Quantification of Output Growth and Value-Added Captured by the Irish Food Processing Sector

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Introduction

Value-added is defined as the value of output less the value of intermediate inputs consumed (Hill, 1971). It may be measured for any entity in which economic activity is conducted. It may be expressed in gross or net terms. In accounting terms, gross value added consists of the sum of the values of wages/salaries, profits and depreciation. Gross value added (GVA) represents the payment to all the factors of production in the defined business entity. A measure of net value-added excludes the value of depreciation.

Value-added is the basis for measurement of Gross National Product (GNP) and Gross Domestic Product (GDP) and equates with the word "product" in these terms. Economic growth in a country or region is conventionally measured by reference to change in either GNP or GDP at constant prices.

> Few statistics have such a key role to play in the formulation and assessment of economic policy as the rate of economic growth. In the long term, the gradual improvement in the standard of living of the community, which could be regarded as the prime objective of economic activity, is largely determined by the rate of growth. Indeed, the rate of growth achieved by a country has come to be regarded as a direct measure of the degree of success or failure of its economic policies ... (Hill, 1971).

This paper is concerned with the measurement of value-added in the Irish food processing sector. Food processing in Ireland is a significant economic activity in the national context. The GVA arising from food processing in 1998 was IR£1.7 billion (Irish Statistical Bulletin, June 2000). GNP in that year was IR£53.2 billion (National Income and Expenditure 1999). Food processing, strictly defined, therefore contributed 3 per cent of GNP. In that year, 41,441 people were employed in food processing (Irish Statistical Bulletin, ibid.). Total employment in that year was 1,495,000 (Agri Food 2010, Main Report, 2000). Food processing therefore contributed 2.8 per cent of Irish employment in 1998.

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Apart from its direct contribution to GNP and employment, food processing is inextricably linked to incomes and employment in Irish farming which in 1998 also contributed approximately 3 per cent of GNP but accounted for 8.6 per cent of employment (Agri Food 2010, 2000).

The main focus of this paper is measurement of change in net output of food processing at current prices. Net output is a more comprehensive measure of "value-added" than the published value-added measure and for reasons discussed below is used in preference to that more restrictive measure. Quantification of either definition of "value-added" at constant prices rather than current is more difficult and entails consideration of many conceptual and technical issues relating to the suitability of index numbers. It is a complex and specialised area of work as can readily be appreciated from some of the published work (Diewert, 1995). It is felt that dealing with these methodological issues should form the subject of a paper in their own right.

Data and Concepts

The data used in this paper are, for the most part, data compiled by the Central Statistics Office (CSO) and predominantly those of the Census of Industrial Production as published in the Irish Statistical Bulletin. Some CSO data from Supply Balances are also used as are data published by the Department of Agriculture, Food and Rural Development (DAFRD). All are secondary data.

For Census of Production purposes GVA is equal to production value minus the value of intermediate consumption (Irish Statistical Bulletin, ibid.). Production value is the total turnover of the enterprise irrespective of whether that value derives from production activities related to the main processes of the business. Intermediate consumption value comprises the value of all purchases by the business. Subsidies are excluded and indirect taxes (with the exception of VAT) are included. GVA as published in the Census of Industrial Production reports is therefore measured at current market prices rather than at factor cost. It is a measure of what the business or industry keeps of its market earnings to pay for its factor resources.

Another concept for which census data are presented is that of net output. Net output is equal to the value of gross output minus the value of industrial input. Gross output includes the value of goods and services sold by the business, but other items, for example, royalties are excluded. It is a factor cost measure in that the value of subsidies is included and indirect taxes excluded. For most industries the value of gross output is somewhat smaller than the production value as used in GVA calculation.

Industrial input comprises the value of raw materials, fuels and industrial services. Input costs such as royalties, freight, telecommunications etc. are included only in intermediate consumption. Industrial input is a significantly smaller measure of input than intermediate consumption as used in GVA calculation. In value, it averaged 78 per cent of intermediate consumption over the data period. In practice therefore, net output always exceeds gross value added.

While GVA is measured at market prices, net output (NO) is measured at factor cost. Because of this and because of the definitional aspect described above, NO is therefore a more complete measure of the value-added or "servicing" of raw material by processors than GVA even though the inputs involved in that "servicing" may come from other sectors, for example freight and telecommunications.

For these and other reasons discussed below under "Methodology", the NO measure was used here in preference to the GVA.

Methodology

The first part of this analysis examines the growth rate of the food processing sector in total and that of individual industries within it. It makes comparisons between food processing and the national economy. Growth rates of volume of production are estimated from linear equations of best fit.

The second part of the analysis focuses on the estimation of change in the value of net output per physical unit of input for two major food processing industries, namely, dairy product manufacturing and meat processing. NO is used here in preference to GVA both because it is a more comprehensive measure of the "servicing" by processors of raw material input than is GVA and also because the perspective of the author was to try to get some idea of the degree to which major agricultural inputs into processing are being "added to" over time by way of processing services. NO is the difference between a measure of revenue (R) and a measure of costs (C) and may be denoted as follows:

$$NO = R - C$$

Change in NO may come about because of change in R, C or both.

Change in NO is specified as follows:

$$\Delta NO = f(\Delta SI, \Delta BPM, \Delta NP, \Delta PP, \Delta PS, \Delta IC)$$

where:

ΔNO = change in absolute net output at current prices
ΔSI = change in scale or volume of major agricultural raw material going for processing
ΔBPM = change within product mix as it existed in base period
ΔNP = change in product mix arising from introduction of new products not existing in base period
ΔPP = change in product selling price
ΔPS = change in unit cost of processing services
ΔIC = change in unit cost of material inputs

All changes arising from individual factors may be interpreted on a *ceteris paribus*

or "other factors remaining constant" basis. Thus, on that basis, NO would be expected to double (ΔNO) if the scale or volume of the major agricultural input into processing doubled (ΔSI). Similarly, given that a mix of products of differing levels of processing/marketing services exist in the base period, change *within the confines of that product mix* (ΔBPM) will cause NO to change. The introduction of new products (ΔNP) which did not exist in the base period product mix will also cause NO to change except in the unlikely event that the new products replace existing products with the same NO levels.

A change in product selling prices (ΔPP) will cause NO to change. Such a change may be a general market price level change or it may be specific to the firm or industry concerned. Specific selling price changes may arise, *inter alia*, because of changing product quality unique to the firm or industry, changes in buyer perception arising from changes in marketing (foe example branding and distribution) strategies. Change in unit cost of processing services (ΔPS) is largely determined as the net outcome of changes in costs and productivity of labour and capital.

Finally because NO, like GVA, is defined as the difference between a measure of revenue and input costs, it follows that NO can also change because of change in materials input costs (ΔIC). The input cost of most interest here is the price of the main agricultural input and change in NO will be examined in the context of change in the prices of those agricultural products.

The methodology firstly involves taking the value of NO in the base year and applying the rate of change in the volume of the main agricultural raw material input to it. This generates a new series of NO which builds on the product mix as it existed in the base year. It is an estimate of the change that would have arisen in NO if nothing other than the scale or volume of the main agricultural raw material had changed. The difference between the published NO and this estimated NO is therefore explained in terms of the aggregate effects of changes in all other variables, namely, change in the product mix (ΔBPM, ΔNP), change in product prices (ΔPP), change in unit cost of processing services (ΔPS) and change in raw material unit input (ΔIC).

Secondly, the change in this series (i.e. difference between published and estimated NO) is divided by the volume of the main agricultural input to give an estimate of the *change* in the level, in value terms, of processing service per unit of agricultural raw material used. Conceptually, if the effects of changing unit cost of processing services could be removed, i.e. if one could deflate the series by a price index of processing services, one would have derived a measure of the change in the level, in volume terms, of processing services per unit of agricultural raw material used. This could be referred to as change in the intensity of the processing function. An increasing value for this ratio over time would mean that processors were adding increased volume of processing services to each unit of agricultural raw material processed.

Such a measure would be useful from a policy point of view. It is probably the case that when politicians and others refer to the need for greater value-added in Irish food processing they are intuitively referring to the need to

increase the volume of processing services per unit of raw material input. In this paper, a step is taken in the direction of quantifying that concept.

It is probably also the case, however, that those spokespersons think of increased value-added only in terms of the application of increased capital, labour and material inputs which impact on product mix changes.

However, as pointed out above, change in the value of NO may also occur for many reasons other than product mix changes, amongst which are changes in product selling prices occasioned by, for example, better distribution channel strategy and branding effect. While difficult, it is not always beyond the bounds of research that such effects could be quantified in their own right.

For many years, CBF-The Irish Livestock and Meat Board had the objective of reducing the volume of Irish beef exports sold into wholesale markets and increasing the volume sold directly into higher paying supermarkets. A large measure of success was achieved in this regard (Irish Food Board, personal communication). An analysis of the UK beef market (O'Connell et al., 1981) estimated that processors selling beef directly to UK supermarkets received a positive price effect of 5–8 per cent over the same quality product when sold to wholesalers. Thus, the increased value-added effect ($+\Delta NO$) arising from a better price (ΔPP) achieved through change in channel strategy was readily quantifiable. (It could be argued that the channel effect referred to here is more correctly treated as a product mix effect because, even though the physical product did not change, the conditions of sale were quite different).

CBF also had an objective of changing the product mix away from bone-in beef to boneless vac-pack product (ΔBPM). In this case also a significant degree of success was achieved (CBF Annual Review, 1990) and similarly the value-added gain arising was relatively easy to measure because both the necessary volume and price-effect data were available.

Results

Food Processing Sectoral Growth 1991–1999

Table 5.1 presents growth rates calculated from annual volume of production indices for the food processing sector as a whole and for individual industries within it. Growth rates were estimated on the basis of a fitted trend line thereby incorporating all the observations in the nine-year data period in the calculation.

Table 5.1: Average Annual Growth* in Volume of Production, Ireland, 1991–1999

NACE code	Sector	% annual change
411-423	**Food processing**	**+5.6**
412	Slaughtering and preserving of meat	+1.3
413	Manufacture of dairy products	+1.7

416,422	Grain milling and manufacture of animal and poultry feed	+2.9
419	Bread, biscuit and flour confectionery	+5.7
420-421	Manufacture of sugar and cocoa, chocolate and sugar confectionery	-0.3
411,414,415, 417-418 and 423	Other foods**	+9.5
	Manufacturing industry	**+12.1**
	All industries	**+11.4**

* Calculated on the basis of a fitted line: log index no. = f (year)

** "Other foods" comprise manufacture of vegetable and animal oils and fats; processing of fruit and vegetables; processing of fish; miscellaneous foodstuffs (i.e. NACE 417-418,423)

Volume of production of the Irish food processing sector grew at an average annual rate of 5.6 per cent over the 1991–1999 period. Growth was highest at an annual rate of 9.5 per cent in the "Other foods" category, followed by 5.7 per cent in "Bread, biscuit and flour confectionery" and a 2.9 per cent rate in "Grain milling and manufacture of animal and poultry feed".

However, growth was low at annual rates of 1.3 per cent and 1.7 per cent respectively in the industry's main commodity sectors of "Slaughtering and preserving of meat" and "Manufacture of dairy products". Volume of production declined in "Manufacture of sugar and cocoa, chocolate and sugar confectionery".

The overall growth rate of 5.6 per cent represents a very acceptable performance from what is a mature industry, although it is less than half the rate of growth achieved by Irish manufacturing generally in this period of unprecedented growth of the Irish economy.

The performance of the food sector which is largely an indigenous sector may be more fairly compared with performance of the total indigenous manufacturing sector. Following relatively poor performance in most of the 1980s O'Malley (1998) showed that the volume of production of the Irish indigenous manufacturing industry grew by what he regarded as quite a good rate of 4 per cent per year in the period 1987–95. While in the same period, all Irish industrial output grew by 9.9 per cent per annum but annual production in the OECD as a whole grew by only 2 per cent and that in the EU by only 1.7 per cent.

In addition, as illustrated by Harte (1998/99), a focus only on domestic growth of the Irish food industry ignores the very impressive international growth of Irish-owned food companies over this period.

Within food processing, "Other foods" grew most rapidly. It is likely that growth in this category was driven primarily by the high income growth of Irish consumers with increasing demand for food variety and convenience. Development of French-type bread and in-store baking and the pioneering of

their development by local companies is likely to have been an important factor in growth of the bread and grain milling sectors.

Growth in the dairy, meat and sugar sectors has been constrained by EU quota limits on farm production of the raw materials for these sectors. In addition, both the dairy and beef sectors have especially high commodity export contents and limited exposure to the fast-growing domestic market.

It is unfortunate that a breakdown of the "Other foods" category is not available. It would be of considerable interest to be able to get a better focus on the types of businesses that produced such high growth rates.

Apart from problems of industry classifications, the volume of production concept is also deficient to an extent. Volume of production, while of interest, is not necessarily a reliable indicator of the more important concept of value-added or of the wealth retained by an industry and which is the focus of this analysis.

A classification system introduced in 1991 (NACE Rev.1) for the census of industrial production gives some greater breakdown of food processing. Values for turnover and gross value added and for gross and net output for this classification are available. It was argued earlier that net output was the preferred measure in this exercise. Since net output is a "broad" measure of value-added it is reasonably valid to compare it with GNP. This will give some indication of the relative size and growth of food processing although the result derived using net output will tend to overestimate the size of food processing as strictly defined. The results of this comparison are presented in Table 5.2. Both net output and GNP are expressed in factor cost terms.

Table 5.2: Comparison of Net Output of Food Processing with GNP, Both at Factor Cost*

		1991	1998	1998 as % 1991
NACE	Sector	Net output as % GNP		
151-158	**Food processing**	**8.5**	**7.8**	**91.8**
1511, 1512	Meats	1.0	0.66	66
153	Fruit and veg.	0.22	0.12	55
155	Dairy products	1.77	1.01	57
1571	Animal feeds	0.29	0.18	62
1572, 1581	Prepared pet foods	0.03	0.036	120
1582,	Bread and flour confect.	0.49	0.35	71
1583, 1584	Sugar, cocoa, chocolate and sugar confectionery	0.63	0.31	49
1585, 1586,	Macaroni, noodles, couscous etc.			
1587	Tea, coffee Condiments, seasonings	0.10	0.13	130
154,156,1588,	Vegetable and animal oils and fats			

1589	Grain mill products, starches and starch products Homogenised food preparations and dietetic food Other foods n.e.c.	3.46	4.53	131

Note: The NACE codes and related official titles of the industries named in Table 5.2 are given in Appendix 5.1

* GNP at factor cost was estimated from data in "National Income and Expenditure 1999"

The net output of Irish food processing in 1998 comprised over 90 per cent of its 1991 position in GNP. In view of the extraordinary growth rates achieved by the Irish economy in the 1990s this performance is quite creditable given the demographic and income elasticity status for food of most of the markets into which Irish processors sell.

However, some industries have failed, to a significant degree, to keep pace with the growth in the general economy and this includes some major sectors. The "laggards" are "Sugar, cocoa, chocolate and sugar confectionery", "Fruit and vegetable processing", "Dairy products manufacture", "Meat processing" and "Grain milling and animal feeds".

The production of the raw materials for sugar and dairy processing are very severely restricted by EU supply-restricting systems and those for meat processing to a lesser degree.

Prepared pet foods improved their relative position by 20 per cent from a small base.

However, the last category in Table 5.2, namely the combination of "Vegetable and animal oils and fats; grain mill products, starches and starch products; homogenised food preparations, and dietetic food; and other foods n.e.c." closely followed by the second-last category, namely "manufacture of macaroni, noodles, couscous etc., tea, coffee, condiments and seasonings" were the star growth performers.

There is, however, a major difference of scale between the second-last and the last categories in Table 5.2. The manufacture of macaroni, etc., tea, coffee and condiments etc. (second-last category), while exhibiting high relative growth remained a relatively insignificant part of the economy and of the total food industry over the data period. Their gross output went from 0.67 per cent of total food processing gross output in 1991 to 1.26 per cent in 1998. At the same time their net output went from 1.2 per cent to 1.7 per cent of total food processing net output over the same period.

The scale figures for the last industry sector in Table 5.2, namely "Vegetable and animal oils and fats; grain mill products, starches and starch products; homogenised food preparations, dietetic food; and other foods n.e.c." are much larger. The gross output of the industries represented by these classifications was 16 per cent of total food industry in 1991 and 27 per cent in 1998.

Correspondingly their net output grew from 41 per cent of food industry net output in 1991 to 58 per cent in 1998. These figures illustrate:

- the combined scale of the industries represented by these classifications
- their extraordinary growth-rate performance relative to food processing in general and relative to GNP
- the disproportionately high net output (value-added) per unit of sales.

Once again, it would be of great interest if a further breakdown were available for these classifications.

Analysis of Change in Value-Added Captured by Dairy and Meat Processing

Dairy Product Manufacturing

The rate of change in the volume of milk produced on Irish farms is applied to the base year net output for dairy manufacturing and a new net output series is generated labelled "scale effect" net output. The difference between the CSO NO and "scale effect" NO is the change in NO arising for all reasons other than change in scale of milk production. This series is expressed as Irp/litre of total milk supplied. These results are presented in Table 5.3.

Table 5.3: Actual and Expected Net Output in Dairy Processing

Year	Change in milk supply compared to base 1991 (%)	Actual Net Output (NO) £000 "A"	Expected NO (Scale effect) £000 "E"	"A-E" NO £000 "A-E"	Rate of change in "A-E" to base year Irp/lt.	Annual rate of change in "A-E" Irp/lt.
1991		419,851				
1992	+0.889	488,944	423,583	+65.36	+1.28	+1.28
1993	-0.178	496,741	419,104	+77.64	+1.54	+0.26
1994	+1.146	377,782	424,662	-46.88	-0.92	-2.46
1995	+1.482	482,022	426,073	+55.95	+1.09	+2.01
1996	+1.640	527,306	426,734	+100.57	+1.96	+0.87
1997	+0.869	492,564	423,500	+69.06	+1.35	-0.61
1998	-2.3	471,930	410,194	+61,74	+1.25	-0.10
Average 1992 –98						+0.18

With the exception of 1994 the changes in the A-E value-added both in £millions and on a per-litre-of-milk basis relative to the base year of 1991 were positive. On a *year-on-year* basis the annual increase amounted to +0.18p per litre. On an intuitive basis one is inclined to say that this is a modest increase. Since any scale effect is excluded it necessarily represents the change in monetary return per litre arising because of changes in product mix, distribution, promotions and possible change in producer milk price. It is estimated at current prices and therefore includes any changes in the unit price of the services that were employed in generating the increased value-added of 0.18p per litre.

A common approach to the estimation of margins or values added of any kind at constant prices is that of double deflation (United Nations, 1993). Using that approach both the revenue and the input cost are deflated separately by what are deemed appropriate product price indices. O'Connell (1979) argued that the use of product price indices in either a single or double deflation system is inappropriate and may lead to misleading results. The value-added entity represents a *value* of services and if it is to be expressed in constant price terms should be deflated by an appropriate price index of services. Such indices are not published and would have to be estimated. The services involved would derive from labour and capital. The capital component would, very likely, pose severe practical difficulties in the estimation of a meaningful service price index. The exercise is not attempted here. It is felt that, if it is to be attempted, it is best done as a stand-alone exercise.

The data period of this exercise viz. 1991–98 was one of relatively low general Irish inflation averaging just over 2 per cent per year (Irish Statistical Bulletin, September 2000).

Unit labour cost in dairy product manufacture increased by a little under 3 per cent per year (Irish Statistical Bulletin ibid.). It may be that the level of capital investment in dairy processing, while relatively low, (Personal communication Irish Co-operative Organisation Society) gave rise to enough productivity gains to at least offset this fairly modest labour cost increase and give a position of no change in the overall unit cost of dairy processing services.

It may be that there would be very little difference between the estimated value-added figure whether expressed in current price or constant price terms for this particular data period. Admittedly this is a rather weak and speculative conclusion.

The estimation of the A-E value figure as above provides an absolute figure expressed as p/litre or in £millions. This approach has numerous advantages and opens up many possible avenues for further exploration and research. If a similar exercise were done for other countries, e.g. New Zealand, Netherlands, Denmark, one could reach some useful conclusions regarding the rate of change in an important performance measure in this country compared with our competitors. Furthermore if the total figure could be broken down into its components viz. those components arising from change in product mix,

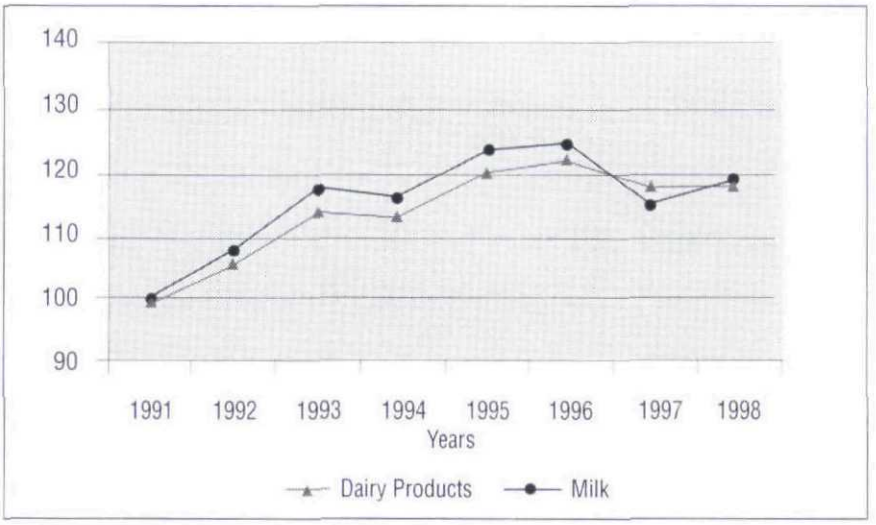
distribution strategies and promotional activities one could begin to explain the basis for different performance as between countries.

The results for value-added gain as expressed here could, when combined with data relating to expenditure on such activities as product development and promotional expenditure, facilitate the quantification and assessment of benefit-cost outcomes.

As defined earlier, any measure of value-added is the difference between a revenue and a cost figure. It is possible therefore that the estimated gain in value-added by the dairy processing industry may be achieved by reducing the price of inputs used in dairy processing or that the value realised for these gains is all retained by processors. It is also possible that the gain in value-added may be greater than that retained by the sector and that the difference is paid out to producers who thereby benefit from the value-adding activities of the processing sector through higher prices for milk. This latter effect which might be expected to be more relevant where the processing sector is largely comprised of farmer-owned co-operatives is not captured in the present exercise.

Raw milk is by far the most important input, the production of which provides incomes for many thousands of dairy farmers. It was felt that an analysis of the relationship between milk prices paid to producers and the prices received by dairy processors over the data period would add further to an understanding of the value-creating and -sharing process. The position is presented graphically in Figure 5.1.

Figure 5.1: Price Movements: Dairy Products and Milk



The data for Figure 5.1 were taken from the Irish Statistical Bulletin. The data for dairy products represent price movements as experienced by Irish dairy

processors. Those for milk represent price movements as experienced by Irish dairy farmers. Milk prices at farm level are determined by market prices and by EU export refunds and product subsidies paid to processors. The price data relating to processors are collected from processors by the Central Statistics Office (CSO). For those processors who sell through the Irish Dairy Board their "prices" are inclusive of EU refunds and product subsidies. This is not so for those who sell outside of the Board. Because of this there is a degree of non-comparability between producer and processor prices.

However, since the data are expressed in index number form and thus represent only movement in prices, they are likely to exhibit less error than absolute price data. In any case the graphs in Figure 5.1 behave quite well and in the firm belief of not fixing it unless it is broken the data are not subjected to further scrutiny.

Conceptually the graphs in Figure 5.1 are a diagrammatic method of presenting the story relating to value-added in the dairy industry.

The nature of the relationship between processor and producer prices provides some insights into the source of processor price gains.

If the dairy processing sector were increasing value-added because of activities on its part which require the allocation of resources at processing level, it would be expected that at least a proportion of any price increase thus earned would go to processors only. While such activity could have the effect of increasing producer prices it would certainly entail a widening gap between the price as received by processors and that received by producers.

If, however, a price increase is of a general market nature requiring no particular resource allocation on the part of the processing sector then it would be expected that a greater proportion of such price increase would be reflected in an increase in producer milk price. This latter effect is dependent on the processing margin being more of an absolute rather than a percentage margin in nature.[2]

On the basis of the movement of processor and producer prices as shown above it appears that processor price increases have largely been of the general market nature rather than having been earned by particular actions of Irish dairy processors.

This result is also consistent with the relatively low rate of increase in value-added (NO per litre) as estimated separately in Table 5.3.

Notwithstanding a low rate of growth in value-added, it may nevertheless be somewhat re-assuring from a dairy farmer perspective, to observe in Figure 5.1, that in general terms at least, there is quite a close correlation between price movements as experienced by Irish dairy processors and those experienced by Irish dairy farmers for their milk.

Finally, it is worth noting that with one exception the price changes in Figure 5.1 are all positive. The fairly substantial price drop from 1996 to 1997 coincides with a significant fall in A-E NO in 1997 as estimated in Table 5.3. The 1998 NO in Table 5.3 shows a further small reduction while Figure 5.1 shows both prices increasing. However, the small reduction in processing NO

could have been brought about by the fact that the milk price increased more than the processed product price in 1997–98.

Meats

A similar exercise is undertaken below for meats as was undertaken for dairy products. Data are presented in Table 5.4.

Table 5.4: Rate of Change in Slaughterings, Actual NO, Expected NO, Actual-Expected NO

Year	Change in slaughterings: all compared to base 1991 (%)	Actual net output (NO) £000	Expected NO (Scale effect) £000	"A-E" NO £m
1991	---	238,785	---	0
1992	+2.9	247,501	245,710	+1.79
1993	-0.7	255,817	237,114	+18.70
1994	-6.7	248,053	222,786	+25.27
1995	-2.4	288,122	233,054	+55.07
1996	+4.5	309,829	249,530	+60.30
1997	+8.5	305,514	259,082	+46.43
1998	+13.4	307,999	270,782	+37.22
Av. for period	+2.79	275,203	245,437	+34.97

The rate of change in tonnage of slaughterings is applied to the base year net output thereby generating a new series of expected net output which is an estimate of what net output would have been if nothing else had changed other than the tonnage slaughtered. The difference between this and actual net output (A-E NO) is the amount of net output arising for all other reasons, e.g. new product development, price gains of a general market or specific Irish industry nature etc. This averaged +IR£34.97 million/year in the data period. It reached a peak of +IR£60.30 million in 1996 and declined thereafter.

While the data refer to all meats the predominant meat is beef, which on a volume basis accounted for 68 per cent of all slaughterings in 1991 and 63 per cent in 1998 (*Animal Production*, 2000). Subsequent to the BSE crisis of 20 March 1996, the proportion of Irish beef marketed in the EU as a whole dropped from its peak figure of almost 60 per cent in 1995 to 40 per cent in 1996 (Trade Statistics). In addition, consequent on re-nationalisation of EU markets the Irish industry suffered a severe loss of better paying accounts within the EU for those sales still being made within the EU (Personal communication, Bord Bia).

In Table 5.5 the A-E NO estimates are expressed relative to tonnage of slaughterings.

Table 5.5: A-E Expressed Relative to Tonnes (cwe) Slaughterings

Year	"A-E" NO/Kg slaughterings. All compared with base yr IR P/kg	"A-E" NO/kg slaughterings. Year-on-year comparison IR P/kg
1991	0	
1992	+0.19	+0.19
1993	+2.0	+1.78
1994	+2.9	+0.91
1995	+6.1	+3.3
1996	+6.3	+0.54
1997	+4.6	-1.39
1998	+3.6	-0.88
1992-98 av.		+0.64p/kg

As can be seen in Table 5.5, gains in value-added per kg of meat were made from 1991 through 1996, although the figures are somewhat erratic. The gains spilled over from the peak of 1995 into 1996 albeit in a modest way while thereafter there was an actual loss in value-added per kg. The average year-to-year change for the period was +0.64p/kg. This compares with an average farm price of IR£2.15/kg carcass weight for heavy steers. The annual growth in value-added amounts to 0.3 per cent of the average farm price for the period.

As discussed in the context of dairy processing above, the results for meats would be of greater utility if similar results were available for other countries. Likewise it would be of interest and benefit if the individual components of the gains and losses in value-added shown above were estimated and related back to actions and costs incurred by the Irish industry in the achievement of gains.

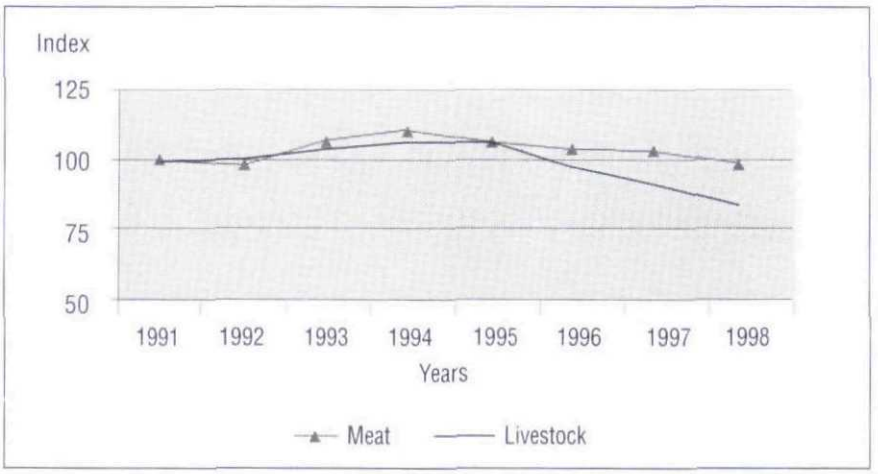
As was done for dairying, an examination of the relationship between ex-factory product prices and farm-level raw material (livestock) prices is carried out to test the possibility that processors might be increasing their value-added "at the expense" of Irish farmers.

It might be considered that this is more of a possibility in the meat industry than in the dairy industry given the long-held suspicions of farmers and their associations in relation to Irish beef processors, culminating in a blockade of beef factories in January 2000.

In addition, the Irish meat processing sector is predominantly in private ownership. The beef processing sector is over 95 per cent privately owned with

less than 5 per cent in farmer ownership, which might be thought by some to be more likely to give rise to "rip-off" farmer prices than would occur in the dairy sector. Figure 5.2 shows prices as received by Irish meat processors and by Irish livestock producers. Both price series are published in the Irish Statistical Bulletin.

Figure 5.2: Irish Industrial Producer Meat Prices and Irish Livestock Prices



As can be seen the relationship between movement in ex-factory meat prices and Irish livestock prices is quite close from 1991 through 1995, coinciding approximately with the period of growth in the A-E NO, but diverges progressively from then onwards. At first sight this is puzzling and, especially if you are a livestock farmer, even alarming. However, there are some further factors to be considered which can shed some light on this.

Firstly, because of the fact that there is no centralised marketing agency akin to the Irish Dairy Board operating in the meat sector, prices as received by meat processors and as recorded by the CSO are totally exclusive of EU export refunds (Personal communication CSO). On the other hand, prices as received by livestock farmers reflect EU refunds for both meat and livestock exports to non-EU destinations. The level of export refund per tonne of meat and meat equivalent of live exports declined significantly in 1997 and 1998 in the data period.

To make the comparison more valid therefore one must either take changes in refunds out of livestock price changes or add them to meat price changes and also allow for live exports. The latter was attempted here.

The methodology involved splicing an index number for export refunds

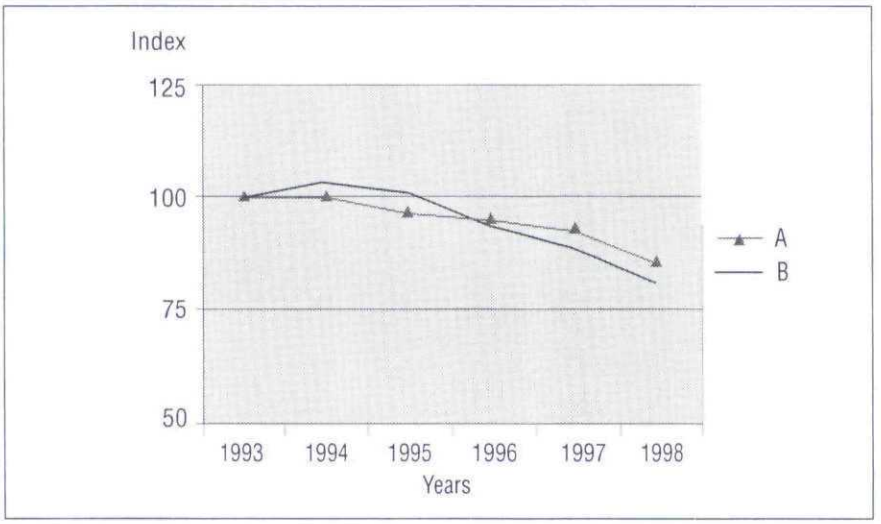
onto the published CSO meat price index to give an index of returns incorporating both market price and EU refunds. Two weightings were used – a base or 1991 weighting and a current or 1997 (1998 not available at time of writing) weighting where the weightings represented the proportion of carcass weight equivalent of combined meat and live exports exported to EU and non-EU destinations. The former was applied to the published CSO price index while the latter was applied to an index of export refunds.

In turn, the index of export refunds was estimated by taking total meat and live exports refunds (DAFRD) received by Ireland, dividing by the carcass weight equivalent of Irish meat and live exports to non-EU destinations (Animal Production, 2000) and expressing the result in index number form.

There appeared to be some problem with the export refund data for the years 1991 and 1992 which was not resolved at time of writing. Accordingly the exercise is confined to the years 1993–1998, which is reasonably satisfactory for present purposes since the divergence in Figure 5.2 which it is hoped to explain commenced in 1996.

Figure 5.3[3] compares the estimated movement in processor/live exporter returns with those in the CSO published livestock price (more correctly "returns") using 1991 weightings as described above. In 1991, 76 per cent of Irish meat and meat equivalent of live exports went to EU markets and 24 per cent went to non-EU markets.

Figure 5.3: Meat Processor/Live Exporter (A) and Livestock Farmer (B) Returns



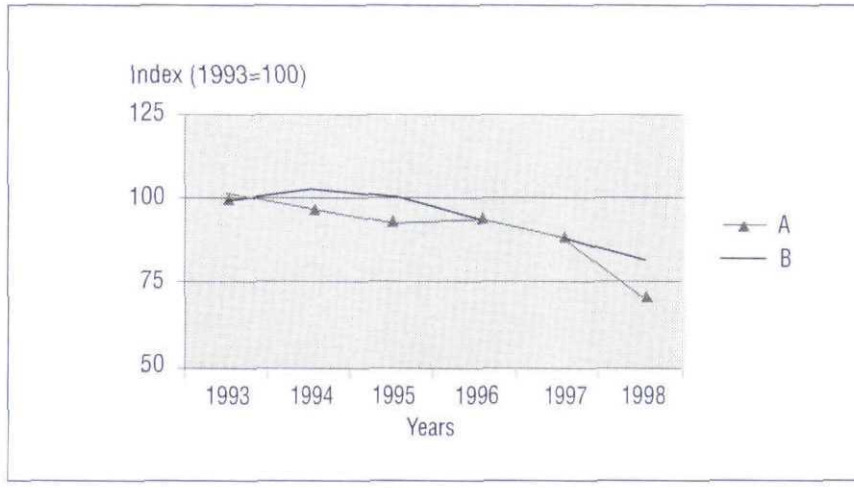
It can be seen in Figure 5.3 that when export refunds are taken into account the movements in processor/live exporter returns and those of livestock producers

are much closer than when the comparison is made simply between ex-factory processor market prices and producer returns as was done in Figure 5.2.

It is also relevant to point out that a charge for the disposal of specified risk material was introduced in 1996 which is not dealt with here but would have the effect of further closing the gap between the two graphs.

The effect of changing the weighting from a base weighting of 1991 to a more current weighting of 1997 can be seen in Figure 5.4.

Figure 5.4: Returns of Meat Processors/Live Exporters (A) and Livestock Farmers (B)



In 1997, a higher proportion of combined meat and livestock exports went to non-EU destinations than in 1991. In 1991, 24 per cent went to non-EU; in 1997 the corresponding figure was 32 per cent. The influence of the greater importance of non-EU trade in the 1997 weighting would have the effect of giving greater impact to the refund cuts which occurred in 1997 and 1998. The graphs in Figure 5.4 using this weighting system show processor/live exporter returns falling faster from 1997 to 1998 than those for livestock farmers while that was not the case when the 1991 weighting was used.

While the exercise attempted here is undoubtedly crude and capable of refinement, the authors are reasonably satisfied that the evidence is consistent with the thesis that, in the data period, the change in value-added in the Irish meat processing sector was not brought about at the expense of Irish livestock producers.

However, it is an area of much interest and importance, especially to producers, and further work could profitably be done to develop it conceptually, to refine the data and methodology, and to bring the exercise more up to date if possible.

Summary and Conclusions

While not keeping up with the extraordinary growth of the Irish economy throughout the 1990s, Irish food processing nevertheless has grown at what, in other periods, would be regarded as a relatively high growth rate. This growth has not come from the large traditional sectors such as dairy processing, meat processing or sugar and related confectionery but from an assortment of newer type sectors. These include macaroni, noodles, couscous, tea, coffee, condiments, seasonings, vegetable and animal oils and fats, grain mill products, starches and starch products, homogenised food preparations, dietetic food and other foods n.e.c.

A new approach to the measurement of value-added was developed in this paper and applied to two relatively large processing sectors that are large scale purchasers of major products of Irish agriculture. The concept chosen was that of net output rather than gross value added. Figures for both are published by the Central Statistics Office. The net output measure was chosen because it is a wider and more complete measure of the total level of processing services attached to raw materials than is gross value added.

Changes in Net Output arising for reasons associated with changes in scale of the main agricultural raw material input were estimated and excluded thus giving a residual net output which arose for all other reasons. Change in this residual Net Output was expressed on a per-litre-of-milk and per-kilogram-of meat basis. If it were expressed in constant price terms it could be termed a measure of change in the intensity of processing. An increase in this ratio would indicate an increase in processing intensity and a decrease would indicate a decline in processing intensity.

Both dairy and meat processing showed an increase, on average, in the ratio at current prices in the period 1991–98. In the absence of standards for comparison it is not possible to evaluate the significance of these increases rigorously, but on an intuitive basis they appear small. The average annual gain ranged from approximately 4/5 of 1 per cent of the average price for milk over the period to approximately 1/3 of 1 per cent of the average price for meats.

The figure for dairy products was positive in 1992, 1993, 1995, 1996 (reaching a peak in 1995, declining but positive in 1996) and negative in 1997 and 1998. For meats it was positive in 1992, 1993, 1994, 1995, 1996 (reaching a peak in 1995, declining but still positive in 1996) and was negative in 1997 and 1998.

With the exception of 1994 the pattern of results is similar for dairy and meat products. For both dairy and meat processing a reasonably close relationship was found as between changes in ex-factory prices and farm-level prices for milk and livestock respectively.

Further work could usefully be done in relation to measuring changes in processing intensity at constant rather than at current prices; making inter-country comparisons; evaluation of the extent to which gains are general market gains or specifically Irish; decomposition of changes in processing intensity (either in constant or current price terms) into its components; and

evaluating the return to Irish expenditure designed to increase those components. However, the data and conceptual and methodological difficulties of doing this are formidable.

Appendix 5.1

NACE Codes and Official Titles of Food Industries

NACE Code	Title
1511,1512	Production and preserving of meat and poultrymeat
153	Processing and preserving of fruit and vegetables
155	Manufacture of dairy products
1571	Manufacture of prepared feeds for farm animals
1572	Manufacture of prepared pet foods
1581,1582	Manufacture of bread, fresh pastry goods and cakes, rusks and biscuits, preserved pastry goods and cakes
1583,1584	Manufacture of sugar, cocoa, chocolate and sugar confectionery
1585,1586,1587	Manufacture of macaroni, noodles, couscous and similar farinaceous products, condiments and seasonings; processing of tea and coffee
154,156,1588,1589	Manufacture of vegetable and animal oils and fats; manufacture of grain mill products, starches and starch products; manufacture of homogenized food preparations and dietic food and other food products

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1 The authors are grateful for assistance from personnel in a wide range of institutions. These are given in the References at the end of the paper. In particular, Michael Lucey of the Central Statistics Office was of immense help both personally and in directing the authors to other personnel and to relevant publications. In this piece of research, as in others, the personnel of the Central Statistics Office have been outstanding. Errors are the responsibility of the authors.

2 The price movements in Figure 5.1 are, on the whole, supportive of this idea. With an absolute processing margin, then *ceteris paribus* when processor prices increase, producer prices should increase at a greater rate and when processor prices decline, producer prices should decline at a faster rate. This is true for 4 out of 7 of the price changes in Figure 5.1. It is not the case for one, namely that from 1995 to 1996 while there appears to be no difference in two others namely, those from 1993 to 1994 and 1994 to 1995.

3 Base year for Figures 5.3 and 5.4 is 1993 and not 1991 as in previous figures.

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