September\ 1964} - E_{September\ 1963}}{2E_{March\ 1964}}$ i.e. centred on March, 1964

$\Delta E_{wt+\frac{1}{2}}$: $\dfrac{E_{December\ 1964} - E_{December\ 1963}}{2E_{June\ 1964}}$ i.e. centred on June 1964

(similarly for ΔE_{wt-1} $\Delta E_{wt-\frac{3}{4}}$ and $\Delta E_{wt-\frac{1}{2}}$)

Profit Rates

The companies from which data was used to derive the industry estimate of D/K for 1963 are summarised below:

Bacon Factories:	Bacon Company of Ireland.
Grain Milling and Animal Feed:	Bolands Ltd. Jacob (W. & R.) & Company. Milford (Donegal) Bakery. Ranks Ireland.
Bread, Biscuits and Flour Confectionery:	Bolands Ltd. Jacob (W. & R.) & Company. Milford (Donegal) Bakery.
Brewing:	Guinness (Arthur) & Sons. Smithwicks Brewery.
Woollen & Worsted:	Irish Worsted Mills Ltd. Salts (Ireland) Ltd.
Linen and Cotton:	General Textiles Ltd. Greenmount and Boyne Linen.
Hosiery:	Smyth & Co. Balbriggan. Sunbeam Wolsey Ltd.
Boot and Shoe: (Wholesale Factories)	Halliday (John) & Son. Rawson (John) & Son (Ireland). Woodington J. H. (1936)·
Clothing (Wholesale Factories) Men's and Boys':	Dubtex Clothing Ltd. Lyons (T.) & Co. Cork. McBirney & Co. Dublin.
Clothing (Wholesale Factories) Women's & Girls':	Greenmount and Boyne Linen Leethems (Ireland) Ltd.
Paper and Paper Products:	Smurfit (Jefferson) & Sons. Torc Manufacturing Co. Swift Brook Paper Mills. Wallpapers Ltd.
Printing & Publishing:	Hely Group Ltd. Independent Newspapers. Temple Press Ltd.
Vehicles:	Booth Poole and Co. Lincoln & Nolan (Hold.). McCairns Motors Ltd. Springs Ltd.

DATA: CROSS SECTIONAL ANALYSIS

Industry	ΔE_{wt}	$\Delta E_{wt+\frac{1}{4}}$	$\Delta E_{wt+\frac{1}{2}}$	$(D/K)_t$	ΔE_{wt-1}	$\Delta E_{wt-\frac{3}{4}}$	$\Delta E_{wt-\frac{1}{2}}$
1. Milling	11·57	13·16	12·09	7·52	3·83	4·84	4·53
2. Bacon Factories ..	13·24	11·26	11·31	14·12	8·62	2·76	1·60
3. Bread	13·22	10·98	8·99	9·33	4·87	4·76	−1·18
4. Brewing	14·88	13·02	12·00	7·82	1·46	−0·06	1·64
5. Woollen	13·48	10·68	12·23	7·33	1·63	−0·36	2·71
6. Linen	16·11	12·01	9·82	7·90	−0·92	−1·95	−0·75
7. Hosiery	3·87	2·18	5·46	10·51	6·03	5·40	1·81
8. Boot and Shoe ..	19·06	12·22	5·19	15·62	8·31	3·76	5·61
9. Clothing (Men) ..	15·91	13·65	13·37	6·33	2·60	4·89	−0·32
10. Clothing (Women)	12·62	11·97	13·10	5·29	2·00	1·61	2·09
11. Paper	15·59	6·76	5·65	13·48	3·51	6·42	4·18
12. Printing	15·32	12·36	11·91	8·80	4·26	4·46	4·50
13. Vehicles	18·54	11·08	13·31	11·99	13·40	7·51	6·20

III. Covariance Analysis

UNION ORGANISATION: RANKING BY INDUSTRY

Paper	"Very highly organised": national agreement	1
Printing	"Very organised"	2
Boot and Shoe	"Industrial union": registered J.I.C.	3
Electricity	"Highly organised"	
Milling	"Highly organised" (but animal feed sector not so)	4
Bread	"Well organised": national agreement	5
Bacon	"Well organised": no national agreement	6
Woollen	"Well organised": no national agreement	
Hosiery	"Average" organisation	7
Brewing	Local bargaining	8
Mining	Many firms unorganised	
Vehicles	"Local, poor organisation"	
Building	"Poor"—but centralised negotiations	9
Clothing (Men)	"Low level organisation"	10
Linen	"Low level organisation"	
Clothing (Women)	"Very low level organisation"	11
Agriculture	"Very poorly organised"	12

IV. Aggregate: Wage Earnings and Wage Rates

1. Earnings

E_{ht}: Index of average hourly earnings (during a week in October) in the Transportable Goods industry (base October 1963): the figures for 1963 is an estimate for a week in September from a Quarterly Industrial Production Enquiry.

Source: *Statistical Abstract of Ireland* 1964, Table 125 *Irish Trade Journal and Statistical Bulletin*

2. Wage Rates

W_{ht}: Index of average hourly wage rates in twenty-three industries (base: January 1953=100). Source: *Statistical Abstract of Ireland* 1964.

ΔW_{ht}: $\frac{W_{ht+1}-W_{ht-1}}{W_{ht}} \cdot 100$ = percentage rate of change W_{ht}

3. Unemployment

$\overline{U}_t$: total live register minus industry groups Agriculture, Fishing, Private Domestic Service and Other Construction.

Source: *Statistical Abstract of Ireland* 1964. (Table 177)

4. Profits

D_t: money profits of Transportable Goods industries (£ million at current prices)

Source: *Statistical Abstract of Ireland,* 1964.

ΔD_t: $\frac{D_t-D_{t-1}}{\frac{1}{2}(D_t+D_{t-1})} \cdot 100$ = percentage rate of change of D_t centred on t minus 6 months.

K_t: mid year capital stock of Transportable Goods industries (£ million at current prices)

Source: E. Nevin, *The Capital Stock of Irish Industry,* Paper No. 17, The Economic Research Institute, Dublin, November, 1963.

$\overline{D}_t$: D_t deflated by consumer price index.

5. Unionisation

T_{It}: members of registered Irish trade unions (in thousands) excluding members of employers associations and members of agricultural unions (at year end).

T_{Gt}: Irish members of British trade unions (in thousands at year end).

T_t: T_I+T_G as a percentage of the non-agricultural labour force.

ΔT_t: T_t-T_{t-1} = rate of change of the percentage of labour force unionised (centred on mid-year).

Sources: D. O'Mahony, *Industrial Relations in Ireland: The Background,* Paper No. 19, The Economic Research Institute, May 1964. *Annual Reports of the Registrar of Friendly Societies, Ministry of Labour Gazette* (London).

DATA: AGGREGATE WAGE EARNINGS AND WAGE RATES

Year	(1) ΔE_{at}	(2) ΔW_{ht}	(3) $\overline{U}_{at}$	(4) $\Delta P''_t$	(5) D_{t-1}	(6) $\overline{D}_{t-1}$	(7) T_{t-1}	(8) ΔT_{t-1}	(9) $\Delta \overline{D}_{t-1}$
1949	2·2	4·19	29·63	—0·3	25·523	32·308	32·18	2·22	7·18
1950	3·5	0·37	26·03	1·5	29·321	36·651	34·56	2·38	12·60
1951	10·0	6·36	26·61	7·9	32·514	40·141	36·68	2·12	9·09
1952	6·2	9·98	33·95	8·7	33·999	39·079	37·68	1·00	—2·68
1953	5·8	4·30	36·36	5·5	35·305	37·163	38·21	0·53	—5·03
1954	2·9	0·20	32·66	0·1	42·034	42·034	37·52	—0·69	12·30
1955	5·0	4·03	27·30	2·6	42·235	42·235	37·89	0·37	0·48
1956	6·2	4·89	31·00	4·3	44·495	43·199	38·90	1·01	2·26
1957	2·7	1·94	37·34	4·1	44·317	41·418	39·18	0·28	—4·21
1958	4·9	2·57	34·63	4·5	44·636	39·854	38·90	—0·28	—3·85
1959	3·5	5·02	31·78	0·0	48·889	41·785	39·24	0·34	4·73
1960	7·2	3·94	26·26	0·4	58·874	50·753	40·49	1·25	19·38
1961	6·4	8·27	22·86	2·7	61·099	52·221	42·17	1·68	2·85
1962	12·7	7·26	23·60	4·2	73·529	61·274	43·29	1·12	15·95
1963	3·2	6·75	24·39	2·4	81·614	65·291	44·25	0·96	6·35

V. Aggregate Earnings Gap

U_t: Percentage of insured persons on the live register, excluding agriculture, fishing and private domestic service.

Source: The Trend of Employment and Unemployment

X_t: Output per employee hour in Transportable Goods Industries.

Source: Statistical Abstract of Ireland. The Irish Trade Journal and Statistical Bulletin

H_t: Average total hours worked per week (for a week in October).

Source: Statistical Abstract of Ireland.

DATA: AGGREGATE EARNINGS GAP

Year	(1) $E_{ht}-W_{ht}$	(2) $\Delta(E_{ht}-W_{ht})$	(3) U_t	(4) ΔU_t	(5) X_t	(6) ΔX_t	(7) H_t	(8) ΔH_t
1949	—2·9	—3·9	9·0	—0·4	89·0	6·9	100·0	0·6
1950	—0·4	2·5	7·5	—1·5	95·6	6·6	100·1	0·1
1951	7·3	7·7	7·3	0·2	95·0	—0·6	99·1	—1·0
1952	2·8	—4·5	9·1	1·8	95·0	—	99·4	0·3
1953	—	—2·8	9·6	0·5	100·0	5·0	100·0	0·6
1954	2·6	2·6	8·1	—1·5	101·2	1·2	99·8	—0·2
1955	7·6	5·0	6·8	—1·3	103·5	2·3	100·3	0·5
1956	6·3	—1·3	7·7	0·9	103·8	0·3	99·4	—0·9
1957	6·8	0·5	9·2	1·5	106·0	2·2	99·4	—
1958	10·6	3·8	8·6	—0·6	108·0	2·0	100·0	0·6
1959	10·9	0·3	8·0	—0·6	115·9	7·9	100·6	0·6
1960	13·2	2·3	6·7	—1·3	119·0	3·1	100·8	0·2
1961	20·9	7·7	5·7	—1·0	123·8	4·8	100·3	—0·5
1962	20·2	—0·7	5·7	—	127·8	4·0	98·9	—1·4

TABLE M: AGGREGATE EARNINGS GAP: MATRIX OF ZERO-ORDER CORRELATION COEFFICIENTS

	$\Delta(E_{ht}-W_{ht})$	U_t	ΔU_t	X_t	ΔX_t	H_t	ΔH_t	D_t	ΔD_t	T_t	ΔT_t	t
$E_{ht}-W_{ht}$	0·47	—0·77	—0·15	0·93	—0·02	0·02	—0·48	0·93	0·52	0·96	0·01	0·91
$\Delta(E_{ht}-W_{ht})$		—0·59	—0·54	0·28	—0·19	0·18	—0·26	0·25	0·18	0·30	0·13	0·25
U_t			0·50	—0·68	—0·03	—0·07	0·60	—0·69	—0·40	—0·73	—0·41	—0·56
ΔU_t				—0·22	—0·40	—0·64	—0·16	—0·21	—0·43	—0·11	—0·56	—0·12
X_t					0·18	0·17	—0·34	0·99	0·63	0·97	—0·03	0·97
ΔX_t						0·54	0·39	0·17	0·61	—0·00	0·47	0·06
H_t							0·68	0·12	0·33	0·05	0·36	0·16
ΔH_t								—0·38	—0·04	—0·46	0·05	—0·28
D_t									0·64	0·96	—0·04	0·97
ΔD_t										0·52	0·10	0·52
T_t											—0·07	0·94
ΔT_t												—0·17

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