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Some Aspects of Price Inflation in Ireland

by

R. C. GEARY and J. L. PRATSCHKE

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Some Aspects of Price Inflation in Ireland

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Foreword

We started this research to try to find out why prices are persistently rising or, more precisely, to answer the question: are rising prices a necessary condition for economic advance under modern conditions? What has transpired is a statistical document, mainly descriptive of price trends in Ireland during the post-war period, though we venture to propound in the final section of the paper, unproven theses for discussion. We hope that others will tackle this, one of the most important socio-economic problems of our time, here and elsewhere, and that our data will prove useful to them. We would feel amply rewarded if our paper should lead to more public awareness of, and concern for, the price situation.

While responsibility for the content of the paper is entirely ours, we would like to express our thanks to the Referee, the Central Statistics Office and An Foras Talúntas (for computer services).

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ABBREVIATIONS

CD	Census of Distribution
CIE	Córas Iompair Éireann (Irish Transport Co.)
CIP	Census of Industrial Production
CP(I)	Consumer Price (Index)
CSO	Central Statistics Office
DF	Degrees of Freedom
EEC	European Economic Community
ERI	The Economic Research Institute (now ESRI)
ESRI	The Economic and Social Research Institute
GDFCF	Gross Domestic Fixed Capital Formation
GNP	Gross National Product
IO	Input-Output
ISB	*Irish Statistical Bulletin*
ITJ & SB	*Irish Trade Journal and Statistical Bulletin* (now *ISB*)
MDS	*Monthly Digest of Statistics* (U.K.)
NIE	*National Income and Expenditure* (CSO)
NIEC	National Industrial and Economic Council
RLT	*Returns of Local Taxation*
SA	*Statistical Abstract*
SD	Standard Deviation
SSISI	Statistical and Social Inquiry Society of Ireland
TG(I)	Transportable Goods (Industries)
WP(I)	Wholesale Price (Index)

SOME ASPECTS OF PRICE INFLATION IN IRELAND*

by

R. C. GEARY and J. L. PRATSCHKE

1. INTRODUCTION

In every country prices have risen substantially since the end of the war. In Ireland, as in six other European countries, consumer prices had almost doubled between 1948 and 1965—see Table 2. Is this situation of continuously rising prices in the indefinite future a fact of life which must be accepted and with which we must somehow cope, or does it mean that a sudden, and possibly catastrophic, fall in prices, like that of May 1920 after World War I, is to be anticipated? History generally has a way of repeating itself and similarities are observable between our times and others, but with much longer time-lags between cause and effect in the more recent period. One might hope that, as governments nowadays have much greater control of their economies than in the past, and with the development of the social conscience, disastrous price falls can be avoided or mitigated. It is only a hope, however.

We start our examination with the five most familiar price index numbers,[1] to set the price scene in the Irish context—see Table 1 and Chart 1. There is seen to be a wide disparity between the different indexes in each of the two periods 1946-1953 and 1953-1965 but these disparities are different in character: for example, since 1953 the rise in consumer prices was by far the largest of the five but in 1946-1953 consumer prices rose least. Other points to be noted as significant in the later period are:—

(i) increases in import and export prices are far le ss than in wholesale and consumer prices

(ii) general similarity in trends of wholesale and retail prices but with a widening gap in the later years;

(iii) close similarity in agricultural and export price trends (as is to be expected because of the predominance of farm products in exports), but with a significant deviation in the past two years due in part, no doubt, to the increasing importance of industrial exports;

(iv) the terms of trade (ratio of export to import prices) after being unfavourable for most of the period have moved to nearly 1953 parity in 1964-65.

Chart 1, with other well-known data about the economic trend, suggest a multitude of problems worth investigation, and we hope to examine some of these problems here.

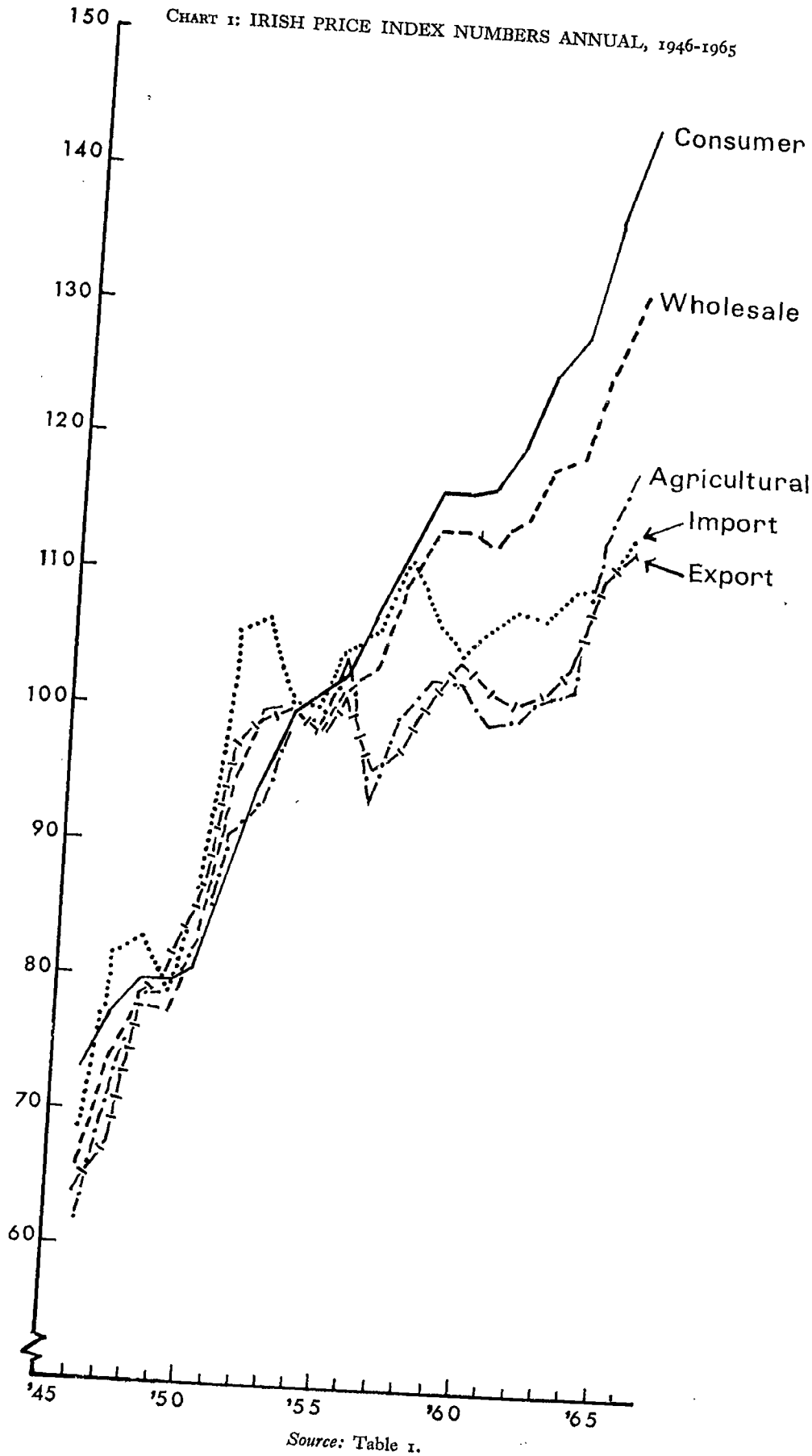
This paper provides a statistical description of some aspects of the Irish price trend since 1946. This background should be useful for a more severely econometric analysis of Irish experience, designed specifically to establish cause-effect relationships.

The trend is first considered in the context of European experience; we then turn our attention to reviewing, in turn, aspects of industrial and

[1]Here ignore the technical distinction between *price* and *unit value* index numbers. In Table 1 import and export price indexes so-called are really unit value indexes. We discuss the point in Section 9.

*R. C. Geary is a Research Consultant and J. L. Pratschke is a Research Assistant of The Economic and Social Research Institute. The paper has been accepted for publication by the Institute. The authors are responsible for the contents of the paper including the views expressed therein.

CHART 1: IRISH PRICE INDEX NUMBERS ANNUAL, 1946-1965



Source: Table 1.

agricultural prices, and also to the price of services. The gain from the terms of trade is considered within the framework of deflated national accounts.

The large quantity of primary analysis which occupied us in the preparation of this paper involved a critical appraisal of some of the available index numbers; we do not, however, claim to be comprehensive in our treatment of them.

TABLE 1: ANNUAL PRICE INDEXES, 1946-1965

Base: 1953 as 100

Year	Consumer Prices	Wholesale Prices	Import Prices	Export Prices	National Accounts (implicit) Indexes		Agricultural Prices
					Expenditure	Fixed Capital	
1946 ...	72·9	66·0	68·8	63·5	(*a*)	(*a*)	62·0
1947 ...	77·0	73·4	81·6	67·2	78·4	82·9	71·2
1948 ...	79·4	77·6	82·6	78·6	80·5	89·6	78·5
1949 ...	79·6	77·2	79·0	80·1	79·9	88·8	78·8
1950 ...	80·8	81·6	86·3	85·6	81·7	89·8	82·3
1951 ...	87·2	94·5	105·4	97·1	88·3	94·1	90·5
1952 ...	94·8	99·8	106·6	99·3	95·5	100·3	93·6
1953 ...	99·8	100·0	100·0	100·0	100·0	100·0	100·0
1954 ...	101·1	98·6	100·7	98·4	100·6	98·8	98·7
1955 ...	102·7	101·6	104·1	101·4	103·2	101·4	103·1
1956 ...	107·1	103·1	106·1	95·9	106·2	107·3	93·5
1957 ...	111·5	109·9	111·9	97·6	110·6	112·0	99·8
1958 ...	116·5	113·5	107·0	101·1	114·8	113·6	102·5
1959 ...	116·5	113·5	104·7	104·0	115·1	113·6	102·4
1960 ...	117·0	112·9	106·6	102·2	115·7	115·8	99·6
1961 ...	120·2	114·7	107·7	101·0	118·4	119·8	100·0
1962 ...	125·3	118·3	107·6	101·9	122·9	123·9	101·7
1963 ...	128·4	119·8	109·4	103·9	125·7	126·3	102·2
1964 ...	137·0	126·8	110·4	109·8	133·5	134·2	113·1
1965 ...	143·9	131·6	112·9	110·9	139	140	117·7

(*a*) Not available.

Basic Sources: (i) *Economic Statistics,*
(ii) *Statistical Abstract* (SA),
(iii) *National Income and Expenditure* (NIE).

2. INTERNATIONAL ASPECTS

In 1965, compared with 1958, Ireland occupied about a middle position amongst European countries as regards the rise in consumer prices—see Table 2. In the period 1948-1958 and again in 1958-1963 the rise in Ireland was less than in the U.K.; and we shall hint at even larger issues. Since 1963 Irish prices have risen more steeply than British prices.

Our interest in Table 2 lies deeper than in its formal showing. We want to try to answer the following question: are Irish and British price movements in time alike? As a simple empirical tool we have devised what we term the *disparity index d* which is given by

$$d = \frac{100}{T} \sum_{t=1}^{T} \left| \frac{x_{1t}}{\bar{x}_1} - \frac{x_{2t}}{\bar{x}_2} \right|$$

where x_1 and x_2 are the indexes for any two countries in year t, $\bar{x}_1$ and $\bar{x}_2$ the means of the indexes over the whole period. The raw data in Table 2 cannot, in our view, validly be used for the construction of our index since, if a single year base other than 1953 were used, different results would be obtained. The formula used may be regarded as affording means over the whole period. The Ireland-U.K. value is 1.94. This value is compared with 10 others (with U.K. as reference in each case) in three periods on the last three lines of Table 2.

Over the whole period 1948-65 the U.K. disparity index is lowest for Ireland, Sweden and Norway. Of the 11 countries, price trends are closer to U.K. in the later period for 5 countries.

These results were sufficiently suggestive to make it seem worthwhile to compute the disparity indexes for groups of countries. The results are shown in Table 3.

TABLE 2: CONSUMER PRICE INDEXES IN SELECTED COUNTRIES
1948-1965

Base: 1958 as 100

Year	Canada	U.S.A.	Belgium	Denmark	France	Germany	Ireland	Italy	Netherlands	Norway	Sweden	U.K
1948	77	84	88	70	49	86	68	76	67	63	65	64
1949	80	83	86	71	57	91	69	77	71	63	66	66
1950	82	84	85	75	63	86	70	76	78	67	66	67
1951	90	90	92	83	75	92	75	83	85	77	77	74
1952	93	92	93	86	83	94	82	87	86	84	83	81
1953	92	93	93	86	82	92	86	88	86	86	84	83
1954	93	93	94	87	82	92	86	91	89	89	85	85
1955	93	93	93	92	83	94	88	93	91	89	87	89
1956	94	94	96	97	85	96	92	96	92	93	91	94
1957	97	97	99	100	87	98	96	97	98	95	95	97
1958	100	100	100	100	100	100	100	100	100	100	100	100
1959	101	101	101	102	106	101	100	100	102	102	101	101
1960	102	102	102	103	110	102	100	102	103	103	105	102
1961	103	104	103	107	114	105	103	104	105	105	107	105
1962	105	105	104	115	119	108	108	109	108	111	112	110
1963	106	106	106	122	125	111	110	117	113	114	115	112
1964	108	107	111	126	129	114	117	124	119	120	119	115
1965	111	109	115	134	132	118	123	130	126	125	125	121
U.K Disparity Index—												
1948–65	8·00	8·67	9·33	3·28	7·61	8·78	1·94	4·28	3·11	1·78	1·72	—
1948–57	7·90	8·70	9·20	2·70	6·90	9·00	2·10	4·00	3·50	2·20	1·70	—
1958–65	8·13	8·63	9·50	4·00	8·50	8·50	1·75	4·63	2·63	1·25	1·75	—

Basic Source : Yearbook of Labour Statistics, International Labour Office (ILO).

TABLE 3: CONSUMER PRICE DISPARITY INDEXES FOR GROUPS OF COUNTRIES

Group	Number	Disparity indexes		
		1948-57	1958-65	1948-65
Ireland—U.K.	2	2·10	1·75	1·94
U.S.A.—Canada	2	1·80	0·75	1·33
EEC	5	7·20	8·63	7·83
EFTA and Ireland	5	2·24	2·38	2·30
EFTA (less Denmark) and Ireland.	4	2·07	1·71	1·91
Benelux	2	6·10	7·38	6·67
Belgium—Germany	2	1·60	1·75	1·67

Note: Based on Table 2. When n countries are in a group

$$d = \frac{200}{Tn(n-1)} \sum_{i<j} \sum_{t=1}^{T} \left| \frac{x_{it}}{\bar{x}_i} - \frac{x_{jt}}{\bar{x}_j} \right|$$

where x_{it} is the index for the ith country in year t, and $\bar{x}_i$ its mean.

The disparities indicated by Table 3 in certain groups are as surprising as the concordances. Intimacy of trade relations may be the explanation of the low indexes for Ireland-U.K. and U.S.A.-Canada, but what of the marked disparity in EEC? As regards the latter, the index is higher after 1958 when the Treaty of Rome was operational. One interpretation of the EEC indexes is that formal economic integration (which should involve equality of prices of given goods throughout the community) is falling very far short of actual integration. Perhaps also Ireland's way of life will not be altered so drastically as we sometimes think, on our entering the Community. Imperfection of competition in EEC is still marked. The same consideration applies in Benelux, which is an older union than EEC. The price trends are far closer between Belgium and Germany than between Belgium and its Benelux partner, Netherlands.

Of course, another interpretation might be given to the phenomenon. If, in 1958, the absolute *level* of prices in the EEC countries was widely different and if, by 1965, the level was much more uniform throughout, the price *indexes* to base 1958 could be very different since the indexes for the 1958 low price countries would have increased more than for the 1958 high price countries: the disparity index between two such countries would be greater than it would have been were it not for the Treaty. These are but superficial comments on a very important subject; further comment would lead us away from our main topic.

The extent to which Canada and Ireland can influence the level and trend of their respective

internal prices is closely circumscribed, dominated, as they are, by external conditions. Nonetheless Ireland should have regard to this margin between its internal price trend and those of its principal trading partners, the U.K., of course, in particular. As shown in Table 2 the change-over from 2 points in our favour in each of the years 1960-63 to 2 points against us in 1964-65 is to be deplored, as increasing export costs, mainly through the influence of the consumer price index on the money wage rate.

It might be thought that the disparities shown in Tables 2 and 3 are partly due to statistical reasons. In our opinion this factor, undoubtedly present, has but a minor effect on the level of the respective index numbers.

These brief paragraphs purport merely to shed a little light on one aspect, albeit an important one, of the problem of Ireland's adaptation to EEC conditions, a general topic surely meriting full investigation, based on the experience of other countries now in the Community.

Our colleague, C. E. V. Leser, has helpfully suggested an alternative approach to the measurement of price index concordance in time between countries. Instead of our disparity index, Leser proposed that we should use the coefficient of correlation between pairs of countries applied to year to year changes in the indexes, either as index points or as percentages: using changes in index points, $r\ (i, j)$, the correlation coefficient between Δx_{it} and Δx_{jt} (where x_{it} is the index for country i in year t, $\Delta x_{it}=x_{it+1}-x_{it}$ would be the measure of disparity in price trends between countries i and j.

Generally the correlation approach yields results consistent with those of the disparity index over the whole period 1948-1965. As regards comparisons with U.K. (Table 2, third last line), of the 11 possible comparisons 9 yield almost the same picture (in particular as showing the indexes of Sweden, Ireland and Norway close to that of U.K.), France and Netherlands, with very low correlation coefficients, being the two exceptions. As regards other comparisons (Table 3, final column) the U.S.A. and Canada trends are seen to be extremely close with a correlation of ·92 (Ireland-U.K., ·76). This analysis reverses the rather surprising disparity index showing of closeness of price trends between Belgium and Germany: the correlation coefficient is only ·49, which is not exceptional.

Many other formulae for the disparity index are conceivable, but none could alter our essential point that the U.K. and Irish indexes are more alike in trend than is the case of most other pairs of countries in Table 2.

The concordance between Irish-U.K. consumer prices shown in Table 2 merits closer examination. In Chart 2 (Table A1) are displayed quarterly indexes for the two countries starting with August 1947. The correspondence is apparent, apart from a marked aberration in 1947-49. After 1949 there may be said to be three phases in the comparison:— (i) 1949-1954, similarity, (ii) 1955-1963, similarity but with U.K. figures more or less regularly higher than Irish figures, (iii) 1964-65, close similarity. With regard to phase (ii), it is evident that the two series would be brought much closer together by modernising the weighting diagram to, say, that of 1958, instead of the actual 1953. The steeper rise in Irish prices starting November 1963 is due partly to the Turnover Tax. At any rate the Tax and, no doubt, other causes have had the remarkable effect of rendering the indexes for the two countries almost identical (to base August 1953) during the period May 1964 to November 1965.

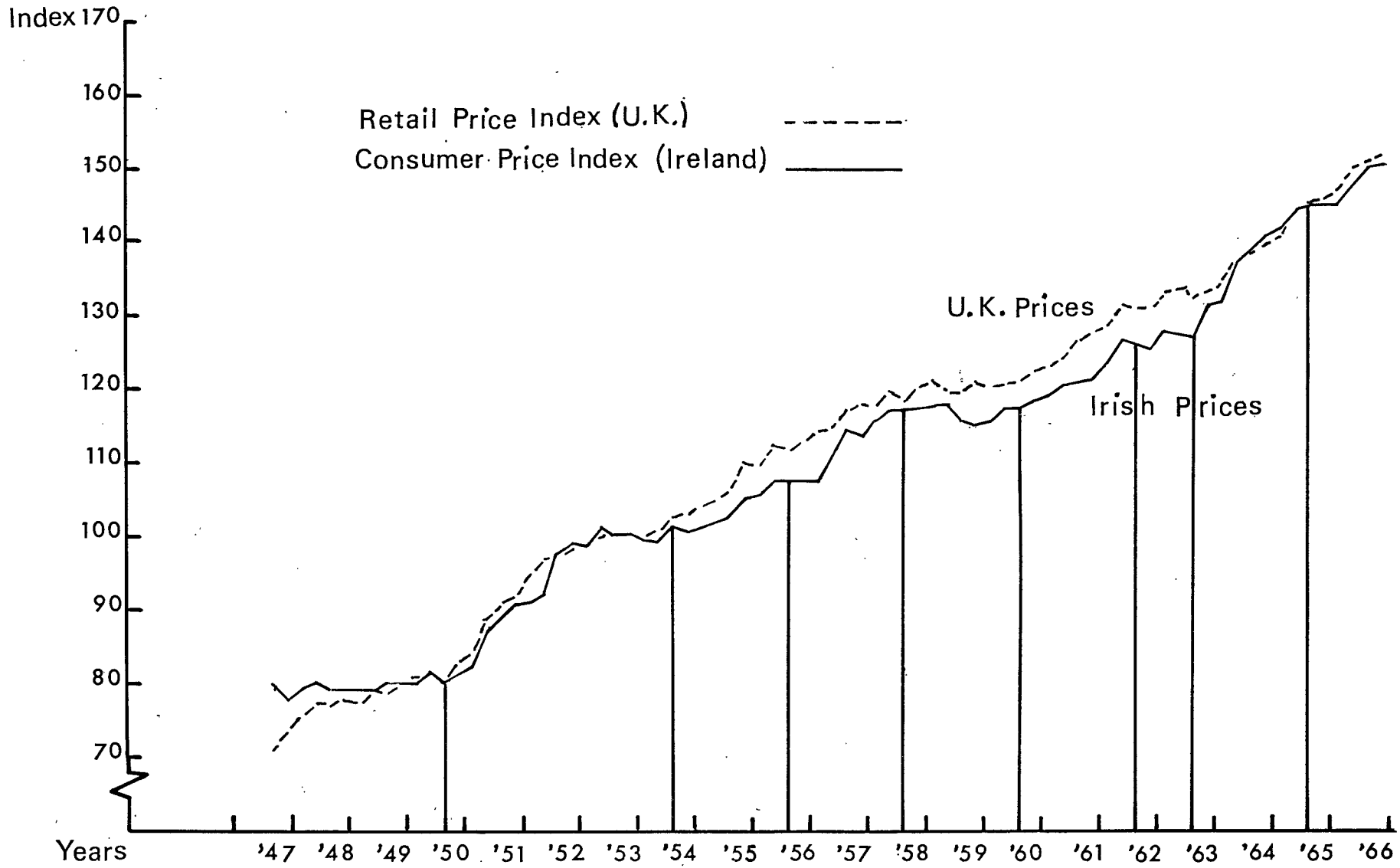
Neither index shows any real tendency to fall throughout the period. There are discernible, however, "level periods" of more or less stable prices as follows (by reference to Ireland):— (i) August 1947-August 1950, (ii) May 1953-November 1954, (iii) May 1956-February 1957, (iv) August 1958-August 1960, (v) May 1962-August 1963. Evidently another level was reached in May 1965. On these levels, prices, as it were, have a breather and then take off again, usually helped on their way by increased indirect taxation, as we shall see in the next section.

The similarities of the two graphs (for example, the near coincidence of the price pause periods) on Chart 2 lead us to conclude tentatively that there has been a marked concordance between the trends in Irish and British consumer prices generally since about 1950. This inference would be so important (answering, as it would, the question "Why are Irish prices rising?" by the affirmation "Mainly because British prices are rising") that we deem it prudent to submit the data to more intensive examination. It may be well to make the preliminary observation that the analysis has nothing to do with the comparative *level* of prices in the two countries *at any given time* (a problem studied by Edward Nevin[2]) but only with price *changes*.

From now on we deal with the common logarithms of the indexes, in the first instance because we want to derive average quarter to quarter price changes in the two countries. In effect, we fit exponential curves to the raw data of Chart 2. In Charts 3 (A and B) the deviations of the

[2]*The Irish Price Level: A Comparative Study*, ERI Paper No. 9, October 1962:— "For commodities which are produced in Ireland it appears to be true, more often than not, that the final price to the consumer is of the order of 8 per cent. higher than the price of the equivalent product to the British consumer. . . . producers' prices may be on average some 10 per cent above the United Kingdom equivalent".

CHART 2: PRICE INDEXES IN IRELAND AND U.K., QUARTERLY, 1947–1966, BASE 1953 AS 100



logarithms from their respective means are graphed, as well as the linear regression lines of these 74 quarterly observations on time. The dotted trend curves will be described later. The regressions are:—

$$\text{Ireland: } (P_c - \overline{P}) = \cdot 003654\ (t - \overline{t})$$

$$\text{U.K.: } (P_c - \overline{P}) = \cdot 003964\ (t - \overline{t}).$$

From the coefficients we deduce that the average quarterly percentage rate of increase in the consumer price index in the whole period 1947-1965 was 0·84 (=0·3654log$_e$10) in Ireland and 0·91 in U.K. While, therefore, the rates were much the same over the whole period, they differ widely in the earlier and the later parts of the period:—

Average Quarterly Percentage Rates of Increase in Consumer Price Index in Different Periods

Period	*Ireland*	*U.K.*
Earlier 37 quarters	1·15	1·42
Later ,, ,,	0·81	0·71
Whole period 74 ,,	0·84	0·91

In both countries there has been a decline in the rate of increase in the later half of the period, very marked in the case of the U.K. Our interest is, however, more in the qualitative nature of the changes in time in the two countries than in the magnitude of change. We effect the comparison, in the first instance, by studying the deviations, shown in Charts 3A and 3B, of the actual logarithms from their linear trend.

Except at the beginning and end of the period the correspondences are remarkable. In both countries the deviations lie below the linear trend until 1951, remain above it until 1959; from 1959 to 1964 they are below. The reason why the Irish actual curve crosses the linear trend at II 1964 is only partly due to the Turnover Tax. Even the shapes of the deviation curves, as well as their timing, are seen to be similar, in the three periods, (i) approximately 1949-1951, (ii) 1951-1959, (iii) 1959-1964; for example, one notes the double-humped character of the actual deviation graph in period (ii) and the double-hump in reverse in period (iii) with a minor peak in both countries coincident II in 1962. We, therefore, rely on purely visual appraisal for our inference, in preference to what might appear more sophisticated statistical procedures, because we are sceptical about any we know, as applied to our problem. For example, however, and for what interest it may have, we may state that the correlation between Irish and U.K. deviations from log linear trend is $r = \cdot 76$. This correlation, satisfactory in itself for our thesis, would be much higher were it not for the aberrations at the beginning and end of the period under investigation. The aberrations at the beginning are probably due to a downward bias in the U.K. index[3] but those at the end are due to some extent to the Irish Turnover Tax.

The percentages quoted above show that the linear trend over the whole period gives but a poor representation of the log data, though the linear term accounts for 96·9 per cent (=100 R^2) in the case of Ireland, and 96·4 per cent for the U.K., of the total variance. We therefore derived a trend curve for the 74 Irish log observations using the first five orthopolynomials,[4] in effect fitting a polynomial of the fifth degree in t to the log data by least squares. The resulting curve, shown as a dotted line on Chart 3A (Ireland), accounts for 98·8 per cent of the variance. To take up about the same percentage of the variance in the case of U.K. required only the three first orthopolynomials, in effect a polynomial to t^3: the actual percentage was 99·0. In both cases the curved trends are incomplete as representing the data and, for our purpose, namely that of comparing actual trends for the two countries with a view to assessing their similarity or otherwise, by the deviation from expected trend method of the text, probably the straight line is the more satisfactory.

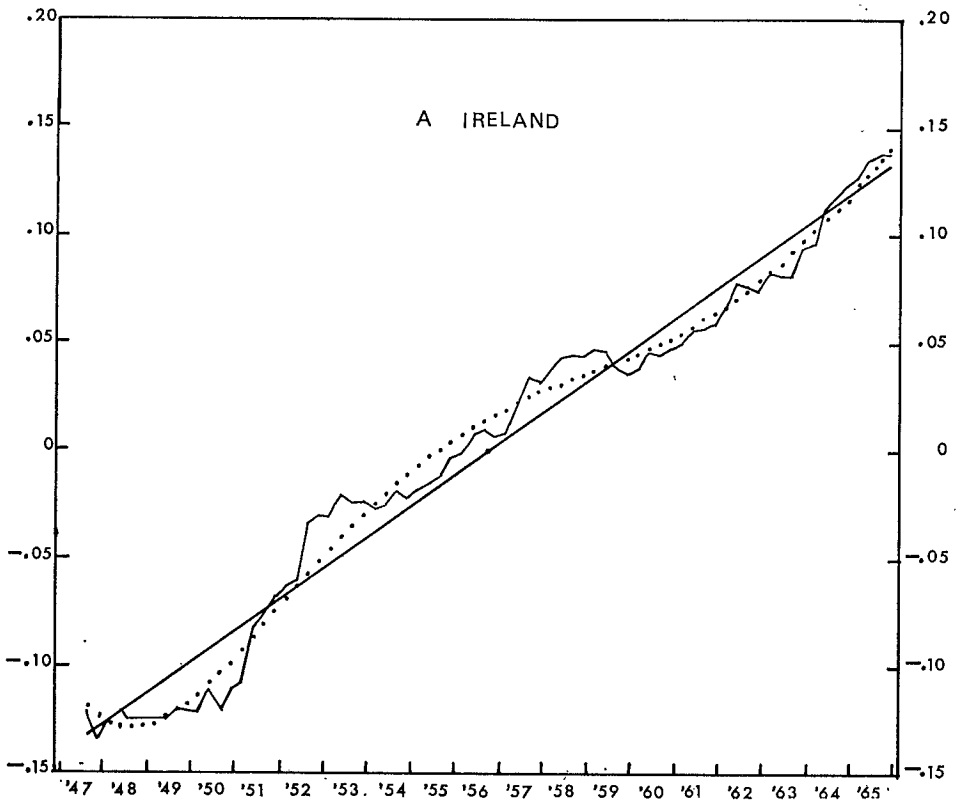
We invite the reader to study and compare the relations between the actual data and the *dotted* trend curve. The physiognomy of the deviations from the curves is still strikingly similar. If the timing of the crossings of data and curve is more awry than in the case of the linear trend, one suspects that if better trend curves were derivable, even the timing would be the same.

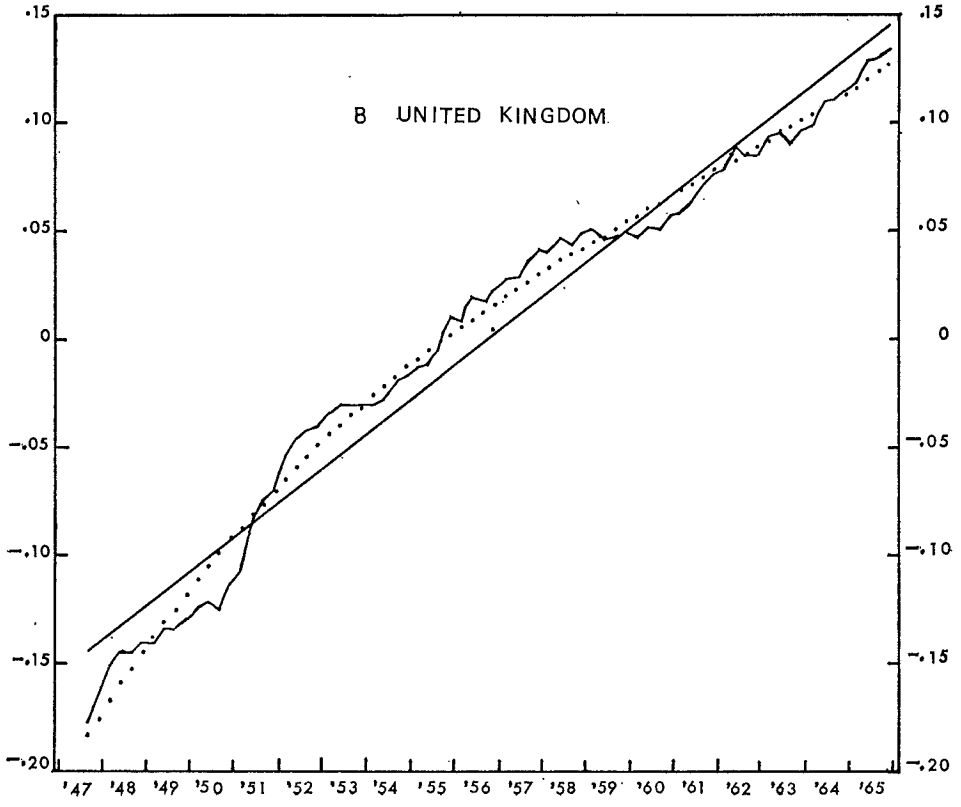
It should be emphasised that the curves (and *a fortiori* the linear trends) have no pretensions to the representation of the log index as a function of time to be used, for instance, for forecasting. Such representation would imply that actual observations $P = f(t) + u_t$ where $f(t)$ is of given functional form and the residual u_t is random and non-autoregressed; we would term such representation complete. It requires no von Neumann analysis to show that the dotted curves do *not* adequately represent the data. It would appear that harmonic terms applied to deviations from linear trend would have been more suitable for the derivation of $f(t)$: if in this case the u_t were random we would expect the coefficients of the Fourier terms to be much the same, similarly

[3]This is confirmed by a comparison between the National Accounts implicit price index for consumer's expenditure and the official index. The underestimation was probably due to the fact that the "weights" used were based on the pre-war pattern of consumption, and took no account of subsequent changes in spending habits. *See:*—Ministry of Labour and National Service (UK), *Interim Report of the Cost of Living Advisory Committee* (HMSO, August 1951), Cmd. 8328, s.4, but cf. Report on the *Working of the Interim Index of Retail Prices* (HMSO, March 1952), Cmd. 8481, s.3.

[4]*Source:* R. A. Fisher and F. Yates, *Statistical Tables*, Fifth edition, Oliver and Boyd, 1957.

CHART 3: QUARTERLY CONSUMER PRICE INDEX NUMBERS, 1947–1965,
LOG DEVIATIONS FROM MEAN, ACTUAL DATA, FITTED LINEAR AND ORTHOPOLYNOMIAL TRENDS





the periodicities, having regard to confidence limits of error. Such a research may appeal to a colleague, but is unnecessary, we think, for our present purpose. We have given all our evidence in support of the thesis that the trend in consumer prices generally in Ireland is considerably influenced by the trend in the United Kingdom, or that the trends are influenced by causes common to both countries.

To some people this conclusion may appear less than sensational, in view of the intimate economic and social relations between the two countries. External trade, mostly with Britain, is a large proportion of GNP and, in view of the considerable movement to and from jobs between the two countries, wage trends in Ireland must be influenced by those in Britain[5] and one surmises that the quasi-constant wage-profit ratio is not very different in the two countries. So price on the cost side, regarded as the unit cost of imports plus factor income, would be accounted for. As tending to influence price trends in the opposite sense, however, are the facts that Ireland is a high-tariff country and the structure of the economy is very different from that of Britain. These are only speculations, however. It must suffice for the present to have established with high probability the close similarity of trend in consumer prices in Ireland and the U.K., if without a clear enough understanding yet of how this comes about.

As the deviations from linear from II 1964 on show, on Chart 3A compared with Chart 3B, Ireland's index trend can differ from that of Britain, all too easily in the upward direction. One surmises that such differential increases in Irish consumer prices, because of their inevitable effect on wages and other costs, must be inimical to the competitiveness of our exports.

We would like to be able to establish a rigorous statistical test of the concordance between Irish and U.K. consumer prices, of the fact of which we are convinced from the showing of the chart and the simple disparity indexes; better we would like to know the mechanism of relationship. Clearly, as between a large and a small country, the U.K. must be the cause, or the leader, and Ireland the effect. The great difficulty in establishing econometric relationships involving time series current and lagged for both countries is that the cause-effect timelag is itself a random variable, so that the customary type of analysis involving lagged terms is likely to be far less decisive than we believe to be the case. However, we do not wish to discourage our Institute colleagues in their efforts to surmount this difficulty; quite on the contrary, in fact.

[5]There is conflict of evidence and opinion on this issue. O'Mahony: *Economic Aspects of Industrial Relations*, ERI Paper No. 24, February 1965:— "As Ireland and Britain form what is virtually a common market for labour owing to the unrestricted access enjoyed by Irish people to the British labour market it is to be expected that rates and earnings in the two countries should be closely related." But C. St. J. OHerlihy, *A Statistical Study of Wages, Prices and Employment in the Irish Manufacturing Sector*, ERI Paper No. 29, January 1966:— "The evidence regarding the determination of wages above suggests that it is dominated by domestic Irish factors rather than by any direct influence from the British labour market." Edward Nevin (*Wages in Ireland*, ERI Paper No. 12, February 1963) tends to agree with O'Mahony.

3. GROUP AND INDIVIDUAL PRICES

Table 4 displays the familiar official group indexes, together with indexes (which we have compiled from CSO records) for prices of services included in the consumer price index computation as well as two significant constituents of these, namely prices of amusements and travel.

The table displays only the direct effect of taxation on the general level of prices. Regard should also be had to indirect effects: the level of prices affects wages (and, through the operation of the quasi-constant wage/profit ratio, profits) thus increasing costs and therefore prices. Even if we cannot measure indirect effects there can be no doubt that their effect is substantial.

We have constructed indexes, as shown in Table 5, of the taxation content for the two groups most concerned. Our method of construction is described in the Notes.

Despite the considerable increase in rates of indirect taxation the steadiness of the Engel ratios for the commodities most concerned is remarkable. Rent of course includes rates on dwellings. The small increase in proportionate expenditure on drink and tobacco in the last four years may be due to the increased tourist traffic. Certainly, however, the Irish tax authorities have been percipient in their appraisal of "what the traffic would bear".

For the purposes of this study we prepared from CSO files a table of price indexes for each of the 197 items of commodities and services entering into the computation of the official consumer index, to base mid-August 1953 and showing the indexes for each mid-August 1954-1965. We also prepared a series for 1965 to base 1963. The table also displays the 1953 basic expenditure weights. Unfortunately the table is too large to reproduce here but we shall be very glad to make our manuscript available in ESRI to students.

From this table sectional indexes can readily be constructed using a desk machine for any group of commodities (for example, for the items of children's clothing); this was how we obtained the three non-

TABLE 4: COMMODITY GROUP CONSUMER PRICE INDEX NUMBERS. MID-AUGUST 1953 TO 1965

Base: August 1953 as 100

Commodity Group	1953 expenditure	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
	%												
Food	40·8	102·3	104·0	104·6	114·7	119·2	115·7	116·6	120·3	123·1	123·2	134·7	140·2
Clothing and Footwear	12·7	100·1	100·2	101·8	102·8	103·3	104·2	105·7	106·9	109·9	111·7	119·1	121·8
Fuel and Light	7·0	99·8	104·2	116·6	121·1	119·7	111·2	108·9	114·9	120·1	124·0	132·4	132·3
Housing	6·2	102·5	105·8	110·9	115·2	117·5	119·8	123·5	127·6	133·1	139·0	147·2	156·4
Sundries—	33·3	99·9	101·2	111·5	116·1	118·4	119·9	122·8	125·7	135·1	136·8	151·1	159·5
Drink and Tobacco	13·2	100·0	100·1	112·7	119·2	121·9	123·1	127·4	130·9	144·9	145·2	161·5	174·2
Consumer Durables	2·5	99·1	99·6	105·3	107·4	109·2	110·5	111·0	112·0	114·3	115·1	121·8	124·4
Other Goods and Services	17·6	100·8	102·6	109·1	115·6	117·7	119·4	121·7	124·7	132·0	134·9	149·5	155·7
Services	10·5	101·1	103·7	111·0	111·0	116·7	118·6	122·1	124·1	132·9	136·9	152·6	158·6
Amusements	2·6	104·1	105·8	110·5	112·6	115·0	115·3	116·9	118·3	130·0	137·1	151·2	157·0
Travel	4·4	99·7	100·2	113·1	119·1	121·4	122·1	126·2	126·2	134·1	133·9	145·8	148·9
Total All Items—													
inc. Drink and Tobacco	100	101·1	102·7	107·8	114·1	116·9	115·6	117·2	120·5	125·9	127·3	138·8	144·8
excl. Drink and Tobacco	86·8	101·2	103·1	107·0	113·4	116·1	114·4	115·6	118·9	123·0	124·6	135·3	140·3

Basic Sources: Irish Trade Journal and Statistical Bulletin (*ITJ&SB*), later *Irish Statistical Bulletin* (*ISB*).

official indexes in Table 4. Table 4 is as far as we consider it necessary to go in the preparation of sub-indexes, which we may perhaps describe as "functional". We could, of course, have contemplated the construction of demand and supply relationships based, as regards final prices, on our data on sub-indexes and important individual commodities, analogous to the work of C. E. V. Leser on cross-section data[6]; when these tasks are undertaken our manuscript table will be useful. For our present purpose it suffices to note that the prices of individual commodities (even of those whose prices contain a large element of taxation) are those which buyers are prepared to pay and sellers to accept. The very wide range of price trend variation which we shall presently describe may be regarded therefore as a social phenomenon. For example, we have nothing to add to the obvious explanation of the very large increases in prices of education and private domestic service but that education is probably largely a phenomenon of increased demand, and domestic service of reduced supply. Of course, many studies on these and other prices, by way of explanation, are conceivable.

We have little to say, therefore, on individual prices but we propose to deal instead with the patterns of price changes in the "population" of 197 items. In what follows we regard the 197 indexes as frequency distributions and analyse them as such.

Four distributions are shown in Table 6 and the computed constants of each in Table 7.

Subtables A and C of Table 6 show at a glance the very considerable range of price changes in both intervals 1953-1965 and 1963-1965. The most remarkable showing of Table 7 is the manner in which the skewness of the distribution (measured by $\sqrt{b_1}=m_3/m_2^{3/2}$) is transformed from the highly significant 1·09 and 0·77 for the raw indexes to 0·38 and 0·06 for the logarithmic distributions: actually for 1953-65 the logarithmic $\sqrt{b_1}$ is significant[7] of normal theory skewness at the ·05

[6]C. E. V. Leser, *Demand Relationships for Ireland*, ERI Paper No. 4, April 1962; and *A Further Analysis of Irish Household Budget Data*, ERI Paper No. 23, August 1964.

[7]For normal theory significant levels for $\sqrt{b_1}$ and a see: R. C. Geary and E. S. Pearson, "Tests of Normality" (*Biometrika* Office, University College, London, 1938).

TABLE 5: INDEXES OF CERTAIN ITEMS OF INDIRECT TAXATION

Year	Rates	Drink, tobacco, petrol	Consumer prices (*excl.* housing, drink, tobacco), Mid-August	As % of personal expenditure	
				Rent	Drink, tobacco
	1	2	3	4	5
1953	100	100	100	5·1	15·7
1954	108·5	99·2	101·1	5·3	15·2
1955	114·7	99·2	102·9	5·2	14·9
1956	118·2	114·6	106·7	5·5	15·2
1957	129·3	121·3	113·3	5·9	15·7
1958	128·8	121·6	116·0	5·7	15·3
1959	130·7	121·6	114·0	5·8	15·4
1960	134·9	129·1	115·0	5·6	15·3
1961	138·6	131·7	118·2	5·7	15·2
1962	143·2	142·9	122·2	5·6	16·2
1963	153·5	142·9	123·5	5·7	16·5
1964	161·8	155·2	134·4	5·6	16·2
1965	178·6	172·2	139·1	(*a*)	(*a*)

(*a*) Not available.

Notes:

Col. 1: *Basic Source: Returns of Local Taxation* (RLT); the index is a Laspeyres-type price index using 1953 valuations as quantum-weights.

Col. 2: *Basic Source:* Revenue Commissioners' *Reports;* the index is a Laspeyres-type price index using 1953 quantity weights. A separate index using 1958 weights was also constructed, but showed no significant divergence from the 1953-weighted index.

Col. 3: *Basic Source: ITJ & SB*, now *ISB*, and CSO files.

Cols. 4-5: *Basic Source: NIE:* raw percentages for 1953-1957 slightly adjusted because of official revisions.

TABLE 6: FREQUENCY DISTRIBUTIONS OF PRICE INDEXES AND LOG PRICE INDEXES OF THE 197 ITEMS INCLUDED IN THE OFFICIAL CONSUMER PRICE INDEX COMPUTATION

1953-1965 (1953 as 100)

A. Index			B. Log Index		
Index	Frequency	Relative Frequency	Log Index	Frequency	Relative Frequency
80—	3	0·0152	1·90—	2	0·0102
90—	2	0·0102	1·94—	2	0·0102
100—	24	0·1218	1·98—	8	0·0406
110—	50	0·2538	2·02—	41	0·2081
120—	48	0·2437	2·06—	53	0·2690
130—	21	0·1066	2·10—	42	0·2132
140—	21	0·1066	2·14—	22	0·1117
150—	7	0·0355	2·18—	8	0·0406
160—	5	0·0254	2·22—	12	0·0609
170—	8	0·0406	2·26—	6	0·0305
180—	4	0·0203	2·30—	1	0·0051
190—	3	0·0152			
200—	1	0·0051			
TOTALS	197	1·000	TOTALS	197	1·000

1963-1965 (1963 as 100)

C. Index			D. Log Index		
Index	Frequency	Relative Frequency	Log Index	Frequency	Relative Frequency
70—	1	0·0051	1·86—	1	0·0051
75—	0	0	1·88—	0	0
80—	0	0	1·90—	0	0
85—	0	0	1·92—	0	0
90—	0	0	1·94—	0	0
95—	2	0·0102	1·96—	0	0
100—	31	0·1574	1·98—	2	0·0102
105—	88	0·4467	2·00—	24	0·1218
110—	48	0·2437	2·02—	87	0·4416
115—	12	0·0609	2·04—	53	0·2690
120—	9	0·0457	2·06—	16	0·0812
125—	3	0·0152	2·08—	8	0·0406
130—	2	0·0102	2·10—	3	0·0152
135—	0	0	2·12—	2	0·0102
140—	0	0	2·14—	0	0
145—	1	0·0051	2·16—	1	0·0051
TOTALS	197	1·000	TOTALS	197	1·000

Basic Source: CSO files.

TABLE 7: FREQUENCY CONSTANTS FOR DISTRIBUTIONS OF PRICE INDEXES AND LOG PRICE INDEXES OF THE 197 ITEMS INCLUDED IN THE OFFICIAL CONSUMER PRICE INDEX COMPUTATION

Constants	1953-1965 (1953 as 100)		1963-1965 (1963 as 100)	
	Index	Log-Index	Index	Log-Index
m_1	129·11	2·11	109·71	2·04
$\sqrt{m_2}=s$	22·32	0·072	7·03	0·028
m_3	12·138	$0{\cdot}0^3138$	267·59	$0{\cdot}0^5133$
$\sqrt{b_1}=m_3/m_2^{3/2}$	1·09	0·38	0·77	0·06
d	17·08	0·056	4·87	0·019
$a=d/s$	0·77	0·78	0·69	0·69

Basic Source: CSO files.

Note: $m_i=i^{th}$ moment from mean; d=mean definition.

probability level, but, in view of the long interval, this is not surprising. The raw data figures are overwhelmingly significant. It is also interesting to note that the a is changed very little in the transition from raw to log.

Perhaps greatest interest attaches to the log distribution in the more recent period 1963-1965. The 0·69 value of a is highly significant of non-normality (·01 probability point 0·76 for 197 observations) indicative of a high proportion of prices which have not changed much about the general mean.

Comparison of subtables A and C raises the question as to whether the variability in price changes is increasing or decreasing. Of course the standard deviation (s—see Table 7) is greater for the longer period—22·3 compared with 7·0. The respective intervals are 12 years and 2 years. If all individual price indexes advanced linearly and if, in the last two years the increase was linear (and not percentage-wise as in the last column) one would expect the SDs to be in the ratio of 12:2=6:1. Since all the 1963 indexes exceed unity the percentage increases are less than the linear increases. Hence the expected SD on this "idealised" hypothesis for 1963-1965 would be less than $\frac{1}{6}$ of the 1953-1965 SD, namely 3·7 (=22·3/6) compared with the actual 7·0. We conclude that the diversity of the changes in the prices of individual consumer goods has been increasing markedly in the last two years.

Table 6D shows that 71 per cent of the log indexes lay in the range $\pm$·02 of their mean 2·04. If the log distribution in 1963-1965 were normal only 52 per cent would be found in this range. Actually the 0·69 value for a is very like that which would be found for the exponential distribution $e^{-|x|}/2$ for which $a=1/\sqrt{2}=0{\cdot}71$ but even if this symmetrical distribution obtained the proportionate frequency in the range $\pm$·02 would be only 64 per cent. This analysis reveals a marked tendency for individual price indexes to concentrate around the mean increase for the period 1963-1965.

Price Leaders

In the general upsurge of consumer prices we have noted (from Chart 2) the appearance of price "levels" of three or more consecutive quarters where the index paused before the next upward flight. Recalling that individual price indexes have been computed only for the month of August we have identified four inter-pause intervals during the period 1953-1965, each, as it happens, of two years' duration:— (i) 1954-1956, (ii) 1956-1958, (iii) 1960-1962, (iv) 1963-1965.

TABLE 8: NUMBER OF ITEMS INCREASING MOST IN PRICE IN FOUR PERIODS AND THEIR INTERPERIOD CONCORDANCE

Period	Increase more than	Number of items	Items in common	t	Probability appraisal
	All items (N=197)				
	%				
(1) 1954-56	5	63	} 25	2·98	highly significant
(2) 1956-58	5	50			
			} 27	3·08	,,
(3) 1960-62	5	69			
			} 44	4·81	,,
(4) 1963-65	10	79			
	Food items (N=60)				
(1) 1954-56	5	19	} 10	0·88	not significant
(2) 1956-58	5	25			
			} 13	2·56	significant
(3) 1960-62	5	19			
			} 8	0·31	not significant
(4) 1963-65	10	22			

We now tackle the following problem:— during the successive intervals have there been persistent price leaders? Our method is to identify the items which increased more than an arbitrary 5 per cent in the first interval 1954-1956 and to repeat the process in the next interval 1956-1958. The total number of items being 197 throughout, items increasing most in price numbered 63 and 50, respectively. It was found that these two sets of items had 25 items in common. Is this number 25 significantly high or low?

Suppose that in a population of N (=197 in our case), n_1 items are marked. In a random drawing of n_2 items k are found to be marked. We find:

$$E(k)=n_1n_2/N$$
$$Var(k)=n_1n_2(N-n_1)(N-n_2)/N^2(N-1).$$

We notice that the formulae are symmetrical in n_1 and n_2. For the first two intervals N, n_1 and n_2 are respectively 197, 63 and 50, so that, applying the formulae, E (k)=15·99 and Var (k)=8·16, hence SD=2·86. Actual k=25 which, on correction for discontinuity=24½. Then:

$$t=(24·5-15·99)/2·86=2·98.$$

The 2·98 is highly significant (normal probability on random hypothesis=·0029) so we concluded that there is a strong tendency for rising prices item-wise to persist, between the first two intervals. Incidentally if actual k were significantly less than its mean value 15·99, we might interpret this as a tendency for laggard prices to catch up on prices which had advanced earlier. Nothing like this happened during 1956-1958. Table 8 shows the value of t for all three consecutive comparison periods for all items and for the 60 food items.

While in all six comparisons shown in Table 8 the actual number of items in common exceeds the expected, clearly the situation is completely different as between food and other prices. Something like random or accidental association obtains in the case of food items, whereas with other prices there is a persistent tendency for the same items of largest price rises to appear in consecutive periods. The most persistent are the 6 drink and tobacco items of which 4 items in common occur between periods (1) and (2) and all 6 between (2) and (3) and (3) and (4).

The items which rose significantly in price in all four periods and their increases during the period 1953-1965 (mid-August) are as follows:—

	Price increase 1953-1965 %
Jam, mixed	52·5
Marmalade	32·5
Beer and ale	73·0
Whiskey, Irish	58·5
Cigarettes	84·8
Tobacco	75·3
Men's haircuts	77·2
Education	108·8
Domestic service	91·7
Housing	56·4

These are the items of most *persistent* (as defined) increase, not necessarily coinciding with those which rose *most* in price. Of the 10 items, 2 are, curiously, foods, one of which, marmalade, has had a modest aggregate rise in price; 5 are taxation items and the remaining 3 are services. The items which increased most in price in the two periods 1953-1965 and 1963-1965 are :—

Largest Price Increases

1953-1965	%	1963-1965	%
Education	+108·8	Potatoes	+47·1
Flour, household	+ 95·1	Beef	+34·8
Domestic Service	+ 91·7	Soap, toilet	+34·3
Bread	+ 91·4	Education	+26·0
Apples, cooking	+ 88·6	Stout (bottled)	+23·1
Papers and Magazines	+ 87·7	Domestic Service	+22·7
Cigarettes	+ 84·8	Fresh herring	+22·4
Potatoes	+ 81·4	Stout (draught)	+22·4
Men's haircuts	+ 77·2	Papers and Magazines	+21·5
Soap, toilet	+ 76·5	Mutton	+21·4
Tobacco	+ 75·3	Cigarettes	+21·1
Carrots	+ 73·6		
Beer and Ale	+ 73·0		

The large and important increases shown for bread and flour in 1953-1965 are, of course, mainly due to the removal of the subsidy on flour early in the period.

By 1965 clothing and fuel and light prices had increased very much less than prices generally. Clearly taxation is overwhelmingly responsible for the increases shown for drink, tobacco and housing. Throughout the whole period 1953-65 the food price index has been very similar to that of all

prices, excluding drink and tobacco, though the weighting of food is less than 50 per cent—see first column of Table 4. As various aspects of prices of services are fairly closely examined later, we note here, from Table 4, simply that prices of service items included in the official computation of the consumer price index (see Table 4) have risen more than prices generally.

4. INDUSTRIAL AND AGRICULTURAL PRICES

A considerable amount of official information is available with regard to value and volume of gross output of Irish industries. We are thus enabled to derive the implicit price index numbers (as P=V/Q) for many industries for several years past. We give the value, volume and derived price data for transportable goods industries for the years 1953-1964 in index number form, as an appendix (Table A5). The table is elaborate but we consider that it may well be useful for further research in connection with the derivation of supply equations for industry, for example. As will appear, in the time available to us for a broad survey of prices, we have been able to exploit only a few aspects analytically. In fact, the table itself may well be our most useful contribution to this section of the paper.

Transportable Goods Industries

In the first instance we examine the relationship between price and volume. Is increased price a stimulus to increased volume, with enhancement of profit (the supply aspect), or is there an inverse relation between the two factors, which would tend to be the case on the demand hypothesis? Of course, we need not postulate any economic law in the inverse relationship case, but the human one that a desired level of profit is conceivable on high prices and low output (with saving of effort and capital), or vice versa.

We give our data in Table 9. As will be seen, we confine our analysis to the single span of years 1955-1963, 1955 because it was the year in which a recession of the economy set in, after a long period of post-war growth, and 1963 as the last year for which *all* the industry data was available when we made our analysis.

As regards price indexes P, of the 42 shown no fewer than 35 (or a proportion of 35/42=·83) lie within the range $m \pm s$ (actually 116·3±15·4= 100·9 to 131·7). On the normal hypothesis the proportion would be only 68 per cent. The finding is therefore similar to that for consumer prices: were it not for a few industries the price increase in the period 1957-1963 would be appreciably lower.

We find $r_{PQ}=-·40$ which, with 42 pairs of observations, is significant at the ·01 probability level. The inverse relationship between price and quantum tends to be true, in a fairly pronounced way, in Ireland in recent years. We must be cautious about our test of significance, however, having regard to the manner in which our data are derived: V, value, being given, P, price, is derived as P=

TABLE 9: PRICE (P) AND VOLUME (Q) INDEXES FOR IRISH TRANSPORTABLE GOODS INDUSTRIES 1963 TO BASE 1955 AS 100, AND PERCENTAGE OF GROSS OUTPUT EXPORTED (E) IN 1963 FOR MANUFACTURING INDUSTRIES

Industry Number	P	Q	E
1	2	3	4
1·1 ...	113·5	114·4	
1·2 ...	107·3	188·8	(a)
1·4 ...	115·1	157·0	
2·1·1 ...	106·8	139·6	41
2·1·2 ...	115·4	249·5	92
2·1·4 ...	101·1	107·1	1
2·1·8 ...	130·9	146·5	11
2·1·9 ...	101·8	155·2	48
2·1·10 ...	111·4	128·7	0
2·1·11 ...	105·4	168·4	67
2·2·1 ...	105·2	141·3	14
2·2·2 ...	126·4	107·1	38
2·2·3 ...	114·9	110·3	3
2·2·4 ...	125·2	114·3	1
2·3 ...	164·6	88·6	0
3·1 ...	98·2	115·0	16
4·1 ...	115·4	188·2	13
4·2 ...	104·1	182·8	12
4·3 ...	113·0	199·0	4
4·4 ...	101·3	145·7	17
5·1 ...	137·1	93·9	6
5·2 ...	127·3	150·9	31
5·3 ...	104·2	174·7	25
5·4 ...	114·1	137·5	4
5·5 ...	110·3	162·2	17
6·1 ...	111·7	141·6	66
6·2 ...	111·2	220·6	26
6·3 ...	101·0	144·3	21
7 ...	105·2	144·7	17
8 ...	123·3	137·1	14
9·1 ...	113·4	118·1	0
9·2 ...	115·5	205·1	14
9·3 ...	109·4	143·7	4
9·4 ...	104·0	221·6	0
10·1 ...	134·1	153·4	20
11 ...	118·2	174·9	16
12·1 ...	132·6	121·2	0
12·2 ...	154·7	117·7	5
12·3 ...	104·1	308·7	24
12·5 ...	157·1	59·7	0
2·1·6/7 ...	110·6	141·3	18
3·2/3 ...	109·5	134·0	3

(a) Not available.

Note: Table A5 is basic source of Cols. 2 and 3, which also gives rubrics (Col. 1). It is to be noted that the figures presented in Table 9 differ slightly from those in Table A5. The latter includes adjustments made subsequent to the first draft of this paper, and may be taken as representing July 1967 estimates. *Source* Col. 4: *Report on the Economic Situation 1965*, National Industrial and Economic Council (NIEC), Report No. 11, Table 13.

V/Q which we then correlate with Q. Now if V and Q were two sets of positive quantities absolutely random to one another, a negative correlation, devoid of meaning, would be found between Q and V/Q.[8] This is not so with our data, since V and Q, value and quantity, are closely related. Also, the official Irish volume data are calculated by first computing price on a year to year basis, using the Fisher Ideal formula, and dividing the value index by the price index so derived. Conceptually this gives identically the same result as if year to year volume were computed directly, also using the Ideal formula; the price approach is used because of the statistical difficulty of dealing with the products for which quantities are not available. In sum, we do not think that our result is seriously affected by this statistical mirage, and we regard the result as significant. We would have wished to carry out the same analysis on a year to year basis using the data in the appendix table, thus increasing our number of pairs of observations from our 42 to 462 (=11x42), thereby greatly improving the test of significance of any correlation as well, perhaps, as showing a trend in time in the correlation, which, in general, reveals a somewhat undesirable state of affairs. The state of demand can scarcely be the causal factor for the inverse relationship, since, with the possibility of export, demand is quasi-infinite for Irish products efficiently produced and marketed. Our finding of this inverse relationship between price and quantum for industry is therefore similar to that suggested for agriculture on time series analysis.[9] As one possible reason it is suggested that what it may show is simply the contraction of output as costs, and, therefore, prices rise, and the good becomes less competitive with imports, and conversely.

As regards exports our analysis was necessarily confined to the 39 manufacturing industries—see Table 9. We would expect exporting industries (i.e. industries which export an appreciable proportion of their gross output) to have increased less in price and to have increased more in volume of output. This actually is what we find:—

$$r_{PQ} = -\cdot 40;\ r_{PE} = -\cdot 25;\ r_{QE} = \cdot 38.$$

The first and third are statistically significant near (but less than) the ·01 probability level (with 37DF), while r_{PE} can claim formally only something like ·1 probability for significance. As far as this analysis goes (and it certainly does not go far enough on these issues of fundamental importance) it would appear that the inverse relationship between price of gross output of manufacturing industry and percentage exported is less emphatic than one might have anticipated.

The partial correlation coefficients are as follows:

$$r_{PQ.E} = -\cdot 34;\ r_{PE.Q} = -\cdot 12;\ r_{QE.P} = \cdot 32.$$

All the partial coefficients are appreciably less emphatic than the corresponding simple coefficients, which showed fairly marked interaction between the three phenomena measured. The first and third are still significant (36DF) at the ·05 probability level, meaning that, as regards $r_{PQ.E}$, when the export percentage is fixed there is still a significant inverse relation between prices and quantum output. As to $r_{PE.Q}$, the inverse relation between price increase and percentage exported is small, if it exists at all.

We do not see much point, at this stage, in trying to establish a regression equation purporting to explain the trend in industrial prices. For this, industrial price indexes for the U.K., as an additional column in Table 1, would be required, since it is possible that price trends in the U.K. are the main determinants of those in Ireland. We recommend this analysis to other researchers as part of the year to year approach referred to above.

An Aspect of Agricultural Prices

We propose to investigate one aspect only: the trend in the terms of trade of the agricultural industry in recent years.

At first sight this trend appears to be unfavourable. Farmers sell agricultural produce and purchase: (i) materials (feedingstuffs etc.), (ii) household goods, (iii) the services of paid agricultural workers and (iv) local government services (rates). In 1965 (to base 1953 as 100) their selling price index was 118 and, as regards purchases, (i) the (general) consumers' price index was 144, (ii) the minimum agricultural wage index was 197 and (as indicated in section 3), (iii) the rates index was 179, mitigated by (iv) the index for feedingstuffs, fertiliser (subsidised), seeds of 93. A weighted price index for expenses (excluding the proportionately heavy household outgoings) would appear to be substantially above the selling price index of 118 in 1965. Our task will be to refine and extend these price index numbers for their proper application to farming and to provide terms of trade indexes for the years 1953-1965.

In its customary sense terms of trade relate to the country as a whole—the terms of trade index is the ratio (x 100) of the export price index to the import price index. Our "country" here becomes

[8] R. C. Geary and T. P. Linehan: "Paradoxes in Statistical Classification", *Studi in onore di Corrado Gini*, Vol. I, Universita degli Studi di Roma, 1960.

[9] R. C. Geary: "Variability in Agricultural Statistics on Small and Medium-sized Farms in an Irish County", *Journal of the Statistical and Social Inquiry Society of Ireland*, 1956-57. See also: R. C. Geary, "Irish Economic Development Since the Treaty", *Studies*, December 1951, p. 410.

all the farms in the country, trading, as an unit, with the "rest of the world" (comprising the rest of Ireland and abroad). Intra-transactions of farmers are ignored. We have decided that paid agricultural workers should be regarded as outside the agricultural boundary, principally because their wages rate seems to be determined by the scarcity of such labour and the climate of opinion affecting wages generally, trade union pressure and the like. We confine our analysis to cash transactions, ignoring the large subsistence element in Irish agriculture. We also ignore the considerable income of agriculturists from non-agricultural activities (road work, income, especially in the West, of farm dwellers who work in towns) and unearned income (income-type grants, emigrants' remittances, etc.). Finally, saving, principally in the form of increase in livestock, is left out of account.

With these qualifications the terms of trade index is interpreted in quantum terms as follows: in the base year (in our case 1953) 100 standard units of agricultural produce were exchanged for 100 units of household and other products. If, in 1965, the terms of trade fell to 80, 125 ($=100^2/80$) identical units of agricultural produce would have to be exchanged for the 100 units "imported" in 1953.

We display our results in Table 10. The price index for farmers' sales is quite straightforward: it is the official agricultural price index. Purchases were considered in 9 categories for weighting purposes, the principal items being: (i) household cash expenses, (ii) feed, fertiliser and seed, (iii) agricultural wages. The basic data for the calculations are given in Appendix Table A3 and A4. As to method, attention is directed to the notes to these tables. Here it is necessary to emphasize the following points:—

(i) A consumer price index had to be constructed for farm households, in default of an official index, for which there is a real need. This was done by eliminating potatoes, milk, eggs, and half the expenditure weight for butter and rent from the official computation.

(ii) Amounts of rates and annuities actually paid were regarded as proportionately their own price index numbers.

(iii) Wage rates were the usual official average minimum agricultural rates per week.

(iv) Rather arbitrary price indexes were used for items of less importance. We are fortunate in having an official index for by far the largest expense item, feed, fertiliser and seed.

(v) The purchase price indexes were calculated on a year to year basis using the Fisher Ideal formula. This greatly increased the volume of computations as compared with using a base-weighted Laspeyres but it was felt that the latter might be unreliable in view of the fairly appreciable change in quantum weights over the 12 years.

(vi) Household cash expenditure, as a weight, was found as a residual. No allowance was, therefore, made for cash saving as a specific item. Our treatment merely involves the assumption that the price index applicable to saving is the (agricultural) consumer price index, a reasonable assumption.

Column 4 shows that, on the 1953 parity which may be seen to apply also in 1954-1955, the terms of trade index fell to about 90 in the subsequent years of the table 1956-1965. This phenomenon was due

TABLE 10: PRICE INDEXES FOR FARMERS' CASH SALES, PURCHASES, TERMS OF TRADE, AND GAINS OR LOSSES FROM TERMS OF TRADE, 1953–1965

Year	Year 1953 as 100			Previous year as 100			
	Sales	Purchases	Terms of Trade	Sales	Purchases	Terms of Trade	Gain (+) or Loss (−) from Terms of Trade
1	2	3	4	5	6	7	£ m
1953	100	100	100	—	—	—	—
1954	98·7	99·6	99·1	98·7	99·6	99·1	−1·3
1955	103·1	101·3	101·8	104·5	101·7	102·8	+3·9
1956	93·5	106·8	87·5	90·7	105·4	86·1	−22·2
1957	99·8	111·0	89·9	106·7	104·0	102·6	+4·0
1958	102·5	112·1	91·4	102·7	101·0	101·7	+2·4
1959	102·4	111·7	91·7	99·9	99·7	100·2	+0·3
1960	99·6	111·8	89·1	97·3	100·1	97·2	−4·8
1961	100·0	113·2	88·3	100·4	101·3	99·1	−1·6
1962	101·7	116·4	87·4	101·7	102·8	98·9	−1·8
1963	102·2	118·0	86·6	100·5	101·3	99·2	−1·5
1964	113·1	126·1	89·7	110·7	106·9	103·6	+6·5
1965	117·7	131·7	89·4	104·1	104·5	99·6	−0·8

to the catastrophic fall, price-wise, in the sales index in 1956 which was accompanied by a considerable increase in the price of purchases. Incidentally, the rise in net output volume, which might have compensated for the fall in price, was imperceptible between 1955 and 1956.

The column 7 figures are far more eloquent and generally useful for our purpose than those of column 4. Here the point of reference is always the previous year; each consecutive pair of years are completely isolated, and the figure shown no longer depends on the norm of 1953. The figures are surely surprising in the aggregate; as may be inferred from our remarks at the outset, they certainly surprised us, influenced as we were by the unfavourable comparison of the trends of prices of farm produce and consumer prices. These, it is true, are the two largest weighted items in the farms' accounts but, in our thinking, we did not allow sufficiently for the effect on the calculation of low prices of fertiliser (subsidised), feed, and seed, collectively the third most important item. Except for the bad showing of 1955-1956 farmers were on average scarcely at a disadvantage at all, price-wise, during the period 1953-1965. Even when the 1955-1956 figure is included the average annual terms of trade index over the whole period was 99.2, i.e., the average of the column 7 figures.

We can even estimate the value of the gain (or loss) to farmers exclusively from the operation of prices of sales and purchases in pairs of consecutive years (columns 5-6, Table 10). Let value of aggregate sales and purchases at current prices in any year be respectively X and x. Let the price indexes (to previous year as unity) be p_X and p_x. At previous year prices the current values become X/p_X and x/p_x and the gain (+ or −) from the terms of trade is $x/p_x - X/p_X$. In our case, of course, $x=X$, the values being given in Appendix Table A3. For instance, in 1955-1956 the "gain" s:—

$$£144{\cdot}3 \left(\frac{1}{1{\cdot}054} - \frac{1}{0{\cdot}907}\right) m = -£22{\cdot}2m.$$

The corresponding figures for all years are shown in column 8. In the aggregate the twelve-year loss on relative prices alone was £16·9 million, equivalent to 0·84 per cent of cash receipts (£2,020·2 million—Table A3) during the period 1954-1965.

Table A3 shows that income-type subsidies paid to farmers (other than the subsidies on fertiliser and the Agricultural Grant already taken into account in our calculations) amounted to £14·5 million in 1954-1965, slightly less, therefore, than the price deficit of £16·9 million. We are more surprised at the similarity of the two figures. We do not know the intention of Government in its subsidy policy (whether narrowly to compensate for price changes or more generally) or the method by which the amount of the subsidy was determined. If it were the result of hard-bargaining within the democratic process, we make bold to cite our result as yet another example of how the process results in an equitable outcome of remarkable precision.

We emphasized at the beginning of this sub-section our intention of dealing with only a single aspect of agricultural economics, namely relative prices of sales and purchases in the aggregate. This is, of course, a very important aspect. Farmers are surely not to be blamed for what has been termed their "price obsession" as distinct from a greater interest in improving quantum output for, in the world today, there are severe constraints, both on the demand side and the supply side, against increasing output. In the previous section, it may be relevant to remark, we have shown that individual industries with low increases in output volume have been able to obtain higher than average price rises.

We will add only that factor income (in cash and kind) in the broad sector agriculture, forestry and fishing (including paid farm workers as well as farm family workers) per person engaged increased by 69 between 1958 and 1965, compared with 62 per cent. in industry and 76 per cent. in services. The CPI advance in the period was 24 per cent. The point is that the agricultural community (if mainly because of a reduction in their numbers) on average participated in the general advance in the standard of living since 1958. The picture is not so rosy to 1953 as base since when the respective increases to 1965 have been: agriculture, etc. 81 per cent., industry 107 per cent., services 121 per cent., the last being particularly remarkable. In 1965 added values per person engaged were £500 in agriculture, etc., £863 in industry and £848 in services.

5. ASPECTS OF PRICES IN THE SERVICE SECTOR, WITH SPECIAL REFERENCE TO RETAIL DISTRIBUTION

If the Irish economy be regarded as in three broad sectors (i) agriculture, forestry, fishing; (ii) industry; and (iii) services, the latter (including the sectors of distribution, transport, public service, professional, domestic services etc.) is the most important by reference both to numbers engaged and to factor share. In fact in 1965 the percentages of numbers at work were (i) 32, (ii) 28, (iii) 40 and

the percentages of factor income (i) 22, (ii) 32, (iii) 46. Consequently, no study on prices, or any other economic aspect, with any pretension to breadth of coverage, can disregard the great service sector, as a whole and in its main parts.

It unfortunately happens, however, in this as in all other countries, that the relevant statistics relating to services are fewer than in the case of agriculture and industry. There are obvious statistical difficulties. How is one to quantify the services of medicine, education or the public service, as a preliminary to pricing them? This problem has just begun to be studied in a few countries, U.S.A. in particular.

In our opinion there is, at any rate, no conceptual difficulty; exactly as in the case of sectors producing material goods, a service sector has an output value, a non-factor input value and hence an added value and this added current value V is factorisable into price P and quantum Q; later we shall give actual figures for the retail distribution sector.

We have tried to factorise the service sector as a whole (i.e. (iii) above) but our effort proved abortive.[10] In very broad outline our method was as follows: Official estimates are available for GNP at constant prices for a long term of years. From these, reasonably accurate estimates of volume of gross domestic product (GDP) were obtained. Also available were value and volume of net agricultural output from which price indexes were calculated; these price indexes were divided into the official current value for the sector (i) constituent to give estimates of volume of added value for agriculture, forestry, fishing. Rather similarly, as regards industry, price indexes were obtained as the quotient of current CIP net output value divided by the official volume indexes, which price indexes were used as deflators of values in sector (ii). Volume in sector (iii), services, was then obtained as a residual —the difference between volume GDP and the sum of the volumes of (i) and (ii).

The price indexes for sector (iii), obtained as the quotient of current value by volume, did not appear to be satisfactory, from other evidence, so we refrain from giving them here. In our view, the weak link was in our assumption that the official CIP volume indexes, represented *net* (or added value) volume indexes; actually they are gross volumes for the individual industries weighted by basic net outputs, but represent *gross* volume of output rather than added value volume output. Especially during recent years, when industry has been expanding and diversifying so rapidly, our assumption is untenable; nothing less than a full double deflation process, applied industry-wise to CIP data, would suffice. This method was used by one of us for two terms of years in the past[11] but proved to be far beyond our present computational resources. We consider that these computations should be made regularly and systematically, in particular to show the extent, if any, to which prices of services contribute to general price inflation. This is our purpose here. Unable to obtain the comprehensive view indicated, we are compelled to have recourse to bits and scraps of rather indirect evidence bearing on wages, labour productivity and the like and speculate on our data, such as they are. We preface our results by a note on the inter-relationship of these entities.

[10]We tackle this problem later (see Section 7) from another angle, showing some results.

Price, Productivity and Income per Person

In a later section we will encounter this relationship again in the context of the construction industry, but we can reduce it here to simple terms. Imagine a nation (or an economic sector) with no external trade, with current value of production V, price (base unity) P, so that quantum of production $Q=V/P$. Suppose that factor input consists exclusively of N hours of labour (i.e. capital is nil). The productivity $\pi=Q/N$ and current cash wage per head $W=V/N$. Hence $P=W/\pi$, the relationship sought. Given the average wage W, the higher the productivity index, the lower the price index, and vice versa. Of course, more realistically, V is added value at current prices, N is the factor input index (labour and capital combined) at constant prices. We make the point that there is, in the sense indicated, an inverse relationship between price and productivity, to justify the relevance of dealing in what follows with labour productivity and, to a certain extent, with cash income in one or two service sectors for which price data is at present inadequate. As already remarked, there is no conceptual difficulty about applying the notion of price to the service sectors; if the current output (added value) is V and its quantum Q, then by definition price $P=V/Q$.

The simple theory of the previous paragraph is applied in Table 11 to the Irish economy regarded as in two main sectors (*a*) agriculture, forestry, fishing and (*b*) the rest of the economy. As explained at the beginning of this section, we had hoped to subdivide (*b*) into (*b*1) industry and (*b*2) services but our efforts proved abortive, for the reasons given. Certainly a table on these lines would have

[11]R. C. Geary, "The Concept of the Net Volume of Output with Special Reference to Irish Data", *Journal of the Royal Statistical Society*, Vol. CVII, 1944, and also R. C. Geary and K. G. Forecast, "The Use of Census of Industrial Production Material for the Estimation of Productivity," *Review of the International Statistical Institute*, Vol. 23, Nos. 1-3, 1955.

been more informative than Table 11 which, nonetheless, may be found of interest. The basic principle involved is GDP, or added value, at factor cost. Our main task was to estimate added value, or work done, at constant (1953) prices; this we did in the manner explained in the notes, from which it will be seen that the volume estimate for (*b*) emerges as a residual, with the statistical hazards associated with residual estimation; our justification is that the residual is large, in fact the greater part of the economy. Knowing the numbers engaged in the two broad sectors, the rest of the derivation of the index numbers is automatic, price being derived, as so often in this paper, from V=PQ.

TABLE 11: INDEX NUMBERS OF (i) ADDED VALUE PER PERSON ENGAGED (INCOME PER HEAD), (ii) PRODUCTIVITY, and (iii) PRICE IN (*a*) AGRICULTURE, FORESTRY, FISHING, (*b*) REST OF ECONOMY, AND (*c*) TOTAL ECONOMY, 1958 AND 1961–1965

Base 1953 as 100

Sector etc.	1958	1961	1962	1963	1964	1965
(i) Income per head						
(*a*) Agriculture, forestry, fishing	107	133	140	142	170	181
(*b*) Rest of economy	126	157	169	180	204	215
(*c*) Total economy	121	152	164	173	199	212
(ii) Productivity						
(*a*) Agriculture, forestry, fishing	103	126	132	132	146	147
(*b*) Rest of economy	108	128	131	135	137	141
(*c*) Total economy	107	129	133	136	142	146
(iii) Price						
(*a*) Agriculture, forestry, fishing	104	106	106	107	117	123
(*b*) Rest of economy	117	123	129	134	149	153
(*c*) Total economy	113	118	123	127	140	145

Basic Sources: *NIE* 1964: *Second Programme for Economic Expansion — Progress Report for 1965*; *Economic Statistics—Budget Statistics.*

Notes

Income per head is current factor income divided by number engaged in the different sectors. Productivity is corresponding net volume divided by number engaged. Hence in each sector (i)=(ii)×(iii)/100. The basic volume figures were found as follows:—

1. Agriculture, forestry, fishing: official current value divided by implicit price index for net output of agriculture;
2. Total economy: from official estimates of volume GNP were deducted constant (1953) values for (A) emigrants' remittances, (B) other (net) income from abroad, (C) provision for depreciation, (D) taxes on expenditure, and (E) subsidies at constant prices added. These items were estimated by deflation of the corresponding current values. The price deflator used for (C) was the official (implicit) price index for GDFCF, for (D) our index (Table 5, col. 2) for indirect taxation and CPI for all the rest.
3. Rest of economy: volume found as a residual, i.e., 2–1.

Indexes are shown to nearest unit to emphasise their approximative character.

The table shows that in 1965 (compared with 1953) income per head (as defined) increased considerably in both sectors (the CPI in 1965 was 144) but significantly less in sector (*a*) agriculture, etc., as indicated earlier. The interest here lies in the factorization of income per head into productivity and price. We would expect, of course, that, since agricultural prices (influenced by export prices) have risen less than the national average price, non-agricultural prices have risen more.

What is quite remarkable, however, is the similarity of the productivity indexes in the two broad sectors of the economy: having regard to the statistical uncertainties of our calculations, we are not inclined to attach undue significance to the agricultural figures being somewhat the larger in 1964 and 1965. It is curious that this quasi-equality has come about from widely different causes; in agriculture a marked decline in numbers engaged with a modest increase in output volume, in non-agriculture, constant numbers engaged (since 1958) with a marked increase in volume output.

Retail Distribution

From a table and chart in section 1 we noted a wide disparity in recent years between the General WP and CP indexes, recognising, however, that these indexes were very differently weighted; the General WP index was weighted according to goods available for export and capital formation, as well as goods for home consumption, whereas the CP index contained rent and other services rendered direct to consumers and for which, therefore, there is no wholesale price. We decided to construct adjusted series of wholesale and consumer price index numbers, in which the weighting was identical, from CSO records pertaining only to material goods for the years 1953–1965. The calculation involved two main stages (i) selecting from the CP list of about 200 commodities and services those commodities for which WP data were available, and (ii) estimating wholesale 1953 expenditure weights based on the corresponding official retail expenditures. As to (i), the goods for which prices were quoted were rarely, if ever, identical in quality; fortunately this was not essential for our purposes; we have only needed to assume, reasonably, we think, in large aggregations, that price-percentagewise the two series were representative. As to (ii), the adjusted WPI weights were found by multiplying the corresponding adjusted CPI weights in fairly broad classes by ratios derived from the Census of Distribution (CD).

Our results are given in Table 12 and the two aggregate indexes illustrated on Chart 4.

As regards all items, the retail margin seems to have increased appreciably, especially during the past three years. The specially large margin in 1965 is partly due to the $2\frac{1}{2}$ per cent Turnover Tax, increasing the retail, but not affecting the wholesale

index. No significance should be attached to the irregularity of the margins; these are undoubtedly due to statistical aberrations. The 1965 figure for all items can be interpreted as follows. The retail price index (excluding the effect of the Turnover Tax) was 140·9 in 1965 compared with 106·8 in 1956. The mark-up percentage (retail-wholesale margin as a percentage of selling value) in 1956 was 18·1 for all items. Using the price index numbers it is easy to show that this percentage advanced to 19·8 for all items in 1965, on the trading pattern of 1956, a significant increase in (as we shall see) a very stable proportion.

As regards the groups the showing for 1965 is by no means uniform. For three groups, (i) clothing and footwear, (ii) consumer durables (when allowance is made for Turnover Tax) and (iii) miscellaneous goods, the wholesale index was greater than the retail. On the face of it this would indicate improved efficiency of distribution in these groups. We are not inclined to draw such a firm inference, given the nature of our data and the fact that the wholesale and retail sources are so very different. We are well aware that our table, though onerous to prepare, is far from being the last word on the subject. We give our computations for what they are worth. The methodology may be found to have some interest and an encouragement to others to pursue this aspect in the most important service sector.

A further effort at clarification is displayed in Table 13. Here we try to apply the double deflation method to retail distribution using CD with the adjusted CPI and WPI data described above. We had to confine this aspect of our inquiry to the five years 1956–1960, the only recent period of consecutive years for which CD data were available.

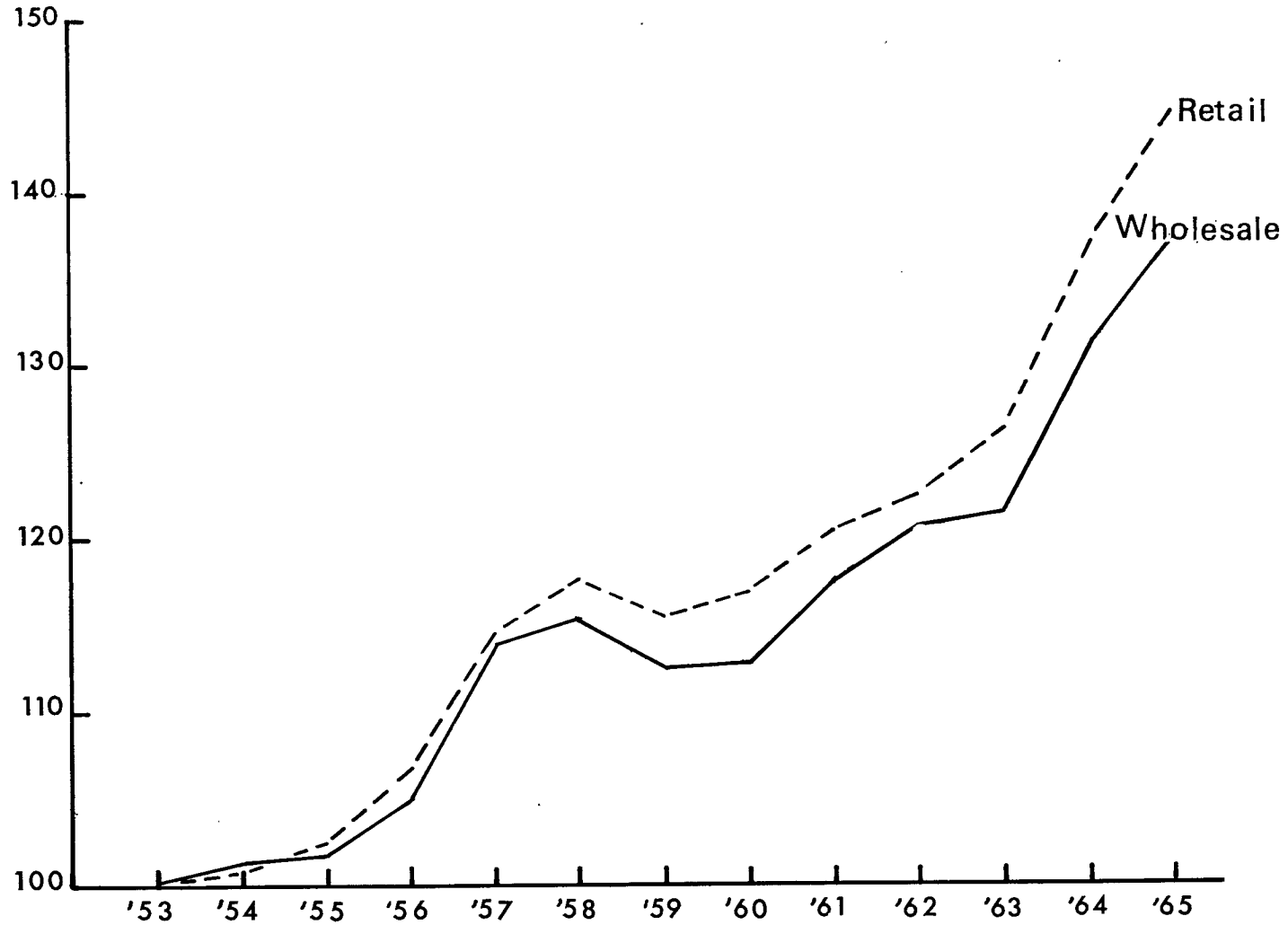
Row 6 of the table purports to represent the quantum of the service of retail distribution, on the basis of 1953 prices. As the notes indicate, it is the difference between the constant (1953) values of sales and purchases. It is, in fact, the deflated value of the row 3 values. These are not precisely what the theory requires, namely added value, since the margins include items like cost of containers and other non-factor charges in addition to employee compensation and profit. However, they will serve our purpose since we are interested only in relative values. Our price deflators were derived from the adjusted CPI and WPI systems used in the preparation of Table 12.

TABLE 12: CONCORDANCE BETWEEN ADJUSTED CONSUMER PRICE INDEX AND ADJUSTED GENERAL WHOLESALE PRICE INDEX, MID-AUGUST, 1953–1965

Base: Mid-August 1953 as 100

Group	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Food:													
Wholesale	100	100·4	100·6	100·3	112·8	116·8	110·9	111·4	116·6	116·8	116·1	127·1	130·1
Retail	100	101·7	103·6	104·4	115·5	119·7	116·8	117·6	121·2	123·5	123·5	135·9	141·8
Clothing and Footwear:													
Wholesale	100	102·2	102·9	107·0	109·5	111·8	113·7	114·6	118·0	120·8	123·7	130·2	132·2
Retail	100	100·2	100·5	102·1	103·2	103·7	104·8	106·5	107·7	110·8	112·7	120·1	122·9
Fuel and Light:													
Wholesale	100	111·9	118·1	125·9	129·7	102·2	97·9	95·3	103·2	102·7	112·4	115·8	117·4
Retail	100	99·7	106·6	123·2	127·6	125·5	110·9	106·6	115·0	121·8	129·1	140·8	140·4
Sundry items:													
Consumer Durables													
Wholesale	100	101·1	102·1	104·6	108·4	112·0	112·9	113·6	117·8	115·7	118·0	122·5	122·2
Retail	100	98·4	99·0	101·6	104·8	107·4	107·6	109·1	109·8	112·2	113·0	119·8	122·2
Drink and Tobacco:													
Wholesale	100	99·2	99·0	109·5	115·9	117·2	117·9	118·7	122·4	134·7	134·8	145·6	157·7
Retail	100	100·0	100·1	112·7	119·2	121·9	123·1	127·4	130·9	144·9	145·2	161·5	174·2
Miscellaneous Goods:													
Wholesale	100	101·4	102·7	111·2	113·3	113·8	123·8	125·8	128·0	132·1	136·8	141·9	149·3
Retail	100	99·9	100·6	107·8	110·4	110·8	112·6	113·4	144·2	121·2	122·1	131·5	135·2
Total Sundry items:													
Wholesale	100	99·7	99·7	109·3	114·9	116·4	118·2	119·1	122·6	132·8	133·7	143·2	153·8
Retail	100	99·9	100·0	111·1	116·9	119·3	120·5	124·1	127·0	139·2	139·7	148·8	165·1
All Items:													
Wholesale	100	101·2	101·7	105·0	113·8	115·1	112·4	112·8	117·6	120·6	121·4	131·0	135·7
Retail	100	100·9	102·4	106·8	114·6	117·5	115·5	116·9	120·2	122·6	126·1	136·9	144·5

CHART 4: ADJUSTED CONSUMER PRICE INDEX AND ADJUSTED WHOLESALE PRICE INDEX, IRELAND, 1953–1965



Having regard to the somewhat rough and ready data of the price systems in their present application (incidentally relating to the month of August and not averages for the whole year, as would be desirable) we were very agreeably surprised by the quite remarkable concordance of the resulting implicit price indexes for sales and purchases (rows 7 and 8); in the years 1957–1960 they are almost identical. At the risk of looking a statistical gift horse in the mouth we must confess that this result is somewhat fortuitous, a cancelling out in aggregate of errors in constituents, for it is not borne out in each of the 14 descriptions of business used in the calculation. The excellent concordance in the aggregate is what one might expect as consistent with a practice of constant percentage mark-up.

The outcome is the three last rows in the table: in 1960 the price P of the service of distribution increased by 5·4 per cent (compared with 1956) because margin per person W (row 13) increased by more than productivity (row 14).

The rise in productivity in the retail distribution sector, while appreciable, was much less than industry:

Volume of Output per Person Engaged
(1956 as 100)

	1956	1957	1958	1959	1960
Industry (transportable goods)	100	103·3	110·3	122·1	126·0
Retail distribution	100	96·7	101·2	103·8	108·1

It is a great pity that CD particulars are not available after 1960, to chart the way during the considerable advance in the economy during the past few years in the important distribution sector. This disparity, especially recently, between the identically weighted wholesale and retail price indexes (Table 12) can leave little doubt about there having been an increase in the retail mark-up percentage, in turn due to income per head in the sector having outdistanced productivity. Improved productivity is of benefit to the general public, in this or any other sector, only insofar as the improvement exceeds the rise in added value per person engaged.

The practice of constant percentage mark-up is

TABLE 13: DERIVATION OF INDEXES OF MARGIN PER PERSON ENGAGED, PRODUCTIVITY, AND PRICE OF DISTRIBUTION FOR ALL RETAIL DISTRIBUTION, 1956–60

	1956	1957	1958	1959	1960
At current prices (£m)—					
1 Sales and stock changes	244·3	243·7	255·0	260·2	271·1
2 Purchases	200·0	200·5	209·7	213·6	221·6
3 Retail margin	44·3	43·2	45·3	46·6	49·4
At constant (1953) prices (£m)—					
4 Sales and stock changes	231·1	216·2	221·8	228·2	235·4
5 Purchases	191·1	177·6	181·8	187·1	192·7
6 Retail margin	40·3	38·6	40·0	41·1	42·7
Implicit price index (1953 as 100)—					
7 Sales and stock changes	105·6	112·7	115·0	114·0	115·1
8 Purchases	104·6	112·9	115·4	114·2	115·0
9 Retail margin	109·9	111·9	113·0	113·3	115·8
10 Persons engaged (000)	110·2	109·2	108·2	108·4	108·0
Retail margin per person engaged (£)—					
11 Current prices	402	395	418	430	458
12 Constant prices (1953 as 100)	366	354	370	379	395
Index numbers (1956 as 100)					
13 Margin per person	100	98·4	104·1	106·9	113·9
14 Productivity	100	96·7	101·2	103·8	108·1
15 Price	100	101·8	102·8	103·1	105·4

Basic Sources: CD and CP and WP records of CSO.

Notes: Rows 1, 2, 3, 10: CD
Row 4: From values for 14 descriptions of business deflated by appropriate price indexes from CP system.
Row 5: From values for 14 descriptions of business deflated by appropriate price indexes from WP system.
Row 6: Difference between 4 and 5.
Row 7: Quotient (x 100) of 1 by 4.
Row 8: Quotient (x 100) of 2 by 5.
Row 9: Quotient (x 100) of 3 by 6.
Row 11: Quotient of 3 by 10.
Row 12: Quotient of 6 by 10.
Row 13: From 11.
Row 14: From 12.
Row 15: Quotient (x 100) of 13 by 14.
Calculations were made from figures with more digits than shown in the table.

confirmed in Table 13. For the five years 1956–1960 row 3 (the retail margin) as a percentage of row 1 (sales) lies within the narrow range 17·8—18·2. This low percentage level of 18 shows that the scope for the reduction (absolute or relative) in retail price through improved efficiency in retail distribution is limited. The lack of data referring to more recent years prevents any evaluation of the effects on productivity of recent developments in retail trading (e.g. supermarkets, and bulk buying by retail groups). From the comparative trends in retail and wholesale prices (Table 12) it appears that the percentage mark-up has increased perceptibly in recent years. It also appears that improved productivity has resulted merely in improved income per head for persons engaged in the sector. The public interest is not served thereby. Improved productivity in any sector of the economy should be shared amongst the general public by price reduction, absolute or relative.

Table 14 shows, for four broad groups of descriptions of business, the index numbers corresponding to those of the last three rows of Table 13, for the aggregate of all retail shops. We now see that the nice statistical regularity of the aggregate conceals widely disparate trends in the constituents. Thus the modest rise in margin per person for all four groups—incidentally the only figure for which official sanction can be claimed as it is the quotient, in index form, of the retail margin by number engaged—factorizes quite differently between the groups into productivity and price. In groups I and III productivity declined and the price of the service increased; in groups II and IV the reverse was the case.

TABLE 14: INDEX NUMBERS OF MARGIN PER PERSON ENGAGED, PRODUCTIVITY, AND PRICE OF RETAIL DISTRIBUTION IN FOUR GROUPS OF BUSINESSES, 1956–1960

Group description of business	1956	1957	1958	1959	1960
I Food, drink and tobacco—					
Margin per person	100	98·5	102·9	103·1	110·4
Productivity	100	94·3	95·8	84·9	86·4
Price	100	104·4	107·5	121·3	127·7
II Drapery and clothing—					
Margin per person	100	98·8	101·5	110·8	117·2
Productivity	100	105·0	113·4	123·0	129·1
Price	100	94·1	89·5	90·1	90·8
III Vehicles—					
Margin per person	100	100·6	104·4	107·9	111·5
Productivity	100	99·1	91·3	90·8	86·9
Price	100	101·5	114·3	118·8	128·4
IV Other businesses—					
Margin per person	100	98·6	108·1	112·0	118·5
Productivity	100	95·4	104·4	122·2	129·6
Price	100	103·3	103·5	91·6	91·4

Note: See Notes to Table 13.

While Table 14 has its own measure of statistical regularity, especially in the transition from year to year, we are far from claiming a high degree of validity for the figures themselves. We are sceptical about the magnitude of changes between 1956 and 1960 in productivity in the groups, and hence in the price index numbers, though we consider that the findings of the preceding paragraph as regards groups I and III (and II and IV) are so emphatic that (apart from the actual figures) they must be true in general tenor. As already stated in connection with Table 12, the CPI and WPI systems used for constructing deflating price index numbers come from sources divorced from one another and from the CD data. As is well known, such divorce is prone to cause statistical trouble.[12]

Elsewhere[13] one of us analysed the reason why the double deflation method is liable to yield aberrant statistical results, in its application to individual manufacturing industries. One of these difficulties was that if the margin (or net output) was small in relation to sales (or gross output), this small margin, a residue, had, on deflation of output and input values, to bear the brunt of inevitable errors in the deflating price indexes. This Irish experience was confirmed in other countries. The consensus is that the double deflation method is theoretically sound but creates difficulties in practice. We have gone a step further with the method in trying to apply it realistically to the most important service sector.

Ours, therefore, is not the last word on this topic, but nearly the first. Truth to say, at this stage, we are more interested in methodology, realistically applied, than we are in actual results. We are convinced, at any rate, that quantum (and therefore prices) of services is an important and realisable concept. We are also convinced that satisfactory statistical results will not be forthcoming unless and until the data are analysed at the individual firm level, whether the firm be in industry or distribution, using its own data for sales, purchases, stock changes, and prices.

It is ironically true that, for all the emphasis nowadays on quantum product (and productivity derived from this), very few firms, here or elsewhere, have any notion about how it is to be calculated, except in the very short term when product mix is homogeneous and structure unchanged between base and current periods. Such cases are few, for change is of the essence of economic advance.

[12]There is a statistical aphorism that statistics, purporting to relate to the same thing but coming from different sources, are different.

[13]R. C. Geary and K. G. Forecast, *op. cit.*, footnote 11.

6. PRICES IN THE INPUT-OUTPUT CONTEXT WITH SPECIAL REFERENCE TO SERVICES

Our object in the first part of this section is to emphasize, if on theoretical grounds, the essential importance of the input-output (IO) approach for the assessment of the ultimate price effect (indirect as well as direct) of price changes in primary inputs (incomes, imports, etc.). If there are n industrial sectors, m primary input factors (including imports) then the basic pricing equations are

$$(6.1)\quad \sum_{i=1}^{n} p_i a_{ij} + \sum_{k=1}^{n} \pi_{kj} b_{kj} = p_j,\ j = 1, \ldots, n.$$

Here a_{ij} are the inter-industrial technical coefficients, b_{kj} the primary input coefficients in the base year. Given these coefficients, the p_i and π_{kj} are price index numbers (or percentage price changes) of the gross outputs of the industries and of the primary inputs respectively. Given the industrial structure, equations (6.1) describe the new equilibrium on a cost basis, consequent on a change in prices. Any set of n variables from the set $(p_i,\ \pi_{kj})$ can be determined from (6.1) given the a_{ij}, b_{kj} (i.e. the basic structure) as well as the values of the rest of the set $(p_{ij},\ \pi_{kj})$. The customary problem is to determine the n industrial gross output prices, given the coefficients and the π_{kj}. The input-output convention will be noted in (6.1); the prices for the output of each industry are the same whatever the purchasing industry, i.e. as if the industry produced a single homogeneous product. This assumption is not very realistic because of product mix. However, if we interpret our answers as *average* prices for the whole producing industry we probably will not be far wrong. In the base year the p_i and π_{jk} are all unity so that

$$(6.2)\quad \sum_{i=1}^{n} a_{ij} + \sum_{k=1}^{n} b_{kj} = 1.$$

These relations simply state that the sums of the column coefficients are unity. In matrix form (6.1) may be written

$$(6.3)\quad p'(\mathrm{I} - \mathrm{A}) = c'$$

where A is the square matrix $\| a_{ij} \|$ and c' is the

TABLE 15: IRISH 1960 INPUT-OUTPUT TABLE FOR THREE INDUSTRIAL GROUPS (IG). VALUES AT SUBSIDIZED PRODUCERS' PRICES

Values in £ million

IG-Consuming / IG Producing	IG			Final demand			Output = input	Coefficients for IG			Coeffs. for households
	1	2	3	Households	Other	Total		1	2	3	
1	2	3	4	5	6	7	8	9	10	11	12
1 Agriculture, forestry, fishing	—	81·7	1·1	61·2	53·8	115·0	197·8	—	·1838	·0041	·1233
2 Industry	27·7	—	23·2	206·7	186·9	393·6	444·5	·1401	—	·0827	·4168
3 Services	11·0	32·2	—	135·2	101·3	236·5	279·9	·0557	·0725	—	·2727
Primary input:—											
Imports	15·3	119·8	7·9	61·0	31·6	92·6	235·6	·0773	·2697	·0281	·1229
Indirect taxation	11·6	49·3	9·2	31·9	4·0	35·9	106·0	·0584	·1108	·0329	·0643
Minus subsidies	−7·3	−5·8	−6·7	—	—	—	−19·9	−·0370	−·0132	−·0239	
Employee compensation	17·1	116·5	155·8	—	6·1	6·1	295·5	·0863	·2622	·5564	
Profit (incl. depreciation)	122·5	50·8	89·5	—	48·3	48·3	311·1	·6192	·1142	·3197	
Total input=output	197·8	444·5	279·9	495·9	432·3	928·2	—	1	1	1	1

Notes: This table is a synoptic version of the 1960 Irish 36 × 36 table prepared by CSO and kindly made available to R.C. Geary for his lectures on IO in ESRI in 1965. These lectures, which incorporate the CSO table (as well as its inverse $(\mathrm{I}-\mathrm{A})^{-1}$), are available in mimeograph in the Institute for the use of graduate students. In these lectures the reservations which CSO have made in regard to the table are emphasized.

The "other" final demand column is the aggregate of government expenditure, capital formation (fixed and stock changes) and exports (visible and invisible).

For the above table transactions within each IG are eliminated; accordingly the output values shown are less than the total of the outputs of the constituent industries in the CSO table (considerably so in the case of IG 2). Also, the value figures shown above (to 1 decimal place) were prepared from the CSO table (to 3 decimal places) so that rows and columns may not exactly add to the aggregates shown. The last 4 unitary columns were calculated from values to 3 decimal places.

row vector of the second term on the left of (6.1). The solution is

$$p=[(I-A)']^{-1}c. \tag{6.4}$$

It is obvious that, if c consists of the sum of several vectors $c_1+c_2+\ldots$, then the solution $p=p_1+p_2+\ldots$, where p_1 is the solution of (6.4) with $c=c_1$ etc. Hence, according to the IO convention, the effects of given changes in prices of the separate primary inputs are additive.

Table 15 is a highly condensed version of the Irish 1960 IO table. It will be seen to consist of 3 ($=n$) industrial groups while the number of primary inputs (including imports) is 5 ($=m$). The technical coefficients (a_{ij} and b_{kj}) are shown in the last columns 9–11.

We confess that in presenting this table here we were as much concerned to place it on record for the use of students as for the use we ourselves make of it in the context of prices. We cannot, however, comment on the table here except to observe (from columns 9–11) the small proportion of output (or input) which is represented, at this high level of aggregation, by Irish materials and non-factor services. In IG2 (columns 3 and 10) imported materials are slightly larger in amount than home materials. We also notice the relatively great importance of IG3, the service industries (transport, trading, communications, public service etc.) in the aggregate.

To apply formula (6.4) the matrix (derived from the A (3×3) coefficient matrix represented by the top right quadrant of Table 15) is

$$[(I-A)']^{-1}= \begin{vmatrix} 1{\cdot}027780 & {\cdot}149623 & {\cdot}068095 \\ {\cdot}190353 & 1{\cdot}033744 & {\cdot}085549 \\ {\cdot}019956 & {\cdot}086104 & 1{\cdot}007355 \end{vmatrix} \tag{6.5}$$

By matrix multiplying (6.5) by the assumed price changes in the vectors represented by the 5 rows of coefficients in the bottom right of Table 15 we obtain the consequent changes in the prices of output, always bearing in mind the basic hypothesis of unchanged (quantum) cost structure of the industry, no weaker an assumption, incidentally, than we make when we construct a Laspeyres price index. Thus if we assume that prices of imports advance in all sectors by 10 per cent, the direct percentage increases in the 3IGs are respectively 0·773, 2·697, 0·281. Then the percentage price increase in 1 Agriculture etc., is:

$$p_1=1{\cdot}027780\times0{\cdot}773+0{\cdot}149623\times2{\cdot}697 +{\cdot}068095\times0{\cdot}281=1{\cdot}22.$$

Table 16 shows the effect on industry prices of uniform rises of 10 per cent in price in each of the primary inputs. We have combined the last two categories into a single heading "income" in the conviction that, at least in non-agriculture, a rise in wages will be closely matched percentage-wise by a rise in profit in accordance with the demonstrable constancy of factor shares, dealt with later (Table 25).

A postulated 10 (or any) percentage rise in income is a rise per unit of goods produced in the base period. It is not necessarily the same as a corresponding rise in the conventional income per hour or per year. Economic arithmetic on the cost side is indifferent to time rates of remuneration, which become significant only when divided by a productivity index, as seen elsewhere. It is a great pity that prices of factor services cannot be measured in piece rates throughout, for then we could discuss labour rates in realistic terms, which might thereby act in some degree as a curb on price inflation. Time rates mask the inflationary realities. The statistical difficulties of assessing piece rates, in the present state of our knowledge, are formidable to the point of impossibility; how can one measure the quantum of work of a high officer in the civil service?

Table 16 shows for each IG the direct as well as the total (including the indirect) effect of the respective across-the-board effects of rises of 10 per cent in primary inputs. The provenance of the direct effects will be evident from Table 15. Thus with 1 Agriculture etc. the direct effect of a rise of 10 per cent in imports is a rise of 0·773 per cent in the cost per unit. But agriculture purchases from

TABLE 16: PERCENTAGE EFFECT ON PRICE IN THREE INDUSTRIAL GROUPS OF 10% RISE IN PRICE IN EACH OF FOUR PRIMARY INPUTS AND IN CONSUMER PRICES

Primary input	1 Agriculture etc.		2 Industry		3 Services		Consumer prices
	Direct	Total	Direct	Total	Direct	Total	
Imports	0·77	1·22	2·70	2·96	0·28	0·53	2·76
Indirect taxes	0·58	0·79	1·11	1·28	0·33	0·44	1·39
Minus Subsidies	−0·37	−0·42	−0·13	−0·23	−0·24	−0·26	−0·22
Income	7·06	8·41	3·76	5·98	8·76	9·29	6·06
Total	—	10·0	—	10·0	—	10·0	10·0

Note: Based on Table 15 and formula (6·5). See text.

2 Industry and 3 Services, the prices of which rise because of their income costs; in turn the rise in the price of agricultural products affects the prices in industry and services; the process continues to infinity. The total rises are those attained when the process (in theory infinite, but in practice finite after a very few rounds) has reached equilibrium.

The consumer price percentage increase is derived from the proportions shown in the last column of Table 15 and the total rises shown in Table 16. Thus, for a 10 per cent rise in import prices the percentage increase in consumer prices is:

$$\cdot1233 \times 1\cdot22 + \cdot4168 \times 2\cdot96 + \cdot2727 \times \cdot53 + \cdot1229 \times 10 = 2\cdot76$$

The total rises shown in Table 16 can be applied to any percentage rises: thus a rise of 1 per cent. in import prices would occasion a rise of 0·122 per cent in agricultural prices. The process is also additive; simultaneous rises of 1 per cent, 3 per cent, 5 per cent and 7 per cent respectively in prices of the four primary inputs in the order of the tables would result in a total rise in the price of 2 Industry of:

$$2\cdot96 \times 1/10 + 1\cdot28 \times 3/10 - 0\cdot23 \times 5/10 + 5\cdot98 \times 7/10 = 4\cdot75\%.$$

Admittedly our treatment so far in this section has been rather unrealistic because, to simplify the arithmetic and to make the *exposé* as clear as possible, we have reduced the matrix to dimensions of 3×3. We have been concerned merely to show the great flexibility and, we believe, the potential in usefulness of IO in the prices context. In any real problem we would, of course, use the full CSO 36×36 table for which, as indicated in the notes to Table 15, the $(I - A)^{-1}$ matrix (and hence its transpose for utiliza-

TABLE 17: DERIVATION OF THE PRICE INDEX NUMBER FOR SERVICES IN HOUSEHOLD EXPENDITURE, 1953, 1958, 1960 and 1964

	Sector	Expenditure 1960	Price indexes (1953 as 100)			
			1953	1958	1960	1964
		£m				
1	Agriculture, forestry and fishing	61·1	100	114	102	121
2	Mining and turf	0·3	100	107	108	120
3	Food	76·4	100	115	115	127
4	Drink and tobacco	55·3	100	117	119	146
5	Textiles	8·9	100	94	92	101
6	Clothing and footwear	18·5	100	114	117	120
7	Wood and furniture	6·7	100	94	96	109
8	Paper and printing	1·1	100	112	118	130
9	Chemicals and chemical products	2·7	100	109	105	112
10	Structural clay products, glass, cement	0·9	100	122	117	127
11	Metals and engineering (incl. vehicles)	17·0	100	115	119	137
12	Other manufacturing industries	5·4	100	104	150	145
13	Construction	1·6	100	110	109	130
14	Electricity, gas, water	12·0	100	107	103	107
15	Services (residual)	135·1	100	115	124	152
16	Imports and indirect taxes	92·9	100	121	117	129
	Total household expenditure	495·9	100	115	116	134

Notes.

The formula used for the derivation of the price index for 15 Services, the object of the exercise, might be described as an "inverted Laspeyres". If, to base 1960, the price index in any other year were p_i and expenditures in the base year (i.e. the figures shown in the first column above) e_{io}, then

$$\Sigma' e_{io}\, p_i + e_{15\cdot0}\, p_{15} = E_0 p.$$

where Σ' extends to every sector except 15, E_0=total household expenditure (£495·9 million) and p the price index appropriate to household expenditure. All the p_i (except p_{15}) and p are directly determinable; hence p_{15} can be found from the foregoing equation; p is derivable as the quotient (x 100) of the current and constant price values of the national accounting item "Personal expenditure on consumers' goods and services" given in *NIE* 1964, Tables A.3, A. 4, B.3, B.4. All the CIP price index numbers, i.e. for sectors 2 to 14, except sector 4, were derived as the quotient of the gross output value by the group volume indexes, most of the latter data being given in *ISB*, September 1966; in the case of sector 4 the gross output value given is exclusive of excise duty on beer and spirits, and there was also the difficulty of the rebate on exports, while we required a home price, i.e. inclusive of duty. It was decided to derive the price index from our data prepared for Table 12, namely of drink and tobacco at wholesale prices weighted as for the official CPI.

This series was also used for the part of sector 1 which consists of the £34·0 million sold in 1960 to Irish households. The remaining £27·1 million represented farm produce and fuel consumed on farms without process of sale for which values at current and constant prices were available (*ISB*, June 1966) and hence the implicit price index could be calculated. For this exercise the item was treated as if it consisted of agricultural produce alone. Of course, agriculture predominates in the gross output value.

As regards item 16, Table 1 shows that this consists of £61·0 million imports (valued c.i.f.) and £31·9 million indirect taxes.

The latter was somewhat conjecturally divided into two parts (i) rates and (ii) remainder, using as weights for price series (i) our rates index given in Table 5 and (ii) the official WP series for imports for personal consumption (including import duty).

Price indexes were calculated from data expressed to more significant digits than those shown in the table.

tion by formula (6.5)) has been provided. It is obvious that for the methods indicated it is not necessary to postulate uniform rises applying to every row, as in the 3×3 treatment above.

It will be evident from Table 15 that the Irish IO table is constructed, like most others, on the principle of sellers' (as distinct from purchasers') prices. For instance, in the row for 1 Agriculture etc., all the values are at agricultural etc. prices, the row (and column) total being the value of the gross output at farmers' etc. prices. In particular this is true of £61 million entered in the column for household expenditure. But the column total of £496 million is the national accounting figure for household expenditure at market prices. Hence the very large figure for services, namely £135 million, in the column includes, indeed as a large constituent, the cost of distribution of the goods shown elsewhere in the column from the producer to the consumer. Of course, the total also includes expenditure on services like education, amusements, professional, personal etc., sold without intermediary from the producer to the consumer. Usually this feature of the sellers' price method is regarded as a disadvantage as applied to the household expenditure column, for which it would appear much more natural to show item by item what purchasers actually paid—see Table 18. For us, on the contrary, it had the advantage of enabling us to estimate, with some reasonable (but not exaggerated, as will appear) degree of confidence, the price trend in the aggregate of this great swathe of expenditure on services. It will be recalled (see Section 4) that this problem of pricing services defeated us when we tried to approach it through industrial shares of GDP, for the reason that these shares were added values and we lacked a reliable price index to deflate added value in industry. The clue to our measure of success with household expenditure lies in these being gross values (at a certain level of pricing) for which price indexes were estimable.

The method of derivation of the price indexes for services is described at some length in the Notes to Table 17, which shows that the index was 152 in 1964, to base 1953 as 100. It will be observed that the weighting system shown in the first column of the table is but an extended version of the "Households" column of Table 15, except for some slight adjustments in the decimal point to make the Table 17 figures add. We are far from claiming a great degree of statistical validity in the actual index of 152. The principal objection is perhaps our implicit assumption that the sectoral price indexes, which relate to total gross output, are applicable to households alone, an objection which, however, does not apply to the heavily weighted items 1, 4 and 16; it may have some relevance in the case of item 3. The point is that if the price indexes were lower generally for sales to other Irish industries, exports, government, capital formation, they would be higher for sales to households. Such an upward bias generally would, admittedly, lower the services index, as calculated, given the price index for total household expenditure. While the latter was impeccably official, we must have regard also to the difficulties of CSO in establishing constant price estimates of service items in personal expenditure. Fortunately we are in a position to derive the latter very readily from *NIE* 1964. The results are shown in Table 18. The indexes for other categories are shown as well.

TABLE 18: CALCULATION OF PRICE INDEXES OF PERSONAL EXPENDITURE AT PURCHASERS' PRICES

Category	Expenditure in 1960	Price Indexes		
		1958	1960	1964
	£m.			
1. Food, non-alcoholic beverages	183·3	100	99	111
2. Alcoholic beverages, tobacco	80·3	100	104	133
3. Clothing, footwear, personal equipment	52·3	100	102	114
4. Fuel and power (excluding motor spirit)	24·8	100	94	100
5. Durable household goods	23·0	100	102	113
6. Transport equipment	13·9	100	101	105
7. Other goods	29·6	100	103	122
8. Other expenditure	128·3	100	102	119
9. Less expenditure by non-residents	−39·7	−100	−101	−118
Total Personal Expenditure	495·8	100	101	116

Basic Source: NIE 1964.

It is impossible to reconcile statistically the 1960 expenditure column of Table 18 with column 5 of Table 15, though we can do so qualitatively. We observe in the first place that total expenditure, at £495·8 million, is the same; the itemised constituents of the two columns are quite different. One of the main reasons is that the Table 18 figures (except the last) include non-resident expenditure, included as an invisible export in Column 6 of Table 15. The short-fall in Table 17 in the values for Sectors 1+3 and for Sector 4, compared respectively with the first two items of expenditure in Table 18, emphasizes the difference in principle of construction of the two sets of figures, those of Table 15 at producers' and Table 18 at purchasers', i.e. retail, prices.

Our main concern is, however, with Item 8 of Table 18 (predominantly "services" in content) and Item 15 of Table 17. It curiously happens that the totals are quite similar (£128 and £135 million), which masks the fact that the respective contents are drastically different. The Table 17 figure includes all the value of the service of distribution, implicitly included in the retail price values of Items 1–7 of Table 18. Item 8, Table 18 includes the

substantial value of Irish tourist expenditure abroad, included, as an invisible import, in Item 16, Table 17. There are many other differences which need not concern us here.

There is nothing remarkable about the price index of 119 for 1964 for Item 8 (predominantly services) of Table 18. The service price index from Table 17, to base 1958, is 132. We are quite prepared to concede that the latter figure is biased upwards though we cannot surmise to what extent.[14] We feel entitled to assume, however, that the price of services (according to the Table 17 definition) has risen significantly more than have prices generally. This is what we would expect. Earlier we have shown that the productivity increase in the very important retail distribution sector in the period 1956–1960 was very considerably less than in the "goods-producing" sectors, agriculture and industry.

[14]Since this was written we have applied our method using the wholesale price CIP-weighted system as far as we could instead of the CPI implicit price indexes as for Table 17, to find the following indexes (to base 1953 as 100) for service prices (still a residual): 1958, 111; 1960, 120; 1964, 147. To base 1958 as 100 the revised index for 1964 was 132, the same figure as derivable from Table 21, which is satisfactory.

7. RATE OF RETURN ON CAPITAL

As obviously related to the trend in prices of goods and services, some reference to the rewards of labour and capital seem necessary here, if only to call attention to the paucity of information in this, as in almost all other countries, on fixed capital stock.

In the existing circumstances our approach must be experimental and hypothetical as regards the rate of earnings on capital in recent years. The correlative, on the capital side, to the familiar earnings per hour figures is profit per £ of capital employed, physical capital employed being expressed in quantum (i.e. fixed price) terms. In this section we attempt to compare earnings per hour and return on capital, both in index number form, in the years 1958–1965. Attention is confined to the non-agricultural companies' sector.

Our method is to capitalize arbitrarily profit income in 1958, deemed as at the beginning of the year, and to estimate net additions to capital in each subsequent year at constant (1958) prices based on the official estimates of gross domestic fixed capital formation (GDFCF) and depreciation at constant and current prices. The annual net addition to capital equals GDFCF *minus* depreciation all at constant prices. While the impression prevails that the official figures for depreciation are somewhat under-estimated, we have decided to rely mainly on them for our present purposes, justifying our decision later, while making an experiment with an alternative assumption. Our basic data are given in Table 19.

It should be emphasized that the whole object of the exercise is the derivation of the index numbers,

TABLE 19: GDFCF AND DEPRECIATION AT CURRENT AND CONSTANT (1958) PRICES, AND PROFIT AT CURRENT PRICES, NON-AGRICULTRUAL COMPANIES' SECTOR 1958–1965

Values in £ million

Year	At current prices			GDFCF constant prices	At constant prices	
	Profit	Depreciation	GDFCF		Depreciation	Addition to capital
1	2	3	4	5	6	7
1958	41	15	39	39	15	23
1959	46	18	39	39	18	21
1960	54	20	43	42	20	22
1961	59	23	54	52	22	30
1962	63	28	66	62	26	36
1963	71	32	75	69	30	40
1964	78	36	82	73	32	41
1965	82	39	93	80	32	48

Basic Sources: NIE 1965 and CSO records.

Notes: The non-agricultural companies' sector is that to which the profit figures in Table A.1 of *NIE* 1965 apply. Profit is defined as "trading profits of companies (including all corporate bodies) before tax" except in agriculture, forestry and fishing.

The apparent discrepancies in this table (and in Tables 20 and 21) are due to rounding to units of £ million, the original calculations having been based (generally) on figures to one decimal place.

Col. 7: col. 5—col. 6.

TABLE 20: ESTIMATES OF CAPITAL (AT 1958 PRICES) ON TWO BASES, PROFIT AS PERCENTAGE OF CAPITAL AND INDEX NUMBERS THEREOF, NON-AGRICULTURAL COMPANIES' SECTOR 1958–1965

Year	Capital at beginning of year, basis—		Profit as percentage of capital, basis—		Index (1962 as 100) of profit rate, basis—		Index (1962 as 100) of earnings per hour in TG industries (C)
	A	B	A	B	A	B	
1	2	3	4	5	6	7	8
	£m	£m	%	%			
1958	406	508	10	8	79	76	75·5
1959	429	531	10·8	8·7	86	83	78·1
1960	450	552	12·0	9·8	95	93	83·8
1961	473	574	12·4	10·2	98	97	89·7
1962	503	604	12·6	10·5	100	100	100
1963	538	640	13·1	11·0	104	105	104·6
1964	578	679	13·5	11·5	108	110	115·1
1965	619	720	13·2	11·4	105	109	120·9

Notes: See Notes to Table 19.
Col. 2: Profit (Table 19 col. 2) in 1958 capitalized at 10%, the A series figures for subsequent years found by adding entries in col. 7, Table 19.
Col. 3: As in col. 2, using capitalization rate of 8% in 1958, the B price.
Col. 8: October 1958–1964, September 1965. *SA* 1965, Table 116 and CSO.

in columns 6–7 of Table 20 and column 7 of Table 21. As will be seen from the note to Table 20, these are derived from the initial capitalization in 1958 of profit on two bases, (A) 10 per cent and (B) 8 per cent, these percentages being quite arbitrary.

It is notorious that the showing of an index number depends largely on the year chosen as base. We have decided that 1962 is more suitable for our purposes than what might appear the more "normal" base, namely 1958. The latter year, while usually regarded as marking the beginning of the economic upsurge of recent years, was also the nadir of a recession starting in 1955 in which it is to be presumed that profit was low. On the other hand (by reference to the annual trend of GNP at constant prices) 1962 was the year in which the economy had recovered to the point it would have reached had there been no recession in 1956.

The principal inference we draw from our exercise is that despite the considerable difference in the assumed rates of initial capitalization, the effect on the index numbers of profit rates (Table 20, columns 6–7) is relatively small: herein lies the justification of the exercise. We also infer that the lower rate of capital assumed initially the steeper the rise in profit rate.[15] Incidentally, for national accounting purposes, profit is defined as after depreciation but before tax. The index numbers, in taking into account the great increase in fixed capital stock since 1958, put a different picture on the considerable increase in the amount of profit (Table 19, column 2) during the period. Thus in 1962–1965 the rate of return increased by 7 per cent (Table 20, column 6) while the amount of profit increased by 30 per cent; in the period 1958–1965 the respective increases were 32 per cent and 102 per cent. During the two intervals the rises in consumer prices were respectively 15 per cent. and 24 per cent. At least since 1962 the *rate* of return on company capital cannot be said to be a major cause of price inflation. Of course, the great increase in the *amount* of capital (GDFCF as percentage of GNP, both at constant prices, 13 per cent in 1951, 16 per cent in 1962, 19 per cent in 1965) may be a source of inflation.

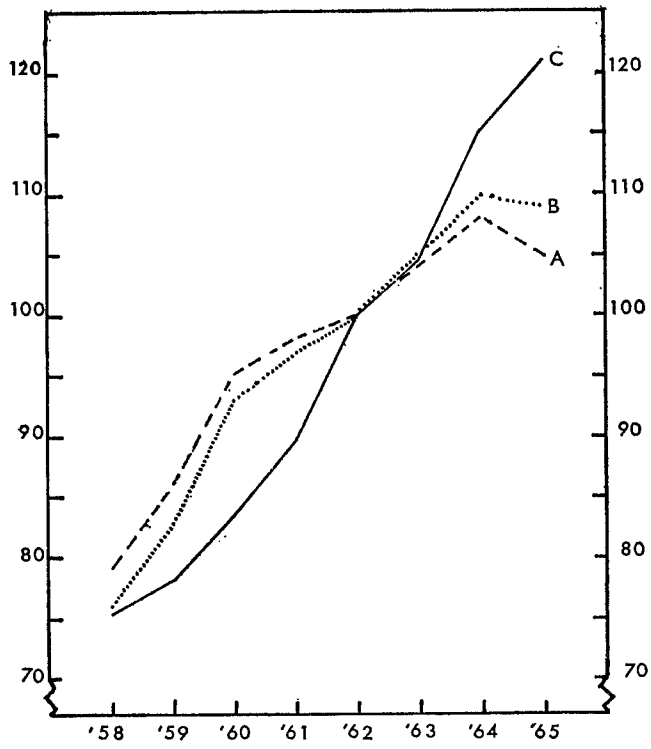
As Chart 5 shows, the A gradient of increase in profit rate was considerably greater during the period 1958–1961 than in the period 1962–1965. The increases in the earlier period must have acted as a stimulus to increased investment. It is significant that, though 1965 was a year of deceleration in the economy, the profit rate continued to grow.

The chart also shows the marked contrast between the rate of growth in hourly earnings in TG industries (C, Table 20, column 8) and in rates of return on capital (A or B). The movements of quanta of labour and capital were in the contrary direction (a small increase in the labour force and a large increase in capital) with the remarkable effect (as we shall see later in this section) of near constancy in proportionate shares of total income.

The figures for capital given in Table 20, columns 2–3, are not designed to be taken seriously. They are but a means to an end, the index numbers shown in columns 6–7, and the latter figures are to be regarded as having an impressionistic rather than an absolute significance. At the same time, the capital figures shown in Table 20, column 2, when considered in relation to the depreciation figures in Table 19,

[15]The view might be taken that our higher rate of 10 per cent is still too low. An assumed higher rate would result in a still lower increase in the rate of return on capital.

CHART 5: INDEX NUMBERS (BASE 1962 AS 100) OF RATE OF RETURN ON CAPITAL ON TWO BASES (A AND B, TABLE 20) AND HOURLY EARNINGS (C) IN TG INDUSTRIES, 1958–1965



Basic Source: Table 20, cols. 6-8.

column 7, have a certain plausibility—we shall certainly make no higher claim for them. In Ireland in 1958 a depreciation rate of 3·7 per cent. (or an average asset lifetime of 27 years) was not unreasonable, having regard to the fact that fixed assets include buildings (with a lifetime of 50–100 years) as well as plant and machinery (with a lifetime of perhaps 10–25 years). We would also expect the depreciation rate to increase in recent years (through improved capital-consciousness, attention to obsolescence, retooling, etc.): we note that in 1965 it had advanced to over 5 per cent.

While we prefer to use the official estimates for depreciation for the present purposes, we were curious to know how the indexes of profit rates would be affected by using higher figures for depreciation in our calculations. Table 21 shows the results, using a fixed annual depreciation rate of 6 per cent. The calculations now become a little complicated since, of course, a change in the amount of depreciation at current prices changes the profit figure as well as the annual addition to capital. We need not enter into the details of the calculations, leaving the reader, if he wishes, to satisfy himself from the table that they are consistent.

The increases in the profit rate index (Table 21, column 7) are very similar to those of A and B from 1962 on. In the period 1958–1962 the Table 21 increases in the index are much steeper than those of Table 20, thus confirming the finding that the gradient of increase in the profit rate has levelled off somewhat compared with the earlier years.

The marked difference in trend in the unitary cost of labour and capital (see Chart 5) highlights the remarkable constancy during the period of the proportionate factor shares in the non-agricultural sector shown in Table 22. It should be explained that the coverage of Table 22 is wider than that of Tables 19–21: unfortunately statistics of remuneration of employees were not available for the companies' sector. This calculation involved the assumption that the sector income described as other than remuneration of employees, was "profit" on capital though it contains remuneration of the

TABLE 21: ESTIMATES OF CAPITAL, PROFIT AND PROFIT RATE INDEX WITH DEPRECIATION TAKEN AT 6% OF FIXED CAPITAL STOCK, ON THE BASIS OF PROFIT CAPITALIZATION AT 10% IN 1958. NON-AGRICULTURAL COMPANIES' SECTOR 1958–1965

Year	Capital at beginning of year at constant (1958) prices	At current prices		Depreciation at constant (1958) prices	Profit as percentage of capital	Index (1962 as 100) of profit rate
		Profit	Depreciation			
1	2	3	4	5	6	7
	£m	£m	£m	£m	%	
1958	350	35	21	21	10	68
1959	368	42	22	22	11·5	78
1960	385	50	23	23	13·1	89
1961	404	57	25	24	14·1	95
1962	432	64	28	26	14·8	100
1963	468	73	30	28	15·5	105
1964	510	79	35	31	15·6	106
1965	552	82	39	33	14·9	101

Notes: See Notes to Table 19. This table has been based on Table 19 on the principles of invariance of (i) gross profit (profit + depreciation) at current prices and (ii) GDFCF at constant prices. Thus (allowing for rounding)
(i) cols. 3+ 4=cols. 2 +3, Table 19.
(ii) Δ col. 2 + col. 5=col. 5, Table 19.

TABLE 22: "PROFIT" AS PERCENTAGE OF TOTAL FACTOR INCOME. NON-AGRICULTURAL SECTOR 1958–1965

Profit basis	1958	1959	1960	1961	1962	1963	1964	1965
I	27·2	28·0	28·7	28·7	28·0	28·2	26·8	27·5
II	24·5	25·9	27·0	27·4	26·9	27·5	25·8	26·4

Notes:
Profit basis I: "Other" as percentage of total factor income in sectors numbered 16–19 *NIE* 1965, Table A2.
Profit basis II: Same sector as I, but "profit" capitalized at 10% and depreciation at 5% capital stock.

self-employed as well as profit. It is not considered that the latter factor seriously vitiates the showing of the table, concerned, as we are, only with trends.

The quasi-constancy of the proportionate factor shares is the more striking when one considers the great increases in the two constituents of factor income, namely employee compensation and profit during the period. There is a considerable literature on the question of the constancy of proportionate factor shares, [16] and all that it implies. If one takes the position, even on empirical grounds (in the Irish context), of the inevitability of the ratio, one is provided with an argument in favour of the validity of the official estimates for depreciation. In fact, in Table 22 the first row of percentages is based on the official figures, the second on the assumption of a 5 per cent depreciation rate. Both rows show little variation but the first row is more stable than the second, the coefficients of variation (ratio of standard deviation to mean) being respectively 0·024 and 0·038. The second row percentages are therefore more than 50 per cent more variable than the first row.

[16] See thesis (in the Library of the Institute) of Mary Boland, M.A., formerly research scholar of ERI.

8. THE GENERAL PRICE LEVEL AND THE EXTERNAL TRADING GAIN

The Fundamental Identity at Current Prices

The well known national accounting identity income=product in current price terms has the advantage that the terms "income" and "product" are indistinguishable and may be used interchangeably. This is not necessarily, or even generally, the case when accounting entities are expressed at constant prices. It is necessary to have regard to some aspects of the controversial problem of accounting at constant prices because at the macro, as at the micro, level, prices and quanta are so intimately related that no price index has any objective meaning unless it can be envisaged as the deflator of a current flow. This near truism does not, unfortunately, solve the methodological problem of making price or volume index numbers: in the identity PQ=V we know only V, except in the case of single, well-defined products. To a certain extent, however, the flow concept does help conceptually in defining price index numbers.

It may be well to start with the income/product identity at current prices in the given period, say a year:

$$Y=C+I+X-M, \tag{8.1}$$

where Y is income, C consumption (government and private), I investment (fixed and stock changes), X exports, M imports. Exports and imports include invisibles and are, in fact, as defined in the balance of international payments. Income Y may be gross or net, depending on whether I includes or excludes capital consumption (i.e. depreciation); Y may be at factor cost or at market prices, depending on whether C (and possibly I) have or have not been purged of indirect taxes less subsidies. On the latter point, when the identity is used in form (8.1) market prices are usually postulated. Identity (8.1) is entirely consistent and additive throughout the economy, when "exports" and "imports" are suitably defined in regard to the sectors (in whatever detail down even to the individual producer), while, of course, the elements of C and I, as final goods and services, are directly additive. The fundamental property enshrined in Y as defined by (8.1) is that total income is the sum of sectoral incomes.

Supply at Current and Constant Prices

The concept moves nearer to the kind of reality contemplated for the constant price concept by writing (8.1) as:

$$Y+M=C+I+X. \tag{8.2}$$

Each side represents the value at current prices of goods and services available in the economy which may be termed the *supply*; the left side describes how this value was formed, namely by the applica-

tion of the services of manufacture, distribution, transport etc., the skills of the nation (given capital stock and natural resources), total Y, to imports M. The right side describes how the goods and services were distributed in the three categories specified.

It is only in a special sense that one can speak of supply as being equal to (i) home production *plus* (ii) imports as distinguishable entities since Y in (8.2) is "home production" only by definition; it is not, in general, "production" in the sense of a visible complex of goods and services (and therefore price-deflatable) except in the trivial case of $M=0$[17]; it is only the combination of the factor services of Y combined with imports M which produce usable goods and services; the two constituents are, in general, indistinguishable in any tangible good or service; on the other hand, the three constituents on the right of (8.2) are each the sum of individual goods and services which can unambiguously be deflated to give a value at constant prices. The value at constant prices (i.e. the prices of the individual goods and services in some base year) of the aggregate availabilities is

$$C'+I'+X', \tag{8.3}$$

where primes indicate constant price values of the respective entities. It will be noted that the constant price version of availabilities can be obtained only in this way. It cannot be derived from the left side of (8.2). This fact marks a fundamental difference between the current and constant price concepts; in the current case each of the five macro elements specified at (8.2) is separately estimable and if there be a discrepancy between the two sides of (8.2) it is merely statistical, an aggregate of errors of estimation.

Net Investment Abroad and the Trading Gain

In the constant price case it is necessary to have recourse to definition. *Define* national product

$$Y'=C'+I'+X'-M', \tag{8.4}$$

where

$$C'=C/p_C\,;\quad I'=I/p_I\,;\qquad X'=X/p_X\,;\quad M'=M/p_M\,, \tag{8.5}$$

with the p's the appropriate price indexes, unity in the base year. If one requires the price index of national product it is *derived* as

$$p_Y=Y/Y'. \tag{8.6}$$

[17]In the non-financial sense; when net external financial claims are conceptually admissible the situation is different: see later.

The practice sometimes adopted in the past of estimating Y′ by deflating Y by some general purposes index like that of wholesale prices, consumer prices etc., was simply incorrect.

The economic purist is wont to point out that the whole concept of values of individual flows, and *a fortiori* the concept of accounts at constant prices, is a fiction, that the only reality is the set of current values. This is correct up to a point. A situation in which between base and current periods the price of each and every commodity remained unchanged is simply inconceivable, even if, in a sense, prices on average were unchanged. He is right in pointing out that quantities demanded are related to relative prices and that, for all its theoretical elegance, the indifference curve (or surface) analysis associated with the names of Konüs, Staehle etc., is not operational. The empiricist's reply is that in a situation of generally rising or falling prices there is a challenge, and indeed a public demand, to measure on average the rise or fall, however he does it; that price and quantity have a meaning in the case of the individual commodity; that it usually does not matter much what formula for measurement is used.

These considerations apply to formula (8.4). It seems in the highest degree desirable to measure the quantum product of the nation, for the measurement of productivity in particular; we simply cannot be content with the current value of the product in a situation of changing prices. The formula enshrines at the national level the principle of "double deflation". It is, of course, constructed on the analogy of the current price formula (8.1); the full series of constant price national accounts, of which (8.4) is one, are so constructed. Exactly as in the case of the current series, formula (8.4) is consistent in that the Y′ is the sum which would be obtained if one applied the formula suitably interpreted to each separate sector of the economy, however the sectorization was made, even down to the individual enterprise. The formula for Y′ is surely the most "natural" way to define national product. It is now used in all countries which have the data for the calculation, by Ireland in particular.[18] Ireland, in fact, seems to have been the first country to adopt the concept officially, as applied to the agricultural sector. The double deflation procedure was proposed many years ago, independently by S. Fabricant, R. Wilson and R. C. Geary. Unofficial attempts to apply the concept to estimate added value at constant prices in different industrial sectors in certain countries (Ireland and Australia in particular) have not so far proved successful, principally because the CIP and price data on which the calculations were based were not sufficiently

[18]*NIE*, 1962, 1964 (Pr. 7424, 8716).

accurate. The results of the elaborate Irish experimentation have been published.[19] It has recently been suggested that the double deflation technique should be applied by individual industrial concerns to estimate the trend of their productivity.[20]

Associated with the internal or production account (8.1) in the national accounting system is the external account at current prices

$$X-M=N, \tag{8.7}$$

where N is the current value of net external investment (+ or −). There is no difference in expert opinion as to the tangible reality of N, in the sense that it may have a positive value due solely to the favourable movement of export, compared with import, prices. On the analogy of (8.7) one cannot, therefore, regard $X'-M'$ as the deflated value of N simply because one would have to contemplate the absurd possibility of N and its quantum N′ being of opposite signs and therefore with an implicit price $p_N(=N/N')$ negative. The consensus is that N should be separately deflatable (like X and M) so that the deflated value is, at least, positive or negative as N is positive or negative. One then introduces a balancing item T′, the trading gain, to give the external account at constant prices:

$$X'+T'=M'+N'. \tag{8.8}$$

T′ may be positive or negative. There is no doubt about its substantial reality in any discussion on the level of incomes, prices and welfare. The trouble is its statistical determination.

Statistical difficulties are, of course, also encountered with X′ and M′ particularly in connection with services, fees, dividends, etc., but these difficulties are as nothing compared with N′ (and hence T′, from (8.8)) on which there is no consensus. A large part of the conceptual difficulty of finding a suitable price deflator p_N for the current export excess N=X−M arises from the fact that N as an entity in its own right has only a remote functional existence, when the economic process is considered in non-financial terms. Supply has to intervene between the economic realities of M and X: M is in a sense functionally related to supply; X is a constituent of the distribution of supply; M in this sense *precedes* X. The ultimate curb on the nation's standard of consumption is the quasi-equality of X and M because unfortunately other nations will give us credit in very limited degree and not for long. When our economic policy statement is "we must export" what we really mean is "we need imports which we must pay for by exports".

Some Remarks on the Balance of Payments

The balance N is, however, meaningful as a financial concept: every payment to normal residents by others is an export and every payment by residents to others is an import. Payments in and out may, in the aggregate over a sufficiently long period, be regarded as equal. From this financial angle there is no qualitative difference between what are regarded as "capital" and "current" items in the balance of payments statement. If one had a complete record of payments and ignored this distinction between "capital" and "current" N would be zero and the difficulty about its deflation would disappear because N′=0; and stocks and foreign currency have prices just as non-financial goods and services have.

As so often in statistical work, determination of the best procedure leads one inevitably to close analysis of one's basic data, in this case the balance of international payments. We cannot take on trust that the different procedures will yield much the same answer; we can only hope. The whole concept of the trading gain is of great importance in Ireland in view of the relative magnitude of its external trade.

In view of the uncertainty about the calculation of N′, we can, at least, agree that we have an interest in trying to make N as small as possible; in policy-making (i.e. for the future) we may plausibly take N=0 which eliminates the difficulty and unambiguously gives

$$T'=M'-X'=M\left(\frac{1}{p_M}-\frac{1}{p_X}\right) \tag{8.9}$$

from (8.8) since N′=0 and M=X.

A National Price Index

We may write

$$Z'=C'+I'+N', \tag{8.10}$$

where Z′ is the quantum of goods and services in the widest sense acquired by the nation during the year of reference, its element N′ can be positive or negative. The national income=national product =expenditure on goods and services of all kinds at current prices is Y. The *national price index* p_Z is accordingly

$$p_Z=Y/Z'. \tag{8.11}$$

Using (8.4) and (8.8) p can be expressed in a more significant manner than (8.11) as

[19] R. C. Geary, *op. cit.*, footnote 11 and also R. C. Geary and K. G. Forecast, *op. cit.*, footnote 11.

[20] R. C. Geary, "Do-It-Yourself Economics of the Firm", *Productivity Measurement Review*, February 1965.

(8.12) $p_Z = Y/(Y'+T')$.

In the denominator the Y′ is national production relevant to the study of productivity, as defined by (8.4).

The trading gain T′ cannot be ignored. In magnitude it may in its year to year changes be as large as the change in production Y′ itself.[21] Attention to the ancient precept of "buying in the cheapest and selling in the dearest market" in its national application may be as advantageous as improving productivity and may be less expensive in so far as the latter involves extension of tangible capital: the issue is really marketing *v.* productive efficiency. It paradoxically happens that a marked improvement in productivity may, however, be inimical to the terms of trade, for a great increase in a particular export may result in a decrease in export price. Actually a normal manner of distributing the benefits of improved productivity to the whole of mankind should be by reduction of export prices. One may surmise that the loss through the terms of trade (expressed in the negative trading gain) will be comparatively small compared to the profits in greater volume of trade. Except for particular products in particular situations, it seems unlikely that a small country can influence the prices of its imports or exports much: the little, however, may be well worth trying for.

Values of Irish Trading and National Prices

The methodological dispute about the deflation of N has delayed the acceptance of the notion of the trading gain T′ and, in turn, of national accounts at constant prices. R. W. Burge would deflate N (to find N′) by p_X when X>M and by p_M when M>X; J. L. Nicholson favours p_M in every case; S. Fabricant would use some capital price deflator; R. C. Geary would accept any deflator with the formula

(8.13) $p_N = ap_X + bp_M$, $a+b=1$, $a \geqslant 0$, $b \geqslant 0$,

using the single degree of freedom to bring about consistency in terms of trade between sectors of the economy. Later Geary opted for the formula (8.13) with $a=b=\frac{1}{2}$, i.e.

(8.14) $p_N = (p_X+p_M)/2$.

The various concepts are discussed in the literature.[22]

It was a pity that no one thought of investigating the effects of the different concepts on the statistical results. This deficiency is now remedied by reference to recent Irish macro data. Formulae for T′, using three formulae for p_N and (8.8), are as follows:

Formula	p_n	T′
A	p_M	$X(p_X-p_M)/p_Xp_M$
B	$(p_X+p_M)/2$	$(X'+M')(p_X-p_M)/(p_X+p_M)$
C	1	$X(p_X-1)/p_X - M(p_M-1)/p_M$

T_A is formally Nicholson's position and *de facto* that of Burge as applied to Ireland where a positive import excess is almost endemic. T_B is based on Geary's formula (8.14) above. Taking p_N as unity as at C implies that net external investment N in any year is money and the formula might be regarded as representing Fabricant's position in an extreme form.

The results are shown in the following table.

TABLE 23: ESTIMATES OF THE TRADING GAIN T′ FOR IRELAND IN EACH PAIR OF CONSECUTIVE YEARS 1958–59 TO 1963–64

£ million

Year		Value of T′ using formula—		
Base	Current	A	B	C
1958	1959	8·8	9·0	9·0
1959	1960	−5·7	−5·7	−5·7
1960	1961	−2·3	−2·3	−2·3
1961	1962	5·4	5·5	5·3
1962	1963	1·1	1·1	0·7
1963	1964	17·2	17·9	16·7

Basic Source: NIE 1964.

There is no significant difference between the figures in the three columns over a testing period in which every kind of aberration in relative prices and in the net external deficit is encountered. These results are reassuring especially having regard to the uses to which T′, in particular, will be put, the determination of the "true" national price level and the permissible level of non-inflationary incomes. It does not really matter what "reasonable" price deflator one uses for current net external investment N. The trading gain T′ is of the same order of magnitude as year to year changes in real GNP (i.e. Y′) and the virtual ignoring of this factor in appraisals of the economic level and trend is hazardous.

Prices in the National Accounts

If within the framework of the national income accounts one desired, *ab initio*, and without reference

[21] P. Deane (ed.) *Studies in Social and Financial Accounting*, Income and Wealth Series IX, (International Association for Research in Income and Wealth, London 1961); see also Table 25.

[22] P. Deane, *op. cit.*, footnote 21.

to the terms of trade, to derive the most comprehensive internal price index possible, it would unquestionably be that of national expenditure p_E, the deflator for the flows of consumption (personal and government) and gross capital formation (fixed and changes in stocks) in the aggregate, so that p_E may be written

$$(8.15) \qquad p_E=(C+I)/(C'+I').$$

Table 24 shows the values of p_E together with those of p_Y and p_Z previously encountered, on a year to year basis and, as regards p_E and p_Z to the fixed base 1958 as 100.

TABLE 24: NATIONAL ACCOUNTS PRICE INDEX NUMBERS, IRELAND, 1947–1964

Year	Previous year as 100			1958 as 100	
	$100p_E$	$100p_Z$	$100p_Y$	$100p_E$	$100p_Z$
1947	—	—	—	63·2	68·1
1948	103·5	103·5	106·0	70·6	70·5
1949	99·9	100·0	101·7	70·6	70·5
1950	102·5	102·4	100·7	72·3	72·2
1951	108·3	107·2	103·5	78·3	77·4
1952	107·1	108·5	110·3	83·9	83·9
1953	104·0	103·8	107·1	87·2	87·1
1954	100·1	100·1	99·5	87·3	87·3
1955	102·6	102·5	102·4	89·6	89·5
1956	103·6	103·7	102·5	92·8	92·8
1957	104·2	103·9	102·9	96·6	96·4
1958	103·5	103·7	106·5	100·0	100·0
1959	100·1	100·1	101·6	100·1	101·1
1960	101·1	101·2	100·3	101·3	101·3
1961	102·9	102·9	102·6	104·2	104·3
1962	103·6	103·8	104·5	108·0	108·2
1963	102·2	102·3	102·4	110·3	110·8
1964	107·1	107·4	109·6	118·1	118·9

Basic Sources: NIE, 1962, 1964.

From Table 24 the practical identity of the showing of p_E and p_Z will be noted. It would, of course, be easy to dismiss this phenomenon as arithmetical: both indexes have very largely the same arithmetical content. There is, however, much more to it than this. As regards arithmetical content, the same remark might be made about p_Y, yet its year to year showing will be seen to be quite different from that of p_E and p_Z. For instance the latter both show a rise of 7 per cent. compared with 10 per cent. by p_Y between 1963 and 1964. The index p_Y, though *formally* the derived price index for gross national product at market prices, Y, is an unreliable index of the global trend of prices.

The quasi-identity of p_E and p_Z is, to the writers, very satisfactory in its revealing the real role of T', the trading gain, in the economy. If p_E represents the "true" global trend of prices and, therefore, the valid deflator for Y, the quotient Y/p_E is not Y' as defined by (8.4) but (Y'+T') (cf. (8.12)) the real product of the nation. Of course, p_E and p_Z are not algebraically identical. A little algebra shows that, to make them so, it would be necessary to take p_N, the element about which controversy has raged, as equal to p_Z, so that we would formally have

$$(8.16) \qquad p_N=p_Z=p_E.$$

To state that p_E is the most comprehensive index in the national accounts system implies that it can be legitimately used to deflate Y. The deflated value will be the quantum of goods (capital and current) and services obtainable by the expenditure of income Y. We therefore write:

$$(8.17) \qquad Y/p_E=Y'+T''$$

defining T'' in this way. Hence

$$(8.18) \qquad T''=Y/p_E-Y'.$$

The values of T' and T'' are compared in Table 25.

TABLE 25: COMPARISON OF ESTIMATES OF THE TRADING GAIN T' AND T'' FOR IRELAND 1948–64, WITH PREVIOUS YEAR AS BASE YEAR

£ million

Year	T'	T''
1948	8·3	8·3
1949	6·8	7·1
1950	−6·7	−7·3
1951	−14·0	−17·7
1952	7·4	13·1
1953	15·6	14·7
1954	−3·2	−2·9
1955	−0·7	−1·2
1956	−6·5	−5·8
1957	−5·8	−7·0
1958	15·0	14·6
1959	9·0	9·0
1960	−5·7	−5·5
1961	−2·3	−1·9
1962	5·5	6·4
1963	1·1	1·9
1964	18	20

Basic Sources: NIE, 1962, 1964.

As might be expected from the closeness of p_Z and p_E, there is, on the whole, an excellent correspondence between T' and T''. Formula (8.17) shows what T'' (and therefore T') is: it is the increment of purchasing power over and above the real national product Y'. The writers, however, prefer p_Z to p_E as the proper deflator for Y, i.e. the national price index for its entire consistency with the external account at constant prices (8.8). Furthermore, as we have seen, the value of T', depending only on the value of N', is, from Table 23, almost invariant to the deflator used for N, normally a small value. On the other hand, T'', from formula (8.18), is virtually

the small difference between two large aggregates and is consequently suspect arithmetically.

The significance of the derivation of T″, via formulae (8.15) and (8.18), lies in its having been determined without explicit reference to the external account. T′ (or T″) is therefore an element in the material welfare of the nation as tangible as any other element and should be taken into account in particular in the determination of the money level of incomes which can be paid without inflation.

9. SOME REMARKS ON INDEX NUMBER MAKING WITH SPECIAL REFERENCE TO THE QUALITY PROBLEM

Some remarks here on the methodology of price index number making may not be out of place. It will be evident that, for us, V=PQ is an identity, implying that, however the price and quantum indexes are calculated, they must be reconciled as a product with V, value, the only element in the identity of which, truth to say, we are sure. The identity implies that a price index number is conceivable only as a deflator of a well-defined value flow. In making a price index number P the possible derivation of Q should always be borne in mind; more and more analysts are coming to realise that the Q should not only be conceivable, but actually be calculated. The various CSO price indexes conform with the flow principle, thus the CPI, agricultural output and input prices (or unit values), the whole WP series of 10 indexes and the sub-indexes. It is only very rarely, however, that official statistical services supply the Q corresponding to the index P, or *vice versa*, consistent with V=PQ. Nearly always one is given P or Q. It would appear to be an easy matter for the statistical authorities to give both P and Q in most cases where they make themselves responsible for either.

We have made it clear that, given V, value, and Q, quantity, we prefer to use P as V/Q than any price index constructed as such: for instance, we prefer, as a general retail price index, the *NIE* quotient for personal expenditure on consumers' goods and services to the official CPI, for all the sacro-sanctity of the latter, and the Irish index is a very good index of its kind. Actually the two series on an annual basis compare very well; comparisons for some other pairs of price indexes are not so good: we later give an important instance of the price of output for the construction industry. Of course there is no suggestion of abandoning CPI in favour of a V/Q figure derived from the national accounts: at present these are available only at annual intervals, which is far too infrequent for CPI purposes, and are much out of date. Mainly for wage escalation purposes the CPI are required at quarterly intervals, and promptly. We suggest that the weighting of CPI be constantly brought up to data *pari passu* with the national expenditure data. This would certainly have the effect of bringing CPI into closer conformity with the corresponding national account derived figure.

When, consequent on the new household budget inquiry, now in process, a revised CPI is issued we hope that the indexes will relate to the whole month of reference and not to a single mid-month day. It would appear that this change can readily be effected by staggering area-wise the quarterly collection of prices of commodities and services throughout the month. As a result of the price quotations relating to a particular day, some of the national average prices (even though based on large numbers of quotations), notably of vegetables, behave in an aberrant way from quarter to quarter. We believe that average monthly prices would be more regular in their behaviour.

In order that there should be consistency between prices and quanta throughout the economic system it is highly desirable that, as far as possible, the basic statistical information should come from the same sources. It is hoped that when the WP system is being revised this suggestion will be considered. Would it not be possible to arrange that the WP correspondents should all be representative of the larger industrial concerns, importers, etc.? We know that in Ireland, some effect is given to this desideratum; it should be made systematic.

We consider that official statistics, in the P and Q index number systems, especially when these are annual figures, should supply figures to previous year as 100. The majority of users of index numbers are interested only in recent percentage changes and should be facilitated. Even if the series has a given year base (e.g. 1953 as 100) the indexes should be constructed on the link relative principle with up to date weights. This method is widely used in CSO. Of course, it is customary to calculate year to year changes from fixed base-weighted Laspeyres indexes. We should recognise what we are doing: we are stating that the year to year percentage change is so-and-so when the basic pattern of expenditure is that of 10 or 15 years ago. Especially when the percentage change is small, this inference usually puts a severe strain on that misused

principle "the weighting doesn't matter". Weighting of all index numbers should be kept up to date according to the latest information available as to consumption, etc., habits. The link relative method, with up-to-date weights, can be made to subserve both ends, namely reliability (i) as a fixed-base figure, and (ii) as showing year-to-year changes. It is only when one has to graft commodities in or out that the link relative method has its hazards, but then no method is quite satisfactory, as regards grafting. A situation can arise in which a commodity practically vanishes (and is therefore left out of the index calculation) and returns perhaps years later (to be included). The link relative and normal grafting procedures would imply that the commodity temporarily excluded has not changed in price during its period of exclusion; and this may be far from being the case. There were many such instances in Ireland during World War II, notably coal. One must be very sceptical of an index number when the number base is remote. All CSO indexes have now a post-war base. Researchers who want to survey a long term of years must use linked index series at their own risk.

Before making our own contribution to the quality problem in its relation to the making of price index numbers we should remark that index number practitioners are wont to distinguish between what are termed *unit value indexes* and *price indexes.* Unit value indexes are constructed for economic flows in which it is customary to state both quantity (Q) and current value (V) in relation to the constituent commodities. It usually happens that both these data are available for a high percentage (say 90 per cent) of the big flows so that the accuracy of the index is not compromised either by omitting the commodities in regard to which value only is stated or making some reasonable assumption about the price trend of the "value only" commodities; the latter procedure is to be preferred since it usually is known that this residual part has a different price trend from the larger part for which both V and Q are known. For the purpose of the discussion the unit value coverage is therefore assumed to be 100 per cent.

The unit value indexes are therefore a by-product of certain series of official statistics, compiled primarily for other purposes. While the official commodity lists of the major commodity flows may contain thousands of items, these descriptions usually are too generalised to furnish "prices" in the sense that businessmen and consumers understand the term. It would never be practical to compile official statistics in the detail required for the conduct of business: hundreds of thousands of rubrics would be necessary. Price index numbers, however, contemplate "prices" in this sense. We therefore speak of *commodities* as the items described in official statistics and *varieties* (of each commodity) as the description which is meaningful from the pricing point of view. Thus import and industrial production statistics will state number (i.e. quantity) of refrigerators; "refrigerator" is the commodity description. The "variety" description may specify name of maker, capacity and other precise attributes in relation to prices. In making a price index number (typically the Irish WPI system) it is customary to use a sample of variety prices. Price index numbers to a fixed base are calculated for each variety, and the simple average of these indexes is taken as the index number for the commodity. Flow indexes are then produced by appropriate base expenditure weighting at the commodity level. The price index derives its prestige from the fact that the precisely defined variety prices are assumed to have all the same qualities at the different points of time to which the price index relates. There can be no such assurance in the case of the unit value index. The variety content at commodity level for most goods can change from time to time. The value per unit at these times relates to different sets of qualities.

Change is of the very essence of economic evolution in time. In consequence, it is impossible to maintain unchanged for an extended period the same varieties of a commodity. The usual practice is to graft in substitute varieties in place of those which fall out; over a few years it can happen that all varieties have changed. During change periods it is usually necessary to assume that the commodity price has moved proportionately as the varieties that remain. There is clearly a possibility of bias (probably downward) during such transition periods, since the new varieties probably have a different price trend from the old. Of course, the lesser the interval of time the lower the bias of this kind, which reinforces our earlier argument in favour of current index numbers to base previous year as 100. Despite the risk of bias it is a wise practice in making price index numbers to use a large number of varieties for each important commodity to provide for fall-out; as a working rule the number of variety quotations might be roughly proportional to the expenditure weight of the commodity. There should be no difficulty in obtaining great numbers of quotations from price lists and time of computation should not be a limiting factor in this computer age.

The impossibility of producing price index numbers in which over a period generally unchanged quality can reasonably be assumed is only one of the reasons why we tend to favour unit value indexes more than do most of our colleagues with practical experience in this field, which is still very far from stating a positive preference for unit value indexes.

It is the great merit of unit values that they cover the whole field and that price, quantity and hence value data come from identical sources—may we, in this connection, refer to our footnoted aphorism.[23] We assume that there is a considerable number of commodities in the flow. We think that unit values of individual commodities should be accorded a prestige in their own right. In our view the commodity description implies a function or use: thus, a suit of clothes, a pound of butter, a typewriter. The statement and consciousness of average unit values of these have some social importance. If at a period in the past socks were all made of wool and nowadays of nylon (say wool socks are extinct) it is meaningful to state and compare the national average retail prices of a pair of socks at the two periods as an element in the cost of living. If at the two times the basic price data are collected at the same outlets one has an added guarantee of comparability. Thus, unit value indexes avoid the "quality problem", as it is normally understood, by defining the quality of goods in terms of function and sales-outlet.

Even when there is no ostensible change between time periods in the variety content for a commodity there may be bias in the average price at commodity level. Even if the variety is specifically described according to many attributes identical at the two times, it is to be assumed that, in general, the variety at the later time has greater utility than at the earlier: this should come about by competition. This remark applies particularly to highly manufactured articles, in which quite simple changes, not implied in the description, may improve the utility. It is a safe inference that price index numbers all have an upward bias, for this reason, and quantum Q a downward bias. No statistical procedure can remove this kind of bias. As an important inference, all the evidence goes to show that the average material welfare (a quantum) has improved over a generation or so to a greater extent than is indicated by any statistical indexes but the bias is not measurable. No price index number, however meticulously computed, is completely reliable, especially over the longer period. There is a diminishing return, therefore, in effort expended in making index numbers.

We are not convinced that stochastic theory has a significant role in assessing limits of error in estimating price index numbers. If the number of quotations is reasonably large the confidence limits of error due to prices sampling are nearly certain to be much smaller than errors which can arise in other ways. Our own empirical rule is to compute both Laspeyres and Paasche indexes whenever this is possible and to regard the "true" index as somewhere between the two figures, on elementary indifference curve considerations: the wider the difference between the figures, the less reliable the index from *any* formula. The Fisher Ideal (the geometric mean of the two) is taken as the estimate of the "true" index.

Building and Construction

In Ireland, as in other countries, this is the largest non-agricultural industry and so merits special attention from the pricing point of view. It also unfortunately happens (in this country as elsewhere) that it is one of the least satisfactory, statistically, from the viewpoint of constructing price and quantity index numbers. It has proved almost impossible to attain adequate coverage for the industry in CIP, despite the devoted and ingenious efforts of the official statisticians.

We confine ourselves here to a *critique* of the official wholesale price index numbers for the industry, a monthly series published quarterly for many years in *ISB*. Table 6 of the series gives an index for prices of materials in the Building industry and the product index is given in Table 9, which pertains to prices of capital goods generally.

The very concept of output price of this industry is beset with difficulties. To determine price one must have a precise notion of the quantum unit, which ordinarily pertains to a single commodity (e.g. a cwt. of creamery butter) or to several commodities combined in fixed quantities, e.g. as in making a Laspeyres price index. In the construction industry, however, the unit is almost inconceivable, since it may be a church, a factory, a road, an office block, a three-room dwelling, each made to different specifications, raising the quality problem (which we deal with later) in its most acute form. There is no special difficulty, fortunately, about stating output in current value; the CIP requirement is "value of work done" in the specified calendar year in the various categories, hospitals, schools, dwellings, etc. which values are meaningfully additive.

We start with the percentages of gross output in the familiar categories (i) materials (including fuel etc.) (ii), employee compensation and (iii) "remainder" (profit and non-factor costs other than materials). The results are shown in Table 26 for the years 1953–1964.

The percentages in Table 26 are derived on two bases (i) including payments to other firms for work done (columns 2–4) and (ii) excluding this item (columns 5–7).[24] Exclusion implies that such receipts were from other firms in the construction industry so that series (ii), in excluding intra-transactions as far as possible, is in accordance with the principle that, for the valid construction of price

[23]See footnote 12.

[24]We are indebted to T. P. Linehan for this suggestion.

TABLE 26: PERCENTAGES OF GROSS OUTPUT OF THE BUILDING AND CONSTRUCTION INDUSTRY IN THREE CATEGORIES OF COST, 1953–64

Year	Percentage of gross output—					
	(i) *including* payment to other firms for work done			(ii) *excluding* payment to other firms for work done		
	Materials, etc.	Employee compensation	Remainder	Materials, etc.	Employee compensation	Remainder
1	2	3	4	5	6	7
1953	50	37	14	45·9	39·5	14·6
1954	52	36	12	47·7	39·2	13·1
1955	52	37	12	47·5	39·8	12·7
1956	51	36	13	46·4	39·6	14·0
1957	50	37	13	45·2	40·6	14·2
1958	49	35	16	44·8	38·1	17·1
1959	50	35	15	45·4	38·5	16·1
1960	54	35	11	48·2	39·1	12·7
1961	53	35	12	47·6	38·8	13·6
1962	54	34	12	46·8	39·7	13·5
1963	54	33	14	45·5	38·4	16·1
1964	54	33	13	45·1	39·0	15·9

index numbers on the flow principle, one should regard the section of the economy (in this case the construction industry) as if it were a single transacting unit, selling and buying. We are confronted with the difficulty, however, that there is a considerable discrepancy between what firms included in CIP state that they paid out to other firms for work done and the amounts stated to be received; of course, if the coverage of CIP were complete and if the sub-contractors were all in the industry, receipts and payments in aggregate would be identical. As it is, payments by CIP firms are greatly in excess of receipts which is quite consistent with CIP firms being predominantly the larger firms. We decided to use the larger payments deduction (from gross output and materials, etc. to keep net output intact), justifying ourselves on the very satisfactory showing of the series (ii) percentages in Table 26. This item has greatly increased in recent years, in fact from £1.8 million in 1953 to £6.6 million in 1963.

Despite the fact that the tendering procedure may impart an element of competition in prices to this industry, the universal practice in pricing appears to be cost-plus, which should result in a quasi-constancy at least to the profit element and therefore to the remainder percentages (columns 4 and 7). As it happens, these are relatively the least stable throughout the period, ranging from 11 to 16 for series (i) and from 13 to 17 in series (ii). The quasi-constancy of the series (ii) percentages, quite devoid of trend, is surely quite remarkable, having regard especially to the great changes in gross output during the period—only £19 million in 1957 and £44 million in 1963: for materials the phenomenon of larger figures in the period 1960–1963, compared with the earlier years, is entirely absent from the series (ii) percentages. The considerable improvement in constancy resulting from "exclusion" in columns 5 and 6, compared with columns 2 and 3 respectively, will be noted.

Because of the difficulties mentioned above of basing estimates of volume or quantum for the construction industry on the categories of gross output, as in the case of nearly all transportable goods industry, output volume is based exclusively on quantities of input, i.e. cement, timber, etc. most of which are specific and priceable. This implies no change in the volume of materials per unit of output. This assumption deserves a critical investigation because of the changing structure of the building industry, and the increasing tendency to have materials made available in a prepared form. Knowing the volume and value indexes, we are now in a position to derive price indexes as $P=V/Q$. The data are given in Table 27.

Let X and x be index numbers (base unity) of gross output and materials respectively, currently valued; p_x is the price index of materials. Then volume Q (according to the official formula) is given by:—

$$(9.1) \qquad Q=x/p_x.$$

But the implicit price index P of gross output is:—

$$(9.2) \qquad \begin{aligned} P&=X/Q \\ &=p_xX/x, \end{aligned}$$

from (9.1). But, from Table 26, we are entitled to assume empirically that (bearing in mind that X and x are index numbers) $X=x$; whence, from (9.2), $P=p_x$. Of course, in practice, it would be imprudent to conclude that in all circumstances the price of output equals price of material input; at this stage we suggest only that the two price index numbers cannot be widely different.

TABLE 27: PRICE INDEX NUMBERS (1953 AS 100) OF PRODUCT AND MATERIALS IN THE BUILDING AND CONSTRUCTION INDUSTRY, 1953–1965, FROM DIFFERENT SOURCES

Year	Gross output			Wholesale price for B & C ind'y P	Employment	Labour productivity, π	Corrected W P index for B & C ind'y, P'	Price of materials	
	Value	Volume	Implicit price					Implicit CIP	Wholesale price
1	2	3	4	5	6	7	8	9	10
1953	100	100	100	100	100	100	100	100	100
1954	101·7	112·6	90·3	97·9	100·9	111·6	93·2	93·9	96·6
1955	100·9	105·4	95·7	100·3	98·9	106·6	97·4	98·9	98·6
1956	94·8	91·3	103·8	106·7	89·4	102·2	105·6	104·9	105·6
1957	70·2	62·9	111·6	111·5	65·2	96·4	113·4	109·9	111·9
1958	79·2	72·6	109·1	113·5	65·0	111·7	108·0	106·4	112·5
1959	84·1	77·7	108·2	111·3	67·0	115·9	104·0	107·0	108·0
1960	90·4	87·0	103·9	114·5	69·3	125·5	103·3	109·1	109·5
1961	104·8	100·7	104·1	119·1	74·9	134·5	104·0	107·9	112·0
1962	123·7	115·9	106·7	125·4	82·5	140·4	107·2	108·8	114·7
1963	150·3	136·4	110·2	126·5	91·9	148·4	105·6	109·2	115·0
1964	170·7	147·2	116·0	136·2	94·4	155·9	110·6	113·9	119·3
1965	(a)	(a)	(a)	140·3	(a)	(a)	(a)	(a)	122·9

(a) not available.
Basic Source: ISB

Notes:

Col. 2: Value excludes amount paid for work given out.
„ 3: Official CIP figures.
„ 4: Quotient (x 100) col. 2 /col. 3.
„ 5: Official. Table 9, wholesale price series.
„ 6: Based on official CIP average numbers engaged.
„ 7: Quotient (x 100) col. 3/col. 6.
„ 8: Formula (9.3) and cols. 5 and 7. x_0 was taken as 0·5426 the proportion borne on average by materials in materials plus employee compensation, CIP 1953–63.
„ 9: Quotient (x 100) index CIP value of materials (excluding amount paid for work given out) by col. 3.
„ 10: Official. Table 6, wholesale price series.

We may state at once our opinion that, in the present state of knowledge, CSO is right in basing estimates of quantum output on volume of material input. Attention should be given, however, to the problem of estimating volume output directly, i.e. from the gross output categories themselves. This industry is an important contributor to gross capital formation, in regard to which reasonably accurate quantum data are essential.

As regards product prices (P) the official formula for current monthly index numbers is a Laspeyres

$$(9.3) \qquad P = p_x x_0 + p_w w_0,$$

where x_0 and w_0 are proportionately value of materials and employee compensation respectively in the base year, p_x and p_w being the current indexes (to base unity) for price of materials and standard rate of wages per hour. Since all indexes are unity in the base year,

$$(9.4) \qquad 1 = x_0 + w_0.$$

Let us consider the underlying logic of the Laspeyres formula in its relation to this industry. In general, the formula states the current cost of a complex of given quantities of goods and services, which cost 100 (usually) or, in our case, unity in the base year. Formula (9.3) states that the fixed cost elements taken into account for pricing the construction industry are so many tons of cement, so many square feet of timber etc. and so many hours of labour. Our point is that the assumption of fixity of hours of labour is, as we shall see, invalid. Fewer hours of labour applied to materials are now required to produce a given piece of construction, compared with the base year. In a word, labour productivity has increased, and increased considerably, in this industry. As an example, suppose that two houses, identical in every detail, are built in the base and current period. The total cost of the base year house was unity (apart from overheads), of which (say) 0.6 ($=x_0$) was cost of materials and 0.4 ($=w_0$) was cost of labour. If prices of materials in the current year have increased by 20 per cent. the new cost of materials is 0.72. But if hours of labour applied to the same quota of materials has declined to 2/3—or labour productivity has risen by 50 per cent.—of those in the base year while money wages *per hour* have increased by 50 per cent., clearly the labour cost element in the current year remains 0.4 ($=0.4 \times \frac{2}{3} \times 1.5$), so that the total current cost is 1.12 ($=0.72+0.40$). This is the correct product price index, in this example. Using (9.3) the official—formula (9.3)—figure would be 1.32 ($=0.72+0.4 \times 1.5$).

Within the logic of the official approach the formula should therefore be:

$$P' = x_O p_x + w_O p_w / \pi \tag{9.5}$$

where π is labour productivity which is estimable for the industry from CIP as the quotient of the official figures for quantum output by average number of persons engaged, during the period 1953–1964. All the relevant data are given in Table 27. Our estimates of P′ are derived by working back from the official prices P, using (9.5), with p_x the official material price index (Table 27, column 10).

Formula (9.5) is so important for our purpose that it seems worthwhile showing how it is consistent with the basic identity V=PQ. If, on the cost-plus basis, current value of output (V) is proportional to:—

$$V = x + w,^{25}$$

with, in the base year, as before:—

$$1 = x_O + w_O.$$

By definition, Q, the quantum index based on materials alone, is:—

$$Q = x / x_O p_x.$$

Then, if the labour productivity and hourly wage indexes are π and p_w respectively, and N the index of labour hours,

$$\pi = Q/N = x / x_O N p_x$$
$$p_w = w / w_O N.$$

Hence, on reduction,

$$P' = V/Q = x_O p_x + w_O p_w / \pi$$

which is formula (9.5).

Comparison of columns 5 and 8 of Table 27 shows that the official wholesale price index has been considerably biased upwards, especially during the last few years because of the implicit assumption in the calculation of unchanged productivity throughout the period, whereas, as column 7 indicates, labour productivity π increased very considerably.[26] It is, however, far easier to be critical of the official wholesale price series than to make useful suggestions for their improvement. The series comprises 12 tables pertaining to most of the major flows of the economy (home production for personal consumption, imports, materials for use in all industry etc.) culminating in Table 12, termed the "general" wholesale price index, which shows by commodity groups the prices applicable to the largest flow in the economy, namely of goods available for home consumption, capital formation and exports. All the indexes are Laspeyres-type, the basic weighting diagram being values of commodities in 1950. Literally thousands of price quotations are used and these have to be separately weighted for each table. The series is a monthly one.

Of course if the weights could be kept reasonably up-to-date (as in the case of agricultural price indexes and other) the statistical reliability would be greatly improved. Up-to-dateness in weighting, however, using formula (9.3) will not give a correct index. Formula (9.5) should be used even with the year to year link relative method, for the construction and any other industries in which employee compensation is an element in weighting. There are two major difficulties here (i) the CIP, on which the weighting is largely based, is nearly 3 years out of date and (ii) even with the data available the construction of the weighting diagrams for the 12 tables is a most formidable task.

In the case of the construction industry, however, the materials plus employee compensation weighting base might be retained. Labour productivity should be taken into account, so that, in effect, the wage index would not be per hour but per unit of output. Productivity data, sufficiently accurate for price index making, should be currently estimable, even by extrapolation of the latest available CIP trend. So the weights would be changed from year to year.

While the indexes in columns 4, 5 and 8 of Table 27 all purport to relate to price of product in the construction industry, it is not seriously suggested that the column 4 series can ever be used for current WP index purposes: it is available only at annual intervals, and is very belated. It should, however, be used systematically as a retrospective check on the current WP series with the ultimate objective of making all the official series of indexes, pertaining to prices, quantum, earnings and productivity, mutually consistent.

In the interest of improved consistency in these series and, of course, for the value of such statistics in themselves, consideration might be given to providing quarterly data for service-type industries (construction, electricity etc.) on quantum output, earnings, employment and hours worked, exactly on the lines of the invaluable Quarterly Industrial Inquiry which now covers TG industries only.

[25] x here is not to be confused with the same symbol in (9.1) and (9.2).

[26] It should be noted that our *critique* concentrates on the omission of labour productivity from the calculation. However, allowance should also be made for possible changes in the quality of material inputs, and if this were done, it may be that the wholesale price series for the industry would be less biased. As an analysis of quality change is presented in the following subsection, no attempt was made to take account of it here.

Two additional series of price indexes are provided (columns 9–10, Table 27) purporting to compare a unit value index (column 9) with a "true" wholesale price index. The latter is a Laspeyres, whereas the unit value is a year-to-year Fisher Ideal. From 1961 on, the implicit CIP index seems to be systematically lower than the wholesale index. We do not know if this is due to the wholesale price weighting getting out of date, or because of the difference between unit value trends (necessarily ignoring quality changes in the different materials) and wholesale prices which have fairly close regard to such changes in using price quotations for many varieties of the materials. The latter should not be a large factor in the discrepancy since the more important building materials are fairly specific. Certainly if the unit values, in statistical quality, are equal to (or better than) the wholesale price quotations the implicit CIP prices (column 9) are to be preferred to those of column 10 because the weighting of the former is up to date. The official material price indexes (column 10) have been biased upwards in the last few years, probably because of the remoteness of the weighting base.

The revealed upward bias in construction product price sheds a certain amount of light on a curious phenomenon which has become apparent in recent years, namely the tendency for "more elaborately transformed products" to increase more in prices than the other two stage of production price categories used "Crude products" and "Simply transformed products". The indexes for certain years are shown in Table 28.

TABLE 28: GENERAL WHOLESALE PRICE INDEX NUMBERS IN STAGE OF PRODUCTION CATEGORIES

Base 1953 as 100

Stage of Production	1955	1958	1963	1964	1965
1. Crude products	109·2	112·0	109·3	121·2	127·7
2. Simply transformed products	96·6	110·4	110·2	113·9	115·1
3. More elaborately transformed products	100·3	114·9	126·3	132·6	137·7
General Index	101·6	113·5	119·8	126·8	131·6

Experience, here and elsewhere, has shown that in the past the more advanced the stage of production of the commodity the less marked the fluctuation in price from time to time. In regard to a particular advanced product the explanation used to be that the factor element was the stabiliser, so that the product price percentage-wise tended to be lower than in the case of its materials. Partly the reason for the exceptional behaviour of stage 3 prices is probably the upward bias in the construction price index,[27] demonstrated above, for construction is, of course, a stage 3 activity. We do not know to what extent this bias affects the stage 3 products or the general index itself. Comparing Tables 8 and 9 of the wholesale price series, i.e. prices of stage 3 industrial goods, with construction prices we find a marked similarity in trend in the period 1953–1965, culminating in an identical figure 140.3 for both in 1965. On the other hand the stage 3 indexes for home production for personal consumption have advanced more than for the other two stages, and building has but a small weight in the personal consumption price index. An explanation of these consumption indexes would be that the factor content of price is ahead of productivity in the economy as a whole. We do not know if this be so, or to what an extent. Our investigation of the construction industry has at least indicated that one must be careful about affirmations with regard to price and productivity, and that the official wholesale price series generally is in need of revision.

The Quality Problem

There has been considerable interest in recent years in the possibility of correcting price quotations for quality changes over time:

> "Consumer price indices should rest in comparisons of identical or equivalent qualities of commodities priced at different times. To ensure that this condition is fulfilled *every possible effort should be made to eliminate the influence of quality changes.*"[28]

In what follows it will be understood that we have in mind price (as distinct from unit value) index number making. In theoretical discussions on price index numbers, it is generally assumed that it is possible to obtain successively over time price quotations for identical goods. As already indicated, this is not always feasible. Most commodities are available in a number of varieties at any given time. Furthermore, the constitution of individual varieties changes over time. These quality disparities may be described as quality differentials and quality changes, respectively. Quality changes in the commodities included in price indexes make it difficult to interpret secular price trends with precision, unless some quantitative allowance is made for the quality change. It is also necessary to quantify quality differentials in order to substitute a new variety into the index computation.

[27]CSO demur in pointing out that the construction industry bias has scarcely any effect on the stage 3 index numbers.

[28]Tenth International Conference of Labour Statisticians, (ILO), Resolution 5, (1); *Report IV* (Geneva, 1962). (Italics ours.)

Once the existence of the problem of quality change is explicitly recognised, it becomes necessary to evolve some technique for quantifying the changes. The failure to evolve an acceptable method has been one of the most serious defects of most price indexes because an index may be biased in either direction unless a suitable adjustment is made.[29] The direction of the bias introduced into the price index depends on the direction of the change in the general price level, and also on the nature of the adjustment being made (if any).

In periods of generally rising costs of production, i.e. in periods when prices generally are tending to increase, entrepreneurs may attempt to maintain their prices but reduce the quality of their products. Failure to separate price and quality change would yield an unduly low measure of the price rise under these circumstances. On the other hand, during periods of gradual improvements in quality the price index will tend to be biased upwards; as stated above, we believe this to be of more common occurrence.

If relative prices were accurate indicators of the quality differentials existing at any given time, there would be no problem in computing prices indexes: new varieties could be grafted into the index quite readily. This is rarely possible, however, except in purely competitive markets "when the majority of buyers are informed and able to judge what they buy. In such a case, differences in price can be trusted to reflect differences in quality".[30]

Attention has recently been given to the extent to which consumers regard price as an index of quality.[31] As a result, it seems that consumers may adopt a *range of prices* as a guide to the quality of various varieties, or goods—i.e. they may feel that all goods of a similar type within a price range $p \pm \Delta p$ are of approximately the same quality. Even though the writers felt justified in reporting that "price serves as an indicator of quality with far greater frequency than is generally believed",[32] their results do not give much reason for believing that price is a sufficiently good index of quality for price indexes. Cases like that of the perfume starkly advertised (no doubt having regard to the psychology of givers and receivers of this commodity as a gift) as "the most expensive perfume in the world" are few.

If, then, relative prices are rejected as indicators of quality differentials, some other approach is necessary. One alternative is to define the quality of a good in terms of its physical, measurable attributes. Goods of exactly similar physical characteristics are defined to be of identical quality, regardless of their relative market prices. Differences in relative prices of identical goods are attributed to buyers' imperfect knowledge or to non-quantifiable qualities.

In the preceding paragraphs, the quality problem has been discussed in rather general terms; at the practical level, however, the particular method adopted for specifying the goods selected for inclusion in the index computation determines the precise nature of the problem. In principle, the statistician is faced with the choice of three techniques:—

(i) he may adopt a very broad system of commodity specification; or
(ii) he may adopt a detailed and rigid system of specification; or
(iii) he may elect to follow the price behaviour of one variety of a good and treat it as representative of all available varieties of the good.

If the first is selected, then there is no means of knowing whether or not price-quotations from different reporters are for the same goods, either successively over time, or at any one time; this is like the unit value situation. The question of quality is ignored, and the price index may be biased in either direction.

If, on the other hand, the system of commodity specification is very detailed, the volume of price-recording and calculations will be very large, unless combined with some random sampling method of price-collection: we have already dealt with this aspect. The price used in the index computation for each good is an average of the prices of the varieties available. If one of these varieties disappears from the market, it is necessary to substitute another variety into the index computation. Unless this is done, an average of the remaining varieties may give a misleading measure of price trends.[33]

The difficulties associated with the selection of the third method are similar to those of (ii) above when the variety originally selected is replaced on the market.

Thus, problems of quality arise when, between successive collections of price quotations, one variety disappears from the market, and is replaced by another. This transition may be sudden or gradual.

In the case of sudden transition, the situation envisaged is as follows: variety X alone is on sale at time o at price p_{ox}; variety Y alone is on sale at time 1 at price p_{1y}. The problem is to calculate the price-index for time 1 (I_{o1}). One method is to regard the quotient $p_{1y}/p_{ox}=I_{o1}$ as the index. However, implicit in this is the assumption that X

[29] *The Price Statistics of the Federal Government* (Price Statistics Review Committee of NBER) 1961.
[30] T. Scitovsky, *Welfare and Competition* (Unwin University Books, London) 1963.
[31] A. Gabor and C. W. J. Granger, "Price as an Indicator of Quality—Report of an Enquiry", *Economica*, February 1966.
[32] *Ibid.*
[33] E. von Hofsten, *Price Indexes and Quality Change* (George Allen & Unwin, London), 1952.

and Y are of exactly the same quality, and that there is no need to adjust I_{01} for quality differential between X and Y. If, however, it is possible to describe the quality of X and Y unidimensionally, then we might define g' as follows:

$$g' = \kappa_x / \kappa_y$$

where κ_i is a measure of the quality of i, and κ_x/κ_y is the quality differential between X and Y. If g' is a unique numerical measure of the quality differential, then the index may be defined as

$$I'_{01} = \frac{1}{g'} \cdot \frac{p_{1y}}{p_{0x}}$$

where I' denotes that the index has been adjusted for quality.

It should be noted that the discussion so far presumes that the dropping-out of one variety from the market is the result of market pressures. If, however, the change in varieties is enforced (e.g. by rationing in wartime), it may be desirable from a general welfare point of view to disregard quality disparities. If the consumer has no option but to buy a variety of higher price (and quality) than heretofore, then the price change might be regarded as entirely a pure price change. Von Hofsten, however, would prefer to allow for quality, and defines $I'_{01} = \frac{1}{g'} \cdot \frac{p_{1y}}{p_{0x}}$ in this case also.

The numerical value of I_{01} may differ radically from I'_{01}. For example, the Irish national average price per glass of Irish whiskey was as set out in the following table:

Time	Price	Proof-Strength
1960 February	47·69d.	76°
May	47·69d.	70°

Source: CSO Files.

In this example, $I_{01} = 100$. But if proof-strength is taken as the one significant quality dimension, then

$$g' = \frac{70}{76}, \text{ and } I'_{10} = 1.086.$$

That is, I_{01} shows no change in the price index for Irish whiskey while I'_{01} shows an increase of 8.6 per cent. It should be noted that the CSO use I'_{01} in the computation of the CPI.

This example is rather special: the difference in quality between X and Y was well-known and publicised. To describe whiskey in terms of but one quality characteristic (i.e. proof-strength) is, obviously, a simplification, but may not be too unreasonable. Proof-strength, however, does not seem to be relevant to the quality of other alcoholic drinks, e.g. wines, where non-quantifiable characteristics seem to be most significant.

A more usual problem is that associated with gradual transition, where one variety gradually displaces another on the market, e.g. variety X is available at time 0 at price p_{0x}; variety X and variety Y are available at time 1 at prices p_{1x} p_{1y} respectively; variety Y alone is available at time 2 at price p_{2y}. Here, $I_{02} = \frac{p_{2y}}{p_{0x}}$. This is unsatisfactory since it makes no allowance for the quality differential between X and Y. Frequently, the reaction is to splice the index, defining $I''_{02} = \frac{p_{1x}}{p_{0x}} \cdot \frac{p_{2y}}{p_{1y}}$. This definition implies that $g' = p_{1y}/p_{1x}$ i.e. that the ratio of the prices of Y to X when they were both available adequately measures the quality differential of Y over X. The legitimacy of I''_{02} as a true index depends entirely on whether or not $g' = p_{1y}/p_{1x}$. This may be true in purely competitive markets, but does not necessarily apply in all markets.

The introduction of this factor g', by von Hofsten, is an improvement on the previous splicing technique. It suffers, however, from the serious difficulty, previously mentioned, that it attempts to capture the quality of goods in a single dimension. The Stone-Griliches approach takes the question a step further.

To quantify qualititative change by their technique we require a method of comparing varieties in terms of their qualities that command a price. "In essence, it [the method] consists of viewing a commodity as a bundle of qualities, each one of which contributes (positively or negatively) to the utility or productivity derived from the commodity in question, with many or most of these dimensions or qualities quantifiable. Moreover, since at any point of time it may be possible to observe different 'quality' combinations selling at different prices, one may be able to estimate (impute) the price (value) of these dimensions at the margin".[34] That is, each commodity i may be said to have n qualities λ_{ij} $(j = 1, \ldots, n)$ indicated by n quality indicators γ_{ij} $(j = 1, \ldots, n)$. Using this notation, we may express p_i, the price of i, as a function of λ_{ij} as follows:—

$$(9.1) \qquad p_i = f(\lambda_{ij}), j = 1, \ldots, n$$

from which we may derive

$$(9.2) \qquad dp_i = \sum_j \frac{\partial p_i}{\partial \lambda_{ij}} d\lambda_{ij}$$

[34] Z. Griliches, "Measurement of Price and Quality Changes" *Models of Income Determination* (Studies in Income and Wealth, Vol. 28; Conference on Research in Income and Wealth), 1964, p. 391.

i.e. the change in price of the ith good, which would have occurred if the jth quality indicator λ_{ij} were increased by $d\lambda_{ij}$, *ceteris paribus*, is represented by $(\partial p_i/\partial \lambda_{ij})d\lambda_{ij}$. This dp_i is the hypothetical price increase—the increase that one would expect from the function: the actual price increase, dp_{ia} may be different. Thus, we may write

$$dp_{ia}=dp'_i+dp_i \tag{9.3}$$

where dp'_i is the element of price change unexplained by quality changes, i.e. dp'_i measures the *pure* price change. Thus, this approach offers a method of converting quality changes into corresponding price changes. To do this, some estimate of $dp_i/d\lambda_{ij}$ is needed. This can be obtained once a set of indicators λ_{ij} for the quality characteristics have been selected, and the functional relationship specified in (9.1) obtained by means of cross-section price-specification regressions.

Confining attention, for simplicity, to the linear case, let the expected price per conventional unit p_e be

$$p_e=a+\sum_{j=1}^{n} b_j x_j \tag{9.4}$$

where a and the b_j are regression coefficients and x_j is the quantum of quality j. If the prices per conventional unit in base and current period for varieties are p_o and p_1, for which the known quality quanta are respectively x_{jo} and x_{j1}, $j=1, \ldots, n$, then the corrected price index is clearly:—

$$I'_{01}=\frac{p_1}{p_o g} \tag{9.5}$$

where

$$g=p_{ej}/p_{ej}=(a+\Sigma b_j x_{j1})/(a+\Sigma b_j x_{jo}). \tag{9.6}$$

Obviously the method can be adapted to prices at the commodity level (some kind of average of the variety quotations), provided that the quantum quality content of the commodity is known at the two periods. We may have determined regression (9.4) for base and current periods inevitably finding different sets of regression coefficients for the two periods, in which case two estimates of g, namely g_o and g_1 would become available; exactly as in the case of classical price index theory, g in (9.5) might be taken as the geometric mean of g_o and g_1 which should not be very different in value. Our success in quantifying quality characteristics will be adjudged by the value of R^2 of the regression. The further R^2 recedes from unity the less our confidence that our set of characteristics is that to which purchasers attach significance. We now try to obtain equation (9.4) for motor cars in Ireland in 1966.

The objective now becomes to establish a price index number corrected for quality changes for each commodity. In general multivariate regression analysis will be used, the variables dependent and independent, at any given time, being price per conventional unit—e.g. per yard, per ton, etc.—(dependent) and the n measures of the various qualities of the varieties of the commodity included. These measures (as in our application which follows) may include 1 and 0 for some "dummy" variables: for variables possessing the quality in question, (1); for variables not possessing the quality, (0); this kind of variable may be very useful for the purpose contemplated in relation perhaps to a highly advertised brand name. It is important to note that we accept market valuations on the qualities which may appear irrational from strict logic; for instance, at the present time quantity of material in women's garments is almost certainly negatively correlated with price; at other times the contrary may be true. The value assigned to a given quality may differ from time to time, due to changes in the public taste, and therefore demand.

Quantification of Quality of Motor Cars in Ireland

The dependent variable is the natural log of list prices of new cars as at December 16th, 1966; data for 47 cars were used. The prices are those recommended by the Society of Irish Motor Traders, and refer only to new cars. Details regarding quality specifications are taken from the reviews published in *Motoring Which?* and *Motoring Life*. The independent variables are as follows:—

x_1: engine capacity, measured in 1000 ccs
x_2: engine power, measured in 100 bhp (net)
x_3: economy, measured in hundreds of miles per gallon of petrol

"Dummy" variables were used to quantify other qualities as follows—

x_4: reliability
x_5: handling performance
x_6: interior comfort
x_7: car manufactured by firm F
x_8: car manufactured by firm G

If a particular model of car was explicitly regarded by the motoring press as reliable, then a value of 1 was given to x_4, and the value 0 was given to the rest. A similar approach was adopted for each of the other qualities indicated by dummies.

Strong collinearity was found to exist between[35] some of the independent variables—Table 29. This

[35]We are indebted to Mr. Dermot Harrington, of An Foras Talúntais, for performing the regression computations on the computer of An Foras.

point was also noted in an American study of the same problem.[36] In an attempt to isolate this feature, the 47 observations of car specifications were divided into three groups—A (15 makes) those of engine capacity less than 1100 ccs; B (14 makes) those between 1101 ccs and 1500 ccs; C (18 makes) those between 1501 ccs and 2000 ccs. Correlation coefficients were also calculated for the independent variables in each group.

TABLE 29: CORRELATION COEFFICIENTS BETWEEN THE INDEPENDENT VARIABLES x_1, x_2, x_3, TAKEN IN PAIRS

	x_1, x_2	x_1, x_3	x_2, x_3
Group A	0·91	−0·84	−0·75
Group B	0·38	−0·83	−0·16
Group C	0·83	−0·80	−0·71
All Groups	0·90	−0·83	−0·74

It will be noted that there is a high positive correlation between x_1 (capacity) and x_2 (power) in each case except Group B, and that there is a strong negative correlation between x_1 and x_3 (economy) in all groups. The correlation between x_2 and x_3 is strongly negative except in group B.

Our regression plan envisaged using as regressors (i) variables 1–3, (ii) variables 1–6 and (iii) variables 1–8 for the car groups A, B, C and All. The results are given in Table 30. Regressions are missing for (ii) B and (iii) A and B because in these cases one dummy variable had constant values (0 or 1) throughout the group.

While the R^2's as a group are rather disappointingly low (i.e. the regression formulae do not afford a particularly good representation of the price data) all the equations are overwhelmingly significant[37], except those numbered 6 and 8: with these exceptions the value of R^2 is greater than its 0.5% probability critical value. Equation No. 6 is, however, significant at the 5% probability level. We confine our comment about the coefficients to the six equations, numbered 1, 2, 4, 5, 7, 9, as those with highest R^2 and therefore most useful for representation purposes. The most significant regressor throughout is No. 2—engine power, the coefficient of which is significant at the 5% probability level at least in the case of equations 1, 4, 7 and 9, i.e. in four of the six equations we deem worth consideration; in one of the exceptions, equation 2, both variables 1 and 3 are significant (but not 2).

The coefficients with largest t's are those

[36] *The Price Statistics of the Federal Government*, (Price Statistics Review Committeee of NBER) 1961, p. 180.

[37] By the $F(f_1, f_2) = f_2 R^2 / f_1(1-R^2)$ test; DF's f_1 = number of variables, $f_2 = T - f_1 - 1$, where T is number of observations

TABLE 30: REGRESSION OF LOG CAR PRICES ON SETS OF INDEPENDENT VARIABLES

Equation No.	Group	Constant	Coefficient of—								R^2
			x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	
1	A	6·12	−0·07 (0·37)	1·51 (0·59)	−0·51 (0·66)						·80
2	B	3·21	1·70 (0·35)	−0·13 (0·19)	4·22 (1·24)						·75
3	C	5·68	0·14 (0·18)	0·74 (0·35)	1·75 (2·18)						·59
4	All	6·36	0·22 (0·11)	0·48 (0·19)	−0·70 (0·57)						·79
5	A	5·90	0·08 (0·36)	1·14 (0·57)	−0·30 (0·73)	0·03 (0·07)	0·05 (0·07)	0·13 (0·06)			·88
6	C	5·89	0·07 (0·25)	0·79 (0·47)	0·86 (2·53)	−0·03 (0·19)	0·10 (0·11)	0·09 (0·16)			·63
7	All	6·15	0·16 (0·12)	0·62 (0·23)	−0·58 (0·58)	0·04 (0·07)	0·07 (0·05)	0·09 (0·07)			·81
8	C	6·55	0·13 (0·29)	0·59 (0·73)	−0·45 (2·78)	−0·20 (0·36)	−0·05 (0·17)	0·16 (0·20)	−0·19 (0·29)	−0·23 (0·18)	·70
9	All	6·24	0·17 (0·12)	0·63 (0·22)	−0·78 (0·58)	0·04 (0·07)	0·05 (0·05)	0·10 (0·07)	0·01 (0·07)	−0·14 (0·06)	·83
Parallel— 10	All	6·35 / 6·39 / 6·48	−0·18 (0·11)	0·42 (0·20)	−0·58 (0·59)						·50
11	All	6·15 / 6·17 / 6·27	0·12 (0·12)	0·56 (0·23)	−0·46 (0·60)	0·04 (0·07)	0·07 (0·05)	0·11 (0·07)			·53
12	All	6·18 / 6·23 / 6·29	−0·14 (0·12)	0·58 (0·22)	−0·60 (0·60)	0·04 (0·07)	0·05 (0·05)	0·11 (0·07)	0·03 (0·07)	−0·13 (0·07)	·58

Note: The values in brackets ( ) under the coefficient estimates are estimated standard deviations.

numbered 2 and 6. We are entitled to assume that in this case also No. 2 is significant, if not stochastically so. From equation 9, with its significantly high negative coefficient for variable 2 we infer that given the attributes we have singled out, firm G's cars are cheaper than the general average.

Equation 5 is of considerable statistical interest as having a value of R^2 (namely .88, the highest of the series) significant at the ·01 probability level but none of its six coefficients significant (by the *t*—test) at the ·05 probability level. In a paper (by C. E. V. Leser and R. C. Geary) to be published elsewhere, anomalies of this kind in multivariate regression are examined. Selecting the two variables numbered 2 and 6 with the highest values of *t* in equation 5, 2.0 (=1.14/0.57) and 2.2 respectively we find:

Equation No.	Group	Regression equation	R^2
13	A	$\log P = 5.77 + 1.53x_2 + 0.11x_6$ (0.20) (0.04)	.87

Both coefficients now become significant, that of variable 2 ($t = 7.7$) overwhelmingly so, while variable 6 is *formally* significant at the .02 probability level; of course, classical probability inference can no longer be applied to these data because of *ex post* selection. However, we can have no doubt whatever about the significance of variable 2. Its simple regression (on variable 2 alone) is given (as Equation No. 14) in the following table. For car prices in Group A we have therefore the following values of R^2 (from equations 5, 13 and 14 respectively) .88, .87 and .79, diminishing, of course, because of decreasing numbers (6, 2, 1) of independent variables. Corrected for DF the values of R^2 become $\bar{R}^2 = .79, .85, .77$. We decide that Equation No. 13 is the best regression for car prices in Group A.

Of greater general interest, however, is the fact that so many of the highly publicised attributes we have selected have so little effect on the price of the car; in our six equations with highest R^2, none of the variables 4–7 have coefficients significantly different from zero. We have noted that, for A, C and All, variable 2 is significant; in view of the high intercorrelation between variables 1–3, probably variables 1 or 3 would "explain" the price nearly as well as variable 2. From our results, on their negative side, we infer that prices are influenced to a considerable extent by qualities which we have not been able to identify or, if we can, we are not able to quantify, even using these as dummy variables; we have in mind salesmanship and the like. The regressions using only variable 2 are as follows:—

Equation number	Group	Regression equation	R^2
14	A	$\log P = 5.80 + 1.65x_2$ (0.24)	·79
15	B	$\log P = 6.48 + 0.34x_2$ (0.29)	·10
16	C	$\log P = 6.34 + 0.82x_2$ (0.19)	·57
17	All	$\log P = 6.09 + 1.04x_2$ (0.09)	·73
18	Parallel	$\log P = \begin{cases} 6.16 \\ 6.24 + 0.76x_2 \\ 6.39 \end{cases}$ (0.14)	·41

All the R^2's are significant except for No. 15, as we might expect from No. 2. Comparing the R^2's for Nos. 14 and 16 respectively with Nos. 1 and 3 we observe that the single variable 2 affords as good a representation as do three variables. For quality correction in the price context it may be possible in many other cases to confine attention to a single attribute.

The results are somewhat disappointing for the prospect they offer of correcting prices generally for quality at the commodity level. One would have thought that the motor car would yield more promising results; this was why we selected it for an examination, which, incidentally, proved quite onerous: in a preliminary investigation, other combinations of independent variables were used, but the results were no more satisfactory than those presented here. Still, it would be worthwhile to use engine power for quantifying quality for this commodity.

Before a definite conclusion can be reached about the value of regression methods for quantification of quality, the method must be tried out on other commodities. We do not think that elaborate regressions (i.e. using many characteristics) are likely to yield more accurate results than in one, or at most two, explanatory variables. In cases where a satisfactorily high R^2 is found with many significant variables, recourse might be had to the principal component of the explanatory variables, a single weighted expression for all the characteristics.

10. CONCLUSION

Our principal findings (with some comments) are as follows (table references being understood to include accompanying textual comment):—

1. In all western European countries consumer prices have risen almost continuously since the war; Ireland's rise occupies about a middle position amongst the countries. Consumer prices in Ireland have doubled since 1946 (Tables 1 and 2).

2. There is demonstrably a marked similarity between the quarterly movements in the CPI in

Ireland and the U.K. since the war except at the beginning and end of the period. From 1964 on, Irish prices have moved above their post-war linear logarithmic trend while U.K. prices are below their trend (Charts 2 and 3, Tables 2 and 3). In statistical terms we would like to explain the trend lines in Chart 3, apart from the deviations from trend. Statistical analysis (including changes from period to period), even when it aspires to the determination of significant cause-effect relationship, seems to bypass this problem; analysis tends to explain the ripples without touching the ground-swell, when the causes of each may be quite different. Closeness of trade and other relations between the two countries would be a sufficient explanation of the similarity. If we are seeking cause-effect relationships, the U.K. level and trend must predominate as the cause, as U.K. is so much the larger country. We in Ireland must therefore hope that present efforts to contain prices and incomes in the U.K. will be successful. Of course, similarity in price movement may be due to common causes affecting prices similarly in both countries. The distinction is less important, however, than the fact, from our point of view, at any rate.[38]

The marked tendency for prices to advance more in Ireland than in the U.K. during the past two or three years is therefore a matter of serious moment.

3. In 1965 (compared with 1953) prices of drink and tobacco and services (for which special indexes were computed) included in CPI have increased much more than the general average, and clothing and consumer durables less (Table 4). Isolating indirect taxes in specially computed indexes it is found that (i) rates and (ii) taxes on drink, tobacco and petrol have increased by twice as much as CPI excluding these items (Table 5). Increased taxation seems likely to be one of the more proximate sources or symptoms of inflation in the near future (because of the direct and immediate effect on CPI).

4. The post-war upward trend of the CPI in Ireland has been characterised by a series of *pause* periods of 3 or more consecutive quarters occurring at more or less regular intervals after which the index takes off steeply again (Chart 2). There is a marked tendency for the same commodities to act as leaders throughout the whole post-war period in magnitude of price rise between consecutive pause periods.

[38]From the point of view of policy, the distinction may be of some importance. If prices here rise inexorably because prices in Britain rise, then attempts to improve our relative competitiveness are doomed to failure. If, on the other hand, our price increases are due, in part at least, to domestic factors, then these factors can be controlled, if it is known how they operate. Even if prices here do eventually rise because British prices rise, it is still important to know how this happens, and whether there is any means by which the timing of the "inevitable" increase in prices can be affected: the postponement of price increases is a good second best policy, since it would give us a competitive edge, even if only temporarily.

5. An examination of retail price changes in two periods (i) 1953–1965 and (ii) 1963–1965 in the approximately 200 individual items included in CPI on frequency distribution lines for both raw and logarithmic data shows that the raw data are highly skewed but the log data are not significantly assymetrical. The log data are, however, significantly non-normal. There is a fairly marked tendency in 1963–1965 for individual prices to rise by much the same percentages (Tables 6 and 7). The same phenomenon is a feature of the implicit price rises in the 42 transportable goods industries in the interval 1955–1963 (Table 9).

6. As regards agriculture, attention is confined to a single aspect; the terms of trade of transactions between farmers and the rest of the economy during the period 1953–1965. Over the whole period farmers were losers but in the aggregate were nearly fully compensated by income-like subsidies of £14½ million other than those on costs (Tables 11, A3 and A4).

7. As an application of the identity $W=\pi P$ where W=factor income per head, π=productivity and P=price per unit of the factor service (all index numbers), the Irish economy was regarded in two major sectors, (i) agriculture etc. and (ii) the rest. While in 1965 compared with 1953, π was much the same, the increase in W was much lower for (i), as a result of P being correspondingly lower (Table 11) for agriculture.

8. In 1965 compared with 1953 retail prices have advanced more than wholesale prices, an inference drawn from similarly weighted price indexes. The disparity results in a significant increase in the retail margin mark-up in the last two or three years (Table 13).

9. During the period 1956–1960 (the only period for which the calculation could be made) the rise in productivity in the retail sector was appreciable but very considerably less than in the case of TG industries (Table 13). During this period productivity declined in food, drink, tobacco businesses but improved markedly in drapery and clothing (Table 14).

10. Using a very simplified summary version of the Irish 1960 IO Table (Table 15) the ultimate effect of rises of 10 per cent. in each primary input on the gross output prices of the three major sectors of the economy, and on consumer prices, is indicated (Table 16).

11. The IO approach, as applied to the household expenditure column of final demand, was used to show that in 1964 (compared with 1953) the unit cost of the service of distribution from producer to consumer had advanced considerably more than the general average of consumer prices. This

phenomenon of increasing price of these services began some time later than 1958, when it was inappreciable (Table 17).

We also regard as demonstrated the fact that prices of services have risen more than the general average. Services, perhaps of their nature, cannot increase productivity in the same degree as in agriculture and industry and yet the income increases they have enjoyed are at least as great as in the other sectors; furthermore services are largely immune from external competition and so are in a better position to command their price.

12. A tentative investigation suggests that in the non-agricultural sector since 1962 the percentage increase in the annual rate of return on capital has been much less than in hourly earnings in TG industry (Table 19).

13. The remarkable constancy of the proportion borne by profits etc. as a percentage of total factor income in non-agriculture is demonstrated (Table 22). We are less sure of the reason for this phenomenon than of the fact of it, but we surmise that it is due to the practice of fixing price as cost *plus* a fixed percentage and, by and large, sellers generally getting their price. This is nothing like the postulated theory of competition in a free market, with its demand price as well as supply price. The manner of price formation is an important aspect of our problem which we have not been able to examine but we consider well worthy of investigation. In more precise terms the problem might be formulated:—

(*a*) to investigate how offering prices are determined over a wide range of product;

(*b*) at what net price were products sold, i.e. net of discounts, trading-in price etc.?

14. As a contribution to the topical problem of price deflation of national accounts, it is shown, by reference to Irish data in the period 1958-1963, that the price index used for the deflation of the net external balance N has very little effect on the estimate of T′, the (constant price) value of the gain from the terms of trade (Table 23). It is also shown how T″ is related to the external price level, from which there emerges an increment (due solely to relative price movements) T‴ which during the period 1948-1964 was nearly equal to T′.

15. From concordance between official volume of output and WP indexes for the construction industry in recent years it is found that the latter indexes are considerably overestimated. There has been a marked rise in productivity in this industry not taken into account in computing WP (Tables 27 and 28).

We also make various suggestions with regard to the calculation of official index numbers including:—

(i) the weighting of CPI should be kept up to date;

(ii) the quarterly average prices used for CPI should be average prices for the month of reference, instead of averages for a particular day in the month, as at present;

(iii) a valid price index should always be conceived as the deflator of a (value) flow;

(iv) wherever a price *or* volume index is given, the official statistical service should provide both;

(v) steps should be taken to reconcile as intimately as possible the implicit or explicit price and volume indexes in official statistics;

(vi) index numbers should be provided explicitly on the basis of previous year as 100, which implies that we strongly favour the link relative type of index for fixed base-weighted indexes; this method is already widely used by CSO.

16. Special attention is given to the problem of quantification of quality changes in time, with a view to the calculation of unbiased index numbers. We apply the regression method to car prices in Ireland, concluding therefrom that quantification of quality changes seems to have limited usefulness in practical index number making.

This paper is largely a statistical document in which the economic and social comment has been slight. Statistics have their traditional role, namely, that of showing in figures what has occurred. We leave discussion of our findings to others. We have left to others also the development of what is ordinarily understood as the econometric approach (specifically designed to establish cause-effect relationships between prices and other economic phenomena), regarding ourselves as dispensed at this stage from this task by the recent thoroughgoing researches of our colleagues C. St. J. OHerlihy and K. Cowling.[39] We have tried to make prices central in this work.

We started this research to try to prove or disprove (or even qualify) by statistical methods the thesis, in the Irish context, that rising prices are a

[39]C. St. J. OHerlihy, *A Statistical Study of Wages, Prices and Employment in the Irish Manufacturing Sector* (ERI Paper No. 29), January 1966· and K. Cowling, *Determinants of Wage Inflation in Ireland* (ERI Paper No. 31), May 1966.

necessary condition for economic advance, while recognising its relevance in all advanced economies in modern times. We have not succeeded in proving it statistically, but believe it to be true, in the main. We have even begun to doubt if, indeed, it requires statistical verification, except to qualify it. In the first draft, we discussed this at length, its causes and social effects, but decided to eliminate the section as out of tone with the rest of the paper.

Table A2 represents one of our efforts to cope with the aforementioned affirmation. We place the table, and Chart 6 based on it, on record for the use of students. The Chart shows that, in the U.K., during the last half of the 19th century, prodigious economic advance was accompanied by generally falling prices. In the century before World War II increasing prices were not always a concomitant of economic advance.

Some means must be found for achieving economic advance without generally rising prices; as a personal viewpoint, we would willingly contemplate a lower (quantum) rate of GNP *per caput* than at present planned (without reference to prices) if thereby stable prices could be ensured. In advanced economies, generally rising prices are evils to be eradicated. Rising prices sap the moral fibre of the community by endowing some individuals with unmerited gains and by reducing the standard of living of the lower and constant income classes, unless compensated for by a policy of income redistribution, entailing high rates of taxation. Rising prices threaten internal peace because they promote labour troubles, and external peace because of the danger of a deterioration in the terms of trade between economically advanced and less advanced countries.

We are impressed by the strength of the great post-war upsurge of prices (little affected, be it noted, by booms and depressions). Observation suggests that most common attitudes and actions are conducive to rising prices. Increases in real income stimulate man's insatiable desire for more: only by securing a higher income can his potential demand become effective. Because we would all like more (if it were not for the constraint of income) demand is potentially excessive.[40] We suggest that, since our potential demands are not dependent on our social class—in this sense, we are almost a classless society, everybody wanting everything—there is a persistent pressure on prices because of both excess effective demand and rising costs of production (arising from real income increases). The point is not pursued here, though it has an extensive literature, for the reason given above.

Our analysis, in Section 2 of the paper, convinces us that Ireland cannot stabilize prices unless and until the U.K. succeeds in doing so. At all times, the Irish price trend must be kept in line with that of U.K., and, if possible, a shade below it. In the last two years covered by this study, Chart 3 shows a disquieting aberration in the contrary sense.

[40]The authors of *The Problem of Rising Prices* (OECD, Paris, 1961), found that Ireland was free from excess demand (in the technical economic sense) during 1953–1959. In *our* sense of the term, potential demand is endemically "excess".

Appendices

TABLE A1: CONSUMER PRICES IN IRELAND & U.K. 1947–1966

Base: August 1953 as 100

Year \ Quarter	Ireland				United Kingdom			
	I	II	III	IV	I	II	III	IV
1947			80·0	77·6			71·0	73·2
1948	79·2	80·0	79·2	79·2	75·3	76·7	76·7	77·4
1949	79·2	79·2	80·0	80·0	77·4	78·8	78·8	79·6
1950	80·0	81·6	80·0	81·6	80·3	81·0	80·3	82·4
1951	82·4	87·2	88·8	90·4	83·8	88·1	90·2	91·6
1952	91·2	92·0	97·6	98·4	94·5	96·5	97·4	98·0
1953	98·4	100·8	100	100·1	98·8	100·0	100	100·0
1954	99·4	99·5	101·1	100·5	99·7	100·7	102·3	103·1
1955	101·2	102·0	102·7	105·0	104·0	104·4	106·2	109·7
1956	105·5	107·5	107·8	107·5	109·3	112·0	111·8	112·7
1957	107·7	110·4	114·1	113·8	114·0	114·3	116·3	117·7
1958	115·4	116·6	116·9	116·9	117·6	119·3	118·4	120·0
1959	117·7	117·6	115·6	114·9	120·5	119·2	119·5	120·2
1960	115·4	117·2	117·2	118·1	120·1	120·5	120·7	122·3
1961	118·9	120·3	120·5	121·1	122·7	124·2	126·4	127·8
1962	123·3	126·5	125·9	125·6	128·5	131·5	130·5	130·7
1963	127·7	127·4	127·3	131·2	133·0	133·4	132·3	133·6
1964	131·9	137·1	138·8	140·3	134·6	137·4	138·4	139·7
1965	141·8	144·3	144·8	144·8	140·6	144·3	145·0	145·9
1966	144·9	147·6	150·0	150·4	146·9	150·0	150·6	151·7

Basic Sources: SA, ISB, MDS.

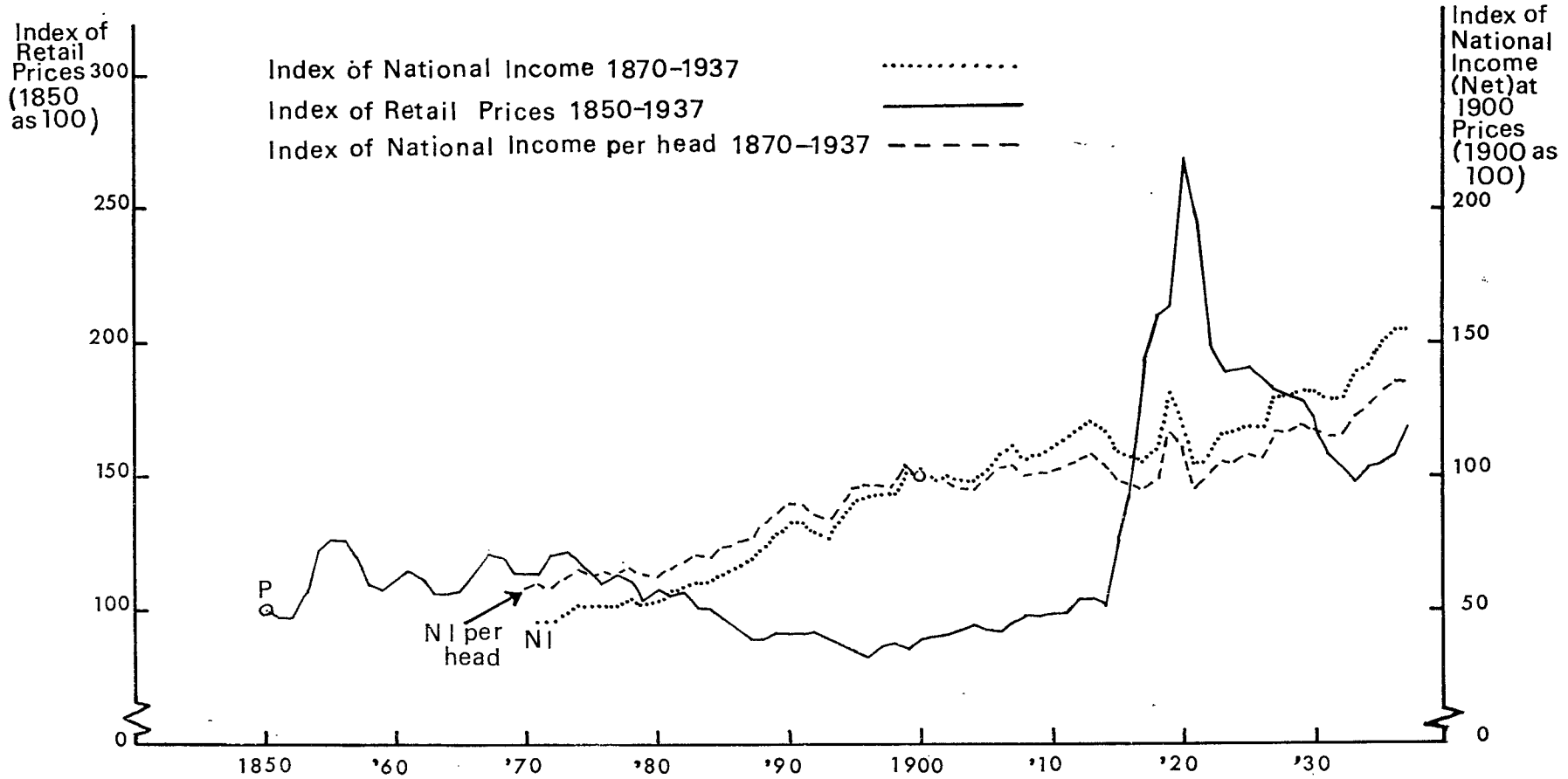
TABLE A2: PRICES AND NATIONAL INCOME IN THE U.K., 1870–1937

Year	Index of (Net) National Income (Constant 1900 Prices) base 1900 as 100	Index of Income per head, 1900 as 100	Index of Retail Prices, 1850 as 100	Year	Index of (Net) National Income (Constant 1900 Prices) base 1900 as 100	Index of Income per head, 1900 as 100	Index of Retail Prices 1850 as 100
1870	45·8	57·7	113	1905	102·4	98·1	92
1871	45·3	59·1	113	1906	108·0	102·6	92
1872	44·9	58·1	120	1907	111·0	104·5	95
1873	48·1	61·6	122	1908	107·3	100·1	97
1874	51·0	64·8	117	1909	108·8	100·5	97
1875	50·6	63·6	113	1910	111·4	102·0	98
1876	51·2	63·7	110	1911	114·3	103·9	99
1877	51·5	63·4	113	1912	117·5	106·4	103
1878	53·4	65·0	110	1913	120·3	108·5	103
1879	52·3	63·0	103	1914	117·4	104·9	102
1880	52·9	63·2	107	1915	(109·1)	(97·6)	(127)
1881	56·0	66·0	105	1916	(108·0)	(96·4)	(148)
1882	58·7	68·5	106	1917	(106·3)	(94·7)	(193)
1883	60·1	69·5	102	1918	(111·6)	(99·2)	(209)
1884	60·7	67·0	100	1919	(131·0)	(116·2)	(214)
1885	63·7	72·8	96	1920	118·4	111·5	269
1886	66·1	74·9	92	1921	102·7	96·1	245
1887	68·5	77·1	89	1922	109·2	101·4	198
1888	73·4	81·9	89	1923	114·5	105·7	188
1889	77·6	85·9	91	1924	116·0	106·4	189
1890	81·5	89·4	91	1925	117·9	107·6	190
1891	80·7	87·9	92	1926	117·9	107·4	186
1892	78·4	84·6	92	1927	128·6	116·6	182
1893	77·4	82·9	89	1928	129·7	117·0	180
1894	84·0	89·1	87	1929	132·0	118·9	178
1895	90·0	94·7	84	1930	130·6	117·1	171
1896	91·8	95·7	83	1931	129·3	115·4	158
1897	92·6	95·7	86	1932	129·3	115·0	154
1898	94·3	96·1	87	1933	137·9	122·1	149
1899	100·8	101·7	86	1934	142·6	125·7	153
1900	100	100	89	1935	148·9	130·7	155
1901	99·3	98·4	90	1936	154·7	135·2	159
1902	100·1	98·3	91	1937	155·4	135·2	168
1903	97·6	95·1	92				
1904	98·1	94·8	93				

Basic Sources: W. T. Layton and G. Crowther, *The Study of Prices*, (Macmillan), 1938, Table 1, App. E: and A. R. Prest, "National Income of the United Kingdom, 1870–1946", *Economic Journal*, March 1948, Table II, App. I.

Note: Figures in brackets are for war years, and so are less reliable.

CHART 6: PRICES AND NATIONAL INCOME IN THE U.K., 1850-1937



Basic Source: Table A2.

TABLE A3: FARMERS' CASH PAYMENTS, 1953–1965

£ million

Item	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Gross output excluding value of change in livestock number	171·9	177·7	181·5	175·5	190·3	178·3	180·2	191·4	209·5	209·0	211·4	230·3	232·1
Subsistence element	31·3	29·5	33·0	31·2	29·4	29·7	29·8	27·1	28·0	28·3	26·7	26·3	28·0
Cash receipts	140·6	148·2	148·5	144·3	160·9	148·6	150·4	164·3	181·5	180·7	184·7	204·0	204·1
Payments:													
1 Feed, fertiliser, seeds	29·5	33·0	32·7	32·3	33·9	35·8	34·2	32·3	37·1	41·2	43·5	45·5	53·9
2 Rates	6·0	6·4	6·7	7·4	7·6	7·7	8·2	8·4	8·9	7·0	7·5	7·2	8·1
3 Repairs, spares, etc., and depreciation	6·7	7·0	7·2	7·5	7·7	7·9	8·1	8·3	8·7	9·9	10·5	11·5	12·7
4 Petrol, etc.	4·0	4·0	4·1	4·3	5·1	5·1	5·4	5·6	5·6	5·6	5·8	6·1	6·3
5 Transport and marketing	2·8	2·7	2·9	2·7	3·0	2·9	2·9	3·1	3·4	3·5	3·5	3·8	3·9
6 Other expenses	4·7	5·0	5·1	5·3	5·4	5·6	5·8	6·3	6·6	6·8	7·2	7·7	8·4
7 Annuities	2·9	2·9	2·9	2·9	2·9	2·9	2·9	2·9	2·9	2·9	2·9	3·0	3·0
8 Wages	14·8	16·7	16·7	16·4	16·5	15·8	15·8	16·1	15·2	15·3	14·8	15·8	17·0
Total enterprise expenses	71·4	77·7	78·3	78·8	82·1	83·7	83·3	82·8	88·4	92·2	95·7	100·6	113·3
9 Household cash	69·2	70·5	70·2	65·5	78·8	64·9	67·1	81·5	93·1	88·5	89·0	103·4	90·8
Reconciliation:													
Subsidies	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	1·1	1·2	3·1	3·5
Subsistence	31·3	29·5	33·0	31·2	29·4	29·7	29·8	27·1	28·0	28·3	26·7	26·3	28·0
Stock increase	6·0	−3·3	5·4	−0·4	−0·1	3·2	11·0	1·7	−3·0	4·1	3·6	9·7	20·1
Check total income	107·2	97·4	109·3	97·0	108·8	98·5	108·6	111·0	118·8	122·0	120·5	142·5	142·4

Basic Source: ITJSB (later *ISB*).

Note: All estimates are official except those for wages, 1954–1960. Figures shown are based on original official figures, consequent on official adjustments downward of £0·7m. in 1953 and £3·2m. in 1961. Cash payments (numbered 1–9) were the expenditure weights used for computing price indexes of farmers' payments (Table 10). The last line of figures agrees with the official estimates (allowing for the small modification in 1954–1960) thus ensuring the comprehensiveness of "Payments".

TABLE A4: PRICE INDEX NUMBERS OF FARMERS' PURCHASES AND CASH RECEIPTS 1954–1965

Base: Previous year as 100

Year	1 Feed, fertiliser, seeds	3 Repairs, spares, etc. depreciation	4 Petrol, etc	5 Transport and marketing	6 Other Expenses	8 Wages	9 Household cash	Cash receipts
1	2	3	4	5	6	7	8	9
1954	93·6	99·2	99·5	101·1	98·0	104·9	100·6	98·7
1955	103·2	101·7	100·0	103·3	101·2	100·0	101·3	104·5
1956	100·0	105·6	113·7	95·3	104·2	113·2	106·0	90·7
1957	100·8	104·3	117·6	114·1	104·6	100·0	105·4	106·7
1958	98·8	101·4	98·4	97·5	97·5	100·0	102·3	102·7
1959	95·7	100·8	100·8	96·6	99·3	106·2	99·5	99·9
1960	94·8	100·3	98·9	99·0	100·7	103·9	101·5	97·3
1961	97·8	101·7	98·4	101·0	100·0	102·8	102·2	100·4
1962	100·8	102·0	102·4	103·5	101·2	111·6	105·0	101·7
1963	101·5	101·3	98·5	101·7	101·8	100·0	101·2	100·5
1964	101·5	102·4	107·9	101·9	105·6	118·6	109·4	110·7
1965	103·7	102·4	104·6	103·9	101·9	110·7	103·9	104·1

Basic Source: WP system in *ITJSB* (later *ISB*).

Notes: Reference numbers are those of Table A3. 2 Rates and 7 Annuities are omitted because the Table A3 figures are deemed to be proportionately their own price index numbers. Thus the index for rates 1953–1954 is 100 x 6·4/6·0.

Col. 2: Official.
,, 3: Simple average of (i) machinery, etc., and (ii) vehicles in General WP Index.
,, 4: CP index (from CSO ms. records).
,, 5: Receipts per ton mile by rail.
,, 6: Materials for use in all industry WP system.
,, 7: Official index divided by agricultural net output volume per person engaged.
,, 8: CP index excluding potatoes, milk, eggs, half expenditure weight for butter and rent (from CSO ms. records).
,, 9: Official agricultural price index.

TABLE A5: *INDEX NUMBERS (TO BASE 1953 AS 100) OF (i) VALUE, (ii) VOLUME AND (iii) IMPLICIT PRICE OF GROSS OUTPUT OF IRISH INDUSTRIES, 1954–1964

Number	Industry	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
		(i) Value										
1.1	Coal, turf	125·4	130·0	155·8	153·3	130·4	160·3	131·4	142·9	150·8	168·7	171·4
1.2	Stone, slate, sand	111·8	126·1	115·5	115·2	112·6	115·6	141·3	158·5	207·7	255·5	298·1
1.3	Other mining	142·7	246·2	284·9	278·9	345·7	571·9	757·8	635·2	324·6	108·0	187·4
1.4	Turf production, development	123·5	141·6	136·7	150·3	110·8	232·2	158·7	224·9	267·7	255·8	273·6
2.1.1	Bacon	98·4	78·8	75·2	85·0	100·4	97·9	102·6	112·4	112·3	117·5	125·4
2.1.2	Slaughtering	118·3	100·4	103·9	192·8	148·4	185·8	208·1	286·0	262·0	289·0	288·9
2.1.4	Grain milling, feedingstuffs	109·1	116·9	107·8	104·7	106·9	110·2	107·2	115·0	124·1	126·0	135·1
2.1.5	Bread, biscuits, flour confectionery	98·6	97·9	95·1	109·5	118·2	119·9	123·5	128·5	138·4	142·8	149·1
2.1.6–7	Sugar, cocoa, sugar confectionery	67·3	82·2	60·9	77·2	77·2	92·2	87·1	92·1	99·9	103·4	110·2
2.1.8	Canning fruit, vegetables, jams	68·6	75·5	70·8	73·4	78·4	85·9	90·7	102·7	128·7	144·8	167·6
2.1.9	Butter, cheese, edible milk products	90·4	88·3	93·6	99·5	95·6	93·1	108·1	117·5	126·2	139·1	155·0
2.1.10	Margarine, butter blending	73·7	71·1	68·7	76·5	81·7	85·1	91·4	91·2	98·4	101·9	115·6
2.1.11	Other food preparations	77·7	92·7	104·5	105·3	108·8	124·0	138·1	146·7	149·7	199·6	249·0
2.2.1	Malting	79·7	76·9	95·4	93·5	92·7	82·4	100·9	102·7	122·5	114·3	115·3
2 2.2	Brewing	101·9	103·9	109·9	107·3	112·7	112·9	118·2	126·9	138·9	140·5	149·2
2.2.3	Distilling	89·5	78·0	72·3	64·8	68·7	69·0	75·6	77·1	87·7	98·9	110·7
2.2.4	Mineral waters	104·7	130·3	125·5	127·9	124·5	137·1	139·0	146·6	165·7	186·6	206·8
2.3	Tobacco	94·0	96·7	99·8	109·5	110·0	110·8	116·7	125·8	133·1	141·0	143·2
3.1	Wood, cork	102·9	102·6	94·0	80·8	76·9	73·8	78·8	89·6	100·4	115·9	128·7
3.2–3	Brushes, brooms and furniture	103·9	110·0	108·6	99·4	103·4	108·3	117·5	126·1	147·2	161·4	178·7
4.1	Jute, canvas, miscellaneous textiles	112·9	115·4	118·9	129·5	133·6	151·9	182·5	226·8	229·9	251·2	262·1
4.2	Linen, cotton	112·9	123·5	148·7	149·9	158·2	170·6	201·8	220·0	234·4	234·8	261·7
4.3	Made-up textiles	95·9	109·5	122·7	133·2	159·1	172·7	190·4	197·3	228·6	246·2	259·4
4.4	Woollen, worsted	102·4	103·3	106·7	116·2	116·1	112·4	130·3	137·8	139·5	152·3	170·1
5.1	Men's and boys' clothing	101·5	108·6	106·2	97·7	97·8	98·3	108·1	122·2	126·7	139·9	148·8
5.2	Shirtmaking	97·1	98·0	103·7	93·0	105·5	119·4	149·4	163·3	188·8	188·4	224·0
5.3	Women's and girls' clothing	99·1	107·8	118·1	124·1	137·2	141·7	153·7	162·5	177·9	188·7	208·1
5.4	Other clothing	102·7	108·7	117·8	113·6	125·6	126·7	133·2	146·0	168·3	170·6	171·4
5.5	Hosiery	98·4	102·5	108·1	102·6	106·9	111·3	127·9	149·2	172·5	192·0	209·4
6.1	Fellmongery, tanning	97·5	94·4	99·2	102·0	100·5	119·7	117·5	120·6	134·3	149·3	150·6
6.2	Leather manufactures	107·9	109·6	123·3	137·6	154·3	175·4	180·1	213·5	241·3	269·4	310·1
6.3	Boots, shoes	92·5	95·3	96·1	98·3	99·8	107·6	121·0	132·9	128·3	138·9	163·8
7	Paper	127·6	144·2	141·1	145·1	155·6	172·0	193·8	208·5	208·8	219·3	246·0
8	Printing, publishing	106·7	118·9	127·1	129·7	136·7	148·6	155·1	170·7	189·7	201·0	220·9
9.1	Soap, detergents, candles	104·6	113·4	119·1	123·7	118·2	133·5	124·0	140·5	144·4	151·8	157·9
9.2	Chemicals, drugs	106·7	118·9	136·9	146·3	159·8	178·0	193·6	214·5	257·3	281·6	304·3
9.3	Oils, paints, inks, polishes	93·7	97·9	98·2	104·4	109·1	120·6	123·1	132·1	137·9	153·9	170·6
9.4	Fertilisers	141·8	155·4	152·0	209·0	194·0	219·1	253·7	309·6	364·2	369·2	372·9
10.1	Glassware, pottery	111·9	127·3	132·7	143·3	151·4	156·0	173·4	200·1	222·8	267·2	294·1
10.2–3	Structural clay and cement	114·3	126·4	137·1	115·7	118·4	133·7	149·2	158·8	194·5	217·5	266·2
11	Metal trades	115·8	130·2	142·3	132·1	144·9	165·1	191·9	218·4	242·9	269·2	345·6
12.1	Assembly of mechanical vehicles	142·1	152·9	100·9	113·1	143·7	156·9	188·8	197·2	216·8	245·7	293·8
12.2	Assembly of other vehicles	108·6	103·9	102·3	117·9	116·0	107·1	101·5	143·6	178·8	189·2	217·0
12.3	Electrical machinery	125·9	146·3	156·0	154·5	175·5	220·5	252·5	307·2	384·1	470·2	518·4
12.4	Non-electrical machinery	100·4	108·3	97·3	103·9	127·9	238·3	295·0	336·6	353·1	397·3	460·8
12.5	Railroad equipment	112·7	97·9	99·0	124·1	109·5	82·6	86·0	96·5	93·2	91·8	94·2
12.6	Ship and boat building	103·2	90·9	111·8	121·2	136·4	140·9	201·4	278·2	509·1	516·8	524·4
13	Other manufacturing	111·6	124·1	123·7	124·3	141·9	341·3	433·6	474·1	511·8	587·9	692·9
	Total Manufacturing Industry	100·5	103·3	101·4	106·1	112·6	122·5	134·1	148·3	159·9	172·6	189·8
	Total Mining	120·3	138·4	137·0	142·8	122·7	191·7	171·3	205·8	233·3	239·1	266·2
	Total Transportable Goods Industries	100·8	103·9	102·0	106·7	112·8	123·7	134·7	149·2	161·1	173·7	191·1

**Note:* The data presented in this table differ slightly from those used in Table 9 in the text. Table A5 includes amendments made to the published figures in July, 1967 which were received too late to be included in the textual calculations.

TABLE A5: INDEX NUMBERS (TO BASE 1953 AS 100) OF (i) VALUE, (ii) VOLUME AND (iii) IMPLICIT PRICE OF GROSS OUTPUT OF IRISH INDUSTRIES, 1954–1964— (*continued*)

Number	Industry	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
		(ii) Volume										
1.1	Coal, turf	128·5	121·8	145·5	145·7	123·7	140·0	123·0	123·9	123·8	139·3	138·5
1.2	Stone, slate, sand	111·2	133·5	123·1	125·1	127·7	128·0	153·7	162·3	219·5	251·8	297·2
1.3	Other mining	130·8	209·2	251·7	297·8	286·1	410·8	591·3	528·6	267·2	107·8	155·2
1.4	Turf production, development	110·0	128·5	146·2	155·4	95·2	203·2	143·5	193·3	201·0	201·8	205·0
2.1.1	Bacon	105·6	85·2	79·0	89·6	103·3	99·5	106·9	116·3	116·2	118·9	122·7
2.1.2	Slaughtering	109·5	97·0	99·4	82·6	127·8	164·1	176·1	252·2	239·3	239·1	214·9
2.1.4	Grain milling, feedingstuffs	100·7	105·3	99·0	95·9	97·1	102·1	99·8	106·3	112·4	112·8	118·2
2.1.5	Bread, biscuits, flour confectionery	101·0	98·7	94·4	88·3	84·4	85·5	86·0	86·3	90·6	93·3	94·1
2.1.6	Sugar	77·4	119·5	63·4	100·3	89·1	122·5	99·6	105·5	115·6	111·6	110·2
2.1.6–7	Sugar, cocoa, sugar confectionery	65·5	75·5	58·3	67·3	67·7	75·9	77·5	83·6	88·3	87·8	90·4
2.1.7	Cocoa, sugar confectionery	59·8	54·3	55·6	55·2	59·2	58·5	69·2	75·3	77·6	78·9	83·2
2.1.8	Canning fruit, vegetables, jams	70·7	75·1	68·6	68·3	73·8	82·6	87·5	94·9	107·6	110·0	120·8
2.1.9	Butter, cheese, edible milk products	90·4	88·3	95·1	102·2	99·4	96·1	108·2	117·2	126·4	137·0	149·4
2.1.10	Margarine, butter blending	84·1	81·9	80·3	82·3	87·5	91·2	98·2	97·1	101·3	105·4	113·6
2.1.11	Other food preparations	90·7	103·1	117·6	127·1	118·6	134·0	146·7	153·4	152·1	165·6	201·4
2.2.1	Malting	100·0	91·3	120·1	107·6	98·6	96·8	122·8	119·8	149·9	129·0	136·1
2.2.2	Brewing	102·9	104·5	111·3	105·5	106·9	105·8	110·6	117·7	113·3	111·9	114·4
2.2.3	Distilling	94·4	82·4	77·3	65·6	67·7	68·5	76·2	76·7	84·8	90·9	92·6
2.2.4	Mineral waters	104·0	129·7	114·1	112·3	107·7	119·3	117·6	124·6	136·9	148·3	159·4
2.3	Tobacco	94·9	99·1	92·8	90·2	80·8	80·9	83·9	87·0	86·1	87·8	85·8
3.1	Wood, cork	102·2	102·1	92·2	83·5	81·7	76·8	81·0	90·5	101·5	117·4	125·2
3.2	Brushes, brooms	106·8	105·7	120·0	106·9	105·7	108·9	119·5	120·1	130·1	139·5	150·4
3.2–3	Brushes, brooms and furniture	111·3	115·5	113·7	98·2	105·9	114·8	117·3	119·9	133·0	148·3	146·6
3.3	Furniture	111·8	116·6	112·9	97·2	106·1	115·7	117·3	120·0	133·6	149·7	146·3
4.1	Jute, canvas, miscellaneous textiles	118·9	128·7	136·3	146·7	151·9	165·2	194·4	229·7	229·2	242·7	244·7
4.2	Linen, cotton	111·5	125·0	148·8	155·3	168·3	185·6	220·4	230·2	240·3	227·8	263·3
4.3	Made-up textiles	96·3	106·0	114·2	128·6	152·2	161·2	172·4	174·2	196·9	209·2	225·0
4.4	Woollen, worsted	103·8	105·8	105·9	113·3	109·1	117·2	137·8	141·2	144·1	153·7	161·3
5.1	Men's and boys' clothing	97·3	97·4	90·7	78·5	77·0	76·3	81·8	89·5	89·8	91·5	97·2
5.2	Shirtmaking	99·4	100·3	104·3	89·6	95·4	103·8	125·6	132·2	148·1	151·4	171·8
5.3	Women's and girls' clothing	98·1	103·9	110·9	110·9	114·6	121·8	127·6	138·0	165·1	167·6	185·5
5.4	Other clothing	108·1	110·8	120·7	111·8	121·7	124·5	123·3	136·3	142·2	152·4	150·3
5.5	Hosiery	105·5	109·4	118·2	113·1	114·3	119·9	138·8	157·4	170·4	181·6	204·5
6.1	Fellmongery, tanning	93·5	93·3	97·0	96·5	101·8	107·3	100·8	106·9	120·2	131·9	134·7
6.2	Leather manufactures	103·4	82·6	90·2	115·1	111·6	128·8	125·7	143·0	169·7	182·5	202·2
6.3	Boots, shoes	90·6	94·8	95·1	94·6	96·4	103·4	115·8	126·4	123·0	136·8	155·5
7	Paper	123·4	137·8	132·9	137·3	148·9	164·4	181·4	194·8	195·8	199·4	220·5
8	Printing, publishing	104·7	112·7	115·7	113·3	117·3	123·8	126·1	135·3	148·7	154·2	158·4
9.1	Soap, detergents, candles	104·4	111·5	111·0	111·5	104·5	116·1	111·7	134·0	129·7	131·7	129·3
9.2	Chemicals, drugs	105·6	115·8	132·6	135·0	144·0	157·3	178·0	196·1	223·0	237·5	272·3
9.3	Oils, paints, inks, polishes	95·5	100·2	94·5	98·8	105·9	113·5	118·0	128·4	131·9	144·3	153·6
9.4	Fertilisers	131·6	141·7	135·6	175·2	162·2	208·6	247·9	287·5	314·1	317·1	320·0
10.1	Glassware, pottery	104·5	119·0	122·4	125·7	132·1	128·6	144·7	161·1	175·0	185·8	202·0
10.2	Cement	125·5	142·4	150·9	111·2	110·4	133·2	158·0	157·8	188·1	187·2	219·7
10·2–3	Structural clay and cement	114·5	121·7	121·9	92·5	92·7	111·0	127·9	135·8	168·3	179·1	218·3
10.3	Structural clay	109·2	112·2	108·4	84·0	84·9	101·0	113·6	126·3	160·8	179·2	224·0
11	Metal trades	121·4	132·4	134·1	120·2	126·6	148·0	169·5	188·5	204·6	231·6	274·5
12.1	Assembly of mechanical vehicles	144·6	157·3	94·5	105·3	131·0	144·2	171·6	165·0	172·1	190·6	219·6
12.2	Assembly of other vehicles	109·0	106·0	98·3	109·7	98·0	87·4	80·6	99·5	120·0	124·8	131·5
12.3	Electrical machinery	124·5	142·2	142·6	138·2	161·3	205·5	233·0	291·8	364·4	439·0	479·5
12.4	Non-electrical machinery	96·2	92·7	79·9	83·9	97·7	170·1	208·6	263·1	251·5	274·1	301·9
12.5	Railroad equipment	113·5	96·2	89·5	112·9	91·8	67·9	64·2	65·2	59·2	57·4	54·3
12.6	Ship and boat building	100.9	108·5	126·7	128·9	122·5	129·2	147·4	195·0	255·5	190·4	182·4
13	Other manufacturing	118·8	122·2	121·1	115·7	131·4	192·5	226·8	250·2	274·3	313·5	367·9
	Total Manufacturing Industry	102·9	106·4	103·6	102·5	105·8	114·5	124·3	135·1	143·6	151·0	162·5
	Total Mining	113·9	132·1	142·8	140·5	114·9	181·0	159·2	186·3	199·2	207·1	223·7
	Total Transportable Goods Industries	103·3	107·5	105·3	104·5	106·5	117·5	126·0	137·4	146·2	153·5	165·3

TABLE A5: INDEX NUMBERS (TO BASE 1953 AS 100) OF (i) VALUE, (ii) VOLUME AND (iii) IMPLICIT PRICE OF GROSS OUTPUT OF IRISH INDUSTRIES, 1954–1964—(*continued*)

Number	Industry	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
		(iii) Implicit Price										
1.1	Coal, turf	97·6	106·7	107·1	105·2	105·4	114·3	106·8	115·3	121·8	121·1	123·8
1.2	Stone, slate, sand	100·5	94·5	93·8	92·1	88·2	90·3	91·9	97·7	94·6	101·5	100·3
1.3	Other mining	109·1	117·7	113·2	93·7	120·8	139·2	128·2	120·2	121·5	100·2	120·7
1.4	Turf production, development	112·3	110·2	93·5	96·7	116·4	114·5	110·6	116·3	133·2	126·8	133·5
2.1.1	Bacon	93·2	92·5	95·2	94·9	97·2	98·4	95·8	96·6	96·6	98·8	102·2
2.1.2	Slaughtering	108·0	103·5	104·5	112·3	116·1	113·2	118·1	113·4	109·5	120·9	134·4
2.1.4	Grain milling, feedingstuffs	108·3	110·5	108·9	109·2	110·1	107·9	107·4	108·2	110·4	111·7	114·3
2.1.5	Bread, biscuits, flour confectionery	97·6	99·2	100·7	124·0	140·0	140·2	143·6	148·9	152·8	153·1	158·4
2.1.6–7	Sugar, cocoa, sugar confectionery	102·7	108·9	104·5	114·7	114·0	121·5	112·4	110·2	113·1	117·8	121·9
2.1.8	Canning fruit, vegetables, jams	97·0	100·5	103·2	107·5	106·2	104·0	103·7	108·2	119·6	131·6	138·7
2.1.9	Butter, cheese, edible milk products	100·0	100·0	98·4	97·3	96·2	96·9	99·9	100·3	99·8	101·5	103 7
2.1.10	Margarine, butter blending	87·6	86·8	85·6	93·0	93·4	93·3	93·1	93·9	97·1	96·7	101·8
2.1.11	Other food preparations	88·0	91·8	93·6	85·3	98·7	118·2	94·1	95·6	98·4	96·8	123·6
2.2.1	Malting	85·3	84·2	79·4	86·9	94·0	85·1	82·2	51·4	81·7	88·6	84·7
2.2.2	Brewing	99·0	99·4	98·7	101·7	105·4	106·7	106·9	107·8	122·6	125·6	130·4
2.2.3	Distilling	94·8	94·7	93·5	98·8	101·5	100·7	99·2	100·5	103·4	108·8	119·5
2.2.4	Mineral waters	100·7	100·5	110·0	113·9	115·6	114·9	118·2	117·7	121·0	125·8	129·7
2.3	Tobacco	99·1	97·6	107·5	121·4	136·1	137·0	139·1	144·6	154·6	160·6	166·9
3.1	Wood, cork	100·7	100·5	102·0	96·8	94·1	96·1	97·3	99·0	98·9	98·7	102·8
3.2–3	Brushes, brooms and furniture	93·4	95·2	95·5	101·2	97·6	94·3	100·2	105·2	110·7	108·8	121·9
4.1	Jute, canvas, miscellaneous textiles	95·0	89·7	87·2	88·3	88·0	91·9	93·9	98·7	100·0	103·5	107·1
4.2	Linen, cotton	101·3	98·8	99·9	96·5	94·0	91·9	91·6	95·6	97·5	102·9	99·4
4.3	Made-up textiles	99·6	103·3	107·4	103·6	104·5	107·1	110·4	113·3	116·1	117·7	115·3
4.4	Woollen, worsted	98·7	97·6	100·8	102·6	106·4	95·9	94·6	97·6	96·8	99·1	105·5
5.1	Men's and boys' clothing	104·3	111·5	117·1	124·5	127·0	128·8	132·2	136·5	141·1	152·9	153·1
5.2	Shirtmaking	97·7	97·7	99·4	103·8	110·6	115·0	118·9	123·5	127·5	124·4	130·4
5.3	Women's and girls' clothing	101·0	103·8	106·5	111·9	119·7	116·3	120·5	117·8	107·8	112·6	112·2
5.4	Other clothing	95·0	98·1	97·6	101·6	103·2	101·8	108·0	107·1	118·4	111·9	114·0
5.5	Hosiery	93·3	93·7	91·5	90·7	93·5	92·8	92·2	94·8	101·2	105·7	102·4
6.1	Fellmongery, tanning	104·3	101·2	102·3	105·7	98·7	111·6	116·6	112·8	111·7	113·2	111.8
6.2	Leather manufactures	104·4	132·7	136·7	119·5	138·3	136·2	143·3	149·3	142·2	147·6	153·4
6.3	Boots, shoes	102·1	100·5	101·1	103·9	103·5	104·1	104·5	105·1	104·3	101·5	105·3
7	Paper	103·4	104·6	106·2	105·7	104·5	104·6	106·8	107·0	106·6	110·0	111·6
8	Printing, publishing	101·9	105·5	109·9	114·5	116·5	120·0	123·0	126·2	127·6	130·4	139·5
9.1	Soap, detergents, candles	100·2	101·7	107·3	110·9	113·1	115·0	111·0	104·9	111·3	115·3	122·1
9.2	Chemicals, drugs	101·0	102·7	103·2	108·4	111·0	113·3	108·8	109·4	115·4	118·6	111·8
9.3	Oils, paints, inks, polishes	98·1	97·7	103·9	105·7	103·0	106·3	104·3	102·9	104·5	106·7	111·1
9.4	Fertilisers	107·8	109·7	112·1	119·3	119·6	105·0	102·3	107·7	116·0	116·4	116·5
10.1	Glassware, pottery	107·1	107·0	108·4	114·0	114·6	121·3	119·8	124·2	127·3	143·8	145·6
10.2–3	Structural clay and cement	99·8	103·9	112·5	125·1	127·7	120·5	116·7	116·9	115·6	118·1	121·9
11	Metal trades	95·4	98·3	106·1	109·9	114·5	111·6	113·2	115·9	118·7	116·2	125·9
12.1	Assembly of mechanical vehicles	98·3	97·2	106·8	107·4	109·7	108·8	110·0	119·5	126·0	128·9	133·7
12.2	Assembly of other vehicles	99·6	98·0	104·1	107·5	118·4	122·5	125·9	144·3	149·0	151·6	165·0
12.3	Electrical machinery	101·1	102·9	109·4	111·8	108·8	107·3	108·4	105·3	105·4	107·1	108·1
12.4	Non-electrical machinery	104·4	116·8	121·8	123·8	130·9	140·1	141·4	127·9	140·4	144·9	152·6
12.5	Railroad equipment	99·3	101·8	110·6	109·9	119·3	121·6	134·0	148·0	157·4	159·9	173·5
12.6	Ship and boat building	102·3	83·8	88·2	94·0	111·3	109·1	136·5	142·7	199·3	271·4	287·5
13	Other manufacturing	93·9	101·6	102·1	107·3	108·0	177·3	191·6	189·5	186·6	187·5	188·3
	Total Manufacturing Industry	97·7	97·1	97·9	103·5	106·4	107·0	107·9	109·8	111·4	114·3	116·8
	Total Mining	105·7	104·8	95·9	95·5	106·8	107·0	107·6	110·5	117·1	115·5	119·0
	Total Transportable Goods Industries	97·6	96·7	96·9	102·1	105·9	105·3	106·9	108·6	110·2	113·2	115·6

Appendix 6

GNP BY SECTOR OF ORIGIN AT CONSTANT FACTOR COST: A NOTE

NIE 1965, which was published after the first draft of this paper was completed, contains, for the first time, a table (11, page 15) of GNP by sector of origin at constant (1958) factor cost. From this table, in conjunction with the corresponding table at current cost (8, page 11), shown in Table A6, implicit price indexes have been derived.

TABLE A6: IMPLICIT PRICE INDEXES IN ECONOMIC SECTORS 1959–1965

Base 1958 as 100

Sector	1959	1960	1961	1962	1963	1964	1965
1. Agr.,For., Fishing	99	97	101	103	104	116	121
2. Industry	98	102	106	110	112	117	120
3. Dist., Trans., Communication	106	107	112	115	120	127	135
4. Pub. Adm., Defence	102	108	114	125	130	158	165
5. Other Domestic	103	108	112	119	125	139	146
GDP at Factor Cost	101	103	107	112	115	125	130

Basic Source: NIE 1965, Tables 8 and 11.

While the showing of Table A6 is in ample conformity with one of the main findings of the paper, namely that price rises in the service sectors (3-5) are a major source of price inflation in Ireland, our opinion, expressed in the text (page 17), that we are not yet in a position to estimate the quantum of added value in sector 2—industry (and hence to calculate the price of added value), remains unchanged. In the text of *NIE* 1965 it is stated that the volume index for sector 2 was derived as the sum product of gross volume output indexes for each industry and 1958 net outputs: this is described as the "second method" for making these estimates, the first method being the double deflation method. It is stated that "Two different methods can be applied to derive net product at constant prices". There are many more than two methods; if, however, a dichotomy is wanted, (i) the double deflation (the "first method" above) and (ii) all other methods will do; (i) is the right method, all other methods being (to be polite) less right. While the practical difficulties of (i) have been recognised, the essential difficulty is not (we think) that stated, namely "there is considerable difficulty in expressing the input at constant prices", when the Irish CIP is almost unique in providing so much data on value and quantity of input commodities. The trouble is that the CIP (in this country and elsewhere) is not sufficiently accurate to provide reliable quantum input indexes *at the level of the individual industry.* For the aggregate of all industries, however, the added value volume indexes seem quite acceptable. Following is a comparison of volume indexes using two methods.

INDEXES OF VOLUME, GROSS AND NET, TG INDUSTRIES 1946–1950

Year	Gross Output	Net Output
	Previous Year as 100	
1947	107·9	109·9
1948	109·6	106·4
1949	113·3	108·8
1950	112·8	112·1
	1946 as 100	
1950	151·2	142·6

Basic Source: R. C. Geary and K. G. Forecast, "The Use of Census of Industrial Production Material for the Estimation of Productivity", *Review of the International Statistical Institute*, Vol. 23, Nos. 1/3 (1955).

The gross output figures correspond closely, in method of calculation, to those of *NIE* 1965; the net output figures are calculated by the double deflation method. There are quite appreciable differences between four of the five pairs of indexes; over the four years 1946–1950 the gross output figure overstates the double deflation estimate by 6 per cent. We do not know what the corresponding comparison would show for 1958–1965: if the same kind of bias occurred it would increase the price index for industry in Table A6 in 1965 which, rather surprisingly, is slightly below the figure for agriculture, etc. It is a pity that, since CSO was almost the world pioneer many years since in the investigation of the double deflation method, which is now very generally accepted in principle, the method was not exploited on the present occasion.

While we appreciate the difficulties of CSO in attempting to quantify some of the service industries, we think that the assumption of unchanged productivity over the years 1958-1965 more than a little dubious, as applied, in particular, to sector 4. In section 9 of the paper we have shown in one important case that the assumption of unchanged productivity can lead to serious upward bias in the implicit price index. Similarly, we regard the gradient of increase in the price index for sector 4 as exaggerated, because of underestimation of quantum: if not, a serious state of affairs is revealed; and it is certainly a challenge to public departments to try to measure, however approximately, the trend in their volume of work in recent years, which might lead to enlightenment in an important sector. As it stands in Table A6, the sector 4 index is merely an earnings per head indicator.

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