Report of the
UK FARM CLASSIFICATION WORKING PARTY

February 2004

Contents

1. MEMBERSHIP OF WORKING PARTY

John Watson	Farm and Animal Health Economics, Defra	(Chair)
Jane Hinton	Farm and Animal Health Economics, Defra	(Secretary)
Roger Price	Farm and Animal Health Economics, Defra	
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Miles Templeton	Statistics (Census & Surveys), Defra	
Sheila Magee	Department of Agriculture & Rural Development, Northern Ireland	
Katherine Falconer	Scottish Executive Environment & Rural Affairs Department (to February 2003)	
Sean Neill	SEERAD (November 2002 to June 2003)	
Michael O'Neil	SEERAD (from June 2003)	
Paul Casey	Welsh Assembly Government	
Ian Banks	Welsh Assembly Government (to April 2003)	

2. BACKGROUND TO THE WORK

2.1 The UK Farm Classification Working Party was convened in December 2001 and charged with reviewing the current farm classification system used by the UK rural affairs Departments. There were several drivers for a review at this time. Defra had recently been created with a wider remit (than the old MAFF) that covers the environment and rural affairs alongside agriculture. The work of the Policy Commission was well underway and it was placing greater emphasis on the wider role of the farmer as manager of the countryside environment. Additionally it has been nearly 10 years since the previous review of the system; the current measure "Standard Gross Margin" was felt to be a difficult and confusing concept to many users with increasing concern being expressed regarding the use of "out of date" SGMs as a measure of farm size and type.

On the 12th December 2001 the group held its first meeting and agreed the following Terms of Reference:

3. TERMS OF REFERENCE

- To review the United Kingdom Farm Classification System (Revised 1994) taking account of:
  - the updating of Standard Gross Margins;

- alternative measures of farm size;
- the need to compare structures over time;
- the introduction of second pillar measures;
- the diversification of farms;
- the Customer Registration Project (formerly Single Business Identifier)

- To devise a transparent system which assists stakeholders in understanding the structure of farming and its role in the environment and rural economy.
- To recommend how such a system may be implemented.
- To influence the development of the EU farm typology system.

3.1 A total of eight face-to-face meetings were held and key stakeholders were contacted to seek their views and requirements. A summary of stakeholder responses can be seen at ANNEX A.

Status of the Report (February 2004)

3.2 This is the final report. It has been reviewed by Steve Wisher of Information by Design who supports the recommendations and made some useful suggestions on additional analysis. This report has been presented to the senior managers in the Economics and Statistics Divisions of the UK Agriculture and Rural Affairs Departments (the 'WINES' group, 7th October 2003 meeting). They have endorsed the recommendations made in this report. This report has also been circulated to a wide range of external stakeholders.

4. SUMMARY OF RECOMMENDATIONS

4.1 In summary, the Working Party recommends the following changes to the UK farm classification system:

1. To measure the size of agricultural production on farms with Standard Labour Requirements instead of Standard Gross Margins.

2. To largely retain the existing definitions of UK agricultural types but with some minor adjustments[1].
3. To retain SGMs as the classification metric for agricultural type but to replace the "1988" SGMs currently used with "2000" centred SGM averaged over five years.
4. To update the SGM coefficients every 5 years and backdate data for 10 years at the point of update.
5. To introduce a minimum threshold for the inclusion of holdings in the production of standard agricultural results from the June Census.
6. To use an output based measure to provide an indication of the size of the farm business, covering their agricultural, environmental and diversified activities. This measure will only be applied to the Farm Business Surveys and Farm Accounts Survey[2].
7. To develop an income based measure (in the FBS/FAS) of farmer household type, reflecting the relative contributions of agricultural, diversified, environmental and other gainful activities to the household income.

4.2 These recommendations apply only to the national classification system. If it is agreed that the recommendations should be implemented, it is also proposed that the views and rationale of the Working Party will be presented to the European Commission, Eurostat and others involved in the EU Classification system through circulation of this report and other key papers as appropriate to the EU Structure & Typology Working Party and the Farm Accountancy Data Network Community Committee.

4.3 This report summarises the rationale for the recommendations of this Working Party, annexing key documents where relevant. More detailed papers and supporting analysis are available on request. First, the existing UK farm

[1] A new main farm type called *specialist hardy nursery stock* is to be created and included within the horticulture robust type. *Specialist mushroom* farms are to be included within horticulture robust type. The robust type Pigs and Poultry is to be separated into specialist pigs and specialist poultry. The cattle and sheep farm types will be renamed as Grazing Livestock. Deer will be given a Standard Gross Margin coefficient and allocated to the new Grazing Livestock farm type.
[2] The Farm Business Surveys (England, Wales, Northern Ireland) and Farm Accounts Survey (Scotland) will be abbreviated to FBS/FAS for ease of reference in the rest of this Report.

classification system is briefly described, then the measurement of farm size is discussed and a new measure recommended. The classification of farms into agricultural production types is considered next along with the extension of this into the wider activities of farm businesses. Finally a timetable for implementation of these recommendations is given.

5. AN OUTLINE OF THE CURRENT UK FARM CLASSIFICATION SYSTEM

5.1 The current UK system classifies farms according to the combination of their agricultural production activities. The UK method is similar to the Eurostat method which is based on Standard Gross Margins (SGM) per hectare of crops and per head of livestock. The SGM is a financial measure founded on the concept of the gross margin for farming enterprises. The gross margin of an enterprise is the value of its total output (the goods which it produces) less the variable costs[3] which are directly attributable to it.

5.2 Standard Gross Margins are calculated as an average over three years and are representative of what could be expected on the average farm under 'normal' conditions (i.e. no disease outbreaks or adverse weather conditions). The total SGM for each farm is calculated by multiplying its crop areas and livestock numbers by the appropriate SGM figure and then summing the result for all enterprises on the farm.

5.3 **Farm size** is currently measured by total SGM, but the actual unit of size is called the European Size Unit (ESU). One ESU is defined as 1,200[4] Euros (previously European Currency Units) of SGM. It is a measure of the economic size of holdings in terms of the value they add to variable inputs and thus differs from physical measures, such as area, which take no account of the intensity or quality of production.

5.4 To put the measure in some context, 8 ESU is the threshold for inclusion of farms in the Farm Business Survey for England and Wales[5]. Using the 1988 SGMs, 8 ESUs is equivalent to 10 dairy cows or 15ha of wheat for example.

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[3] See Commission Decision 85/377/EEC for a detailed list of the costs deducted.
[4] Actually 1000 ECU of SGM at 1980 levels multiplied by an agro-economic trend coefficient (AETC) of 1.2 representing agro-economic inflation at the EU level.
[5] For Scotland farms are only recruited if they are over 16 ESU, although some farms of 8-16 ESU are still included. Northern Ireland includes some farms in the FBS which are less than 8 ESU.

Whilst ESUs do not provide a direct measure of labour use, the threshold of 8 ESU probably represents the minimum size at which a holding could be expected to provide sufficient work to occupy a person fulltime. That said, many holdings of 8 ESU and over are recorded as having a labour input of less than one annual work unit.

5.5 **Farm type** is determined by the relative contribution of each enterprise to total SGM. For example, there are nine 'robust' types (cereals, general cropping, horticulture, pigs & poultry, dairy, hill cattle & sheep, lowland cattle & sheep, mixed, other) and the robust type of a farm is determined by the combination of enterprises that account for two-thirds of its total SGM.

5.6 A detailed description of the current UK agricultural classification system and the value of "1988" SGMs currently employed can be found at ANNEX B.

6. MEASURING AGRICULTURAL SIZE

6.1 The main drivers for considering alternative measures of farm size were that the existing measure, SGM, has been found to be opaque and confusing for many users; it does not afford an easy definition of the full-time or part-time farm, a description that is relevant in many policy contexts; and it is not easily extendable beyond agriculture to reflect diversification and environmental activities.

6.2 It was agreed that a good measure of farm size should have the following attributes, though the relative emphasis on each may be argued:

- transparent, comprehensible, and accords broadly with intuition, particularly when considering the full-time/part-time threshold
- can be applied to a broad range of data sources (eg agricultural census, Farm Business Surveys, etc)
- extends outside agriculture (e.g. agri-environment, diversified activities)
- robust against normal trading variations;
  - does not change where there is no business change
  - insensitive to market prices

6.3 There are a range of alternatives that could be used to assess farm size for national purposes (the EU will continue to use SGMs). These include measures based on assets, inputs, outputs, and profit. Initial assessments of these four types of measure were -

6.3.1 Asset based measures of size were rejected as they could only be applied to FBS/FAS data and could not be used on the whole farm population.

6.3.2 An input based on labour requirements was felt to be transparent and intuitive and applicable to a wide range of data sources. It is relatively robust over time (although changes in capital and productivity will have longer run impacts) and may be extendable outside agriculture. It has a significant advantage by providing a clear and direct measure of the full-time/part-time threshold.

6.3.3 Output based measures can be broadly transparent and applicable but when based on values rather than volumes can suffer from sensitivity to market prices. An output measure may have the advantage of being more extendable beyond agriculture than other measures.

6.3.4 Profit based measures did seem initially to be intuitively appealing, but given the volatile nature of incomes and the limitation of such a measure to FBS/FAS data they were rejected as a measure of agricultural size.

6.4 Based on this initial assessment it was agreed to undertake more detailed consideration of labour and output as measures of agricultural size. The measurement of size through any measure can either be direct, requiring data on the actual labour usage on the farm and the volume or value of production, or they can be obtained through 'standardised' measures linked to other data on the agricultural production undertaken on the farm (for example cropped areas or stocking numbers). As actual labour usage on farms can be determined by the extent to which it is substituted with other factors of production (e.g. machinery), variations in actual labour input would be observed that are not due to variations in farm size. Similarly, the actual output of a farm can vary from year to year due to extraneous reasons (e.g. changes in market prices, yields due to weather) rather than reflecting changes in farm size.

6.5 For these reasons, and as standardised measures can be used with a wider range of data sources, it was agreed that standardised measures of labour input and output should be explored. The following sections describe the calculation

and analysis of Standard Labour Requirements and Standard Outputs and on the basis of this a recommendation is made as to the better measure of agricultural size.

Standard Labour Requirements

6.6 When considering labour inputs it was concluded that a volume based measure would be more appropriate than a value based measure as this eliminates the effect of wage rates and is probably more intuitive to users. We named this measure 'Standard Labour Requirements', or SLRs. This may seem familiar to some readers as prior to SGMs, 'Standard Man Days' were used as a measure of farm size. A central criticism of this measure was that they were insufficiently precise to accurately measure the size of any individual farm. It was agreed that a new set of SLR coefficients should not be calculated to address this criticism but rather aim only to provide a broad brush approach to identifying different sizes of farm. Therefore, the new SLRs are intended to represent the approximate average labour requirements for broad sets of crop and livestock categories. These broad categories group together enterprises which are homogeneous in terms of labour input. The intention is not to make precise estimates of the labour requirements on an individual farm nor to make fine distinctions between say, 1.2 and a 1.4 full-time equivalent farms, but rather to be able to broadly separate a 1 person farm from a 2 person farm.

6.7 Using a range of data sources, but relying predominantly on Defra Special Studies and analysis of England's FBS data, a set of SLR coefficients was put together. The Special Studies collect detailed data on individual enterprises and most record the labour hours allocated to the enterprise (including an allocation of casual, contract and overhead labour). Where labour hours have not been explicitly recorded in the study, an SLR has been imputed from the labour cost using an estimated hourly rate usually derived from the FBS. For those enterprises for which Study data are unavailable, estimates have been made by selecting a subset of FBS farms that predominantly undertake the enterprise and looking at the regression of physical units on labour hours.

6.8 The SLR coefficients were then tested on a range of FBS and June Census data. With some minor modifications, the final proposed set of coefficients are as

given in the following table (and in more detail in ANNEX C). Some of the crop coefficients have been adjusted for Northern Ireland to reflect the smaller field sizes; see ANNEX D.

Table 1: Standard Labour Requirements[6]

Crop/Livestock category	Proposed coefficient (hours per ha or head per year)
Cereals	20
Oilseeds	15
Hops	60
Sugar Beet	33
Field beans & peas	10
Main-crop Potatoes	90
Early Potatoes	120
Outdoor Vegetables & salad	100
Vining Peas	25
Other peas & beans	500
Top and soft fruit	450
Hardy Nursery Stock	1500
Vegetables under glass	5000
Flowers & plants under glass	25000
Mushrooms	7220
Set aside	1
Dairy cows	39
Beef cows	12
Other cattle	9
Ewes and rams (lowland)	5.2
Ewes and rams (lfa)	4.2
Other sheep (lowland)	3.3
Other sheep (lfa)	2.6
Sows	16
Finishing & rearing pigs	1.3
Piglets (<20kg)	1.0
table fowl	0.03
laying hens	0.3
growing pullets	0.12
Other poultry	0.045
Horses	150
Goats	20
Deer	15
Fodder crops	6
Grassland	4
rough grazing	1.5

[6] Adjusted coefficients for Northern Ireland apply for some categories due to different farm structures – see Annex D.

6.9 Clearly there are substantial difficulties in standardising labour requirements and it is important to remember that these SLRs represent the 'typical' labour requirement under typical conditions for enterprises of average size[7] and average performance. There will be a wide variation around this position (see analysis below) and the actual labour used on an individual farm may be higher or lower than the calculated figure for a range of reasons. Nevertheless, if these SLR coefficients are a reasonable reflection of the typical labour requirement, we would expect the calculated labour requirement, on average, to be a good match for that recorded by key data sources. To investigate this, the next section reports a summary of analyses of applying these coefficients to the June Census and FBS/FAS.

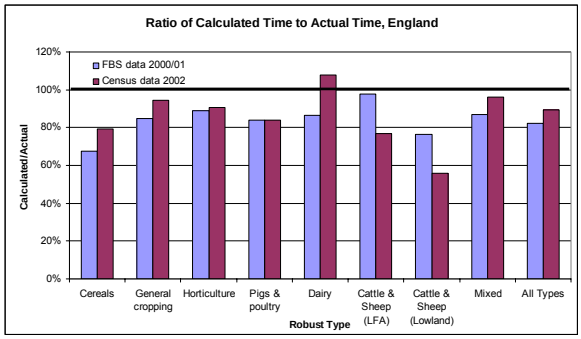
Analysis using the SLR coefficients

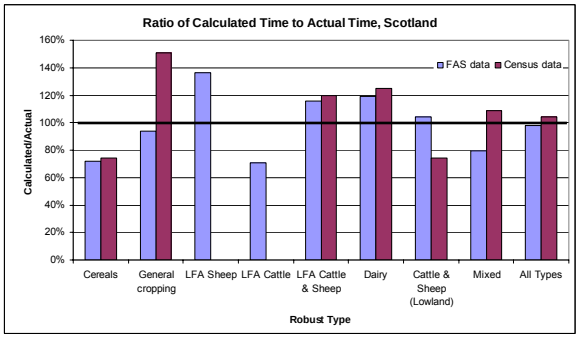
6.8 Chart 1 shows the ratio of the average calculated labour hours to the average actual labour hours - where this proportion is less than 100% the SLRs give a lower figure than the actual average labour hours and vice versa. The Census labour hours have been calculated by applying Annual Work Unit coefficients derived from 1997 Structure Survey data to the number of full time and part time workers. This necessarily means that the Census analysis is subject to a further margin of error. Applying the SLR coefficients to the June Census data and comparing this to the labour as estimated from the Census shows that the calculated labour requirement is around 80% to 100% of the total actual labour recorded. At the aggregate level the SLRs produce a good fit to actual data.

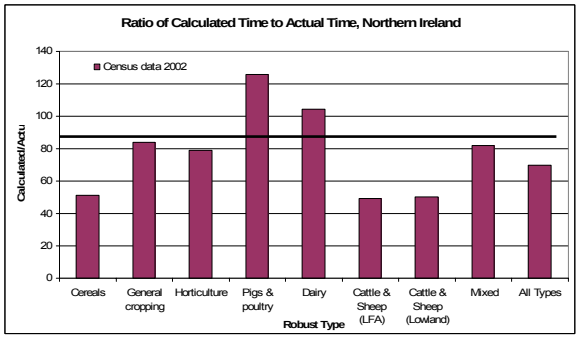
6.9 The fit to Census data does vary by farm type and country. In general, the SLRs tend to provide a lower estimate of the labour for cereal farms than that derived from the Census data. The SLRs provide a high estimate of worker time for general cropping farms in Scotland, and for pig & poultry farms in Northern Ireland.

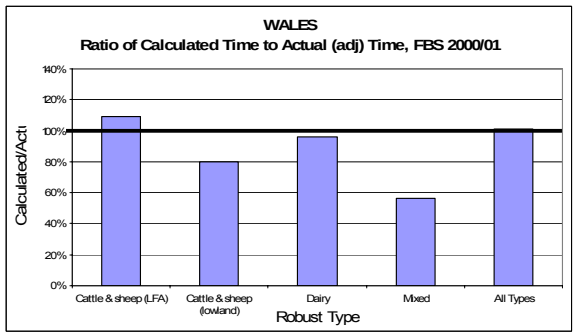
[7] As the SLRs have mainly been calculated from Special Study data they will reflect the average over the population of study. This is normally selected to cover farms over a minimum size defined in terms of livestock numbers or cropped area so that most production is covered.

Chart 1: Ratios of calculated (SLR) time to actual time[8]



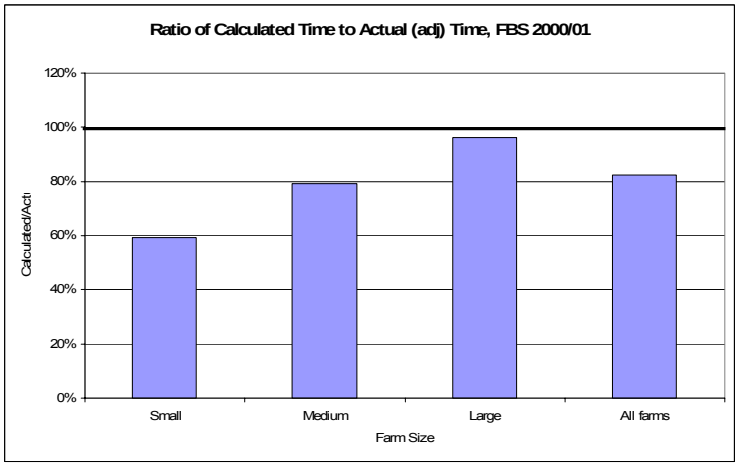






6.10 The relationship between calculated and actual labour time is also related to business size. The ratio of calculated to actual labour increases with farm size and this relationship is illustrated for England using FBS data below. This relationship may arise for several reasons – e.g. larger units may be more labour efficient, smaller units may make more use of unpaid labour whose time input is less accurately recorded, the SLRs may be a better reflection of the labour input on larger farms.

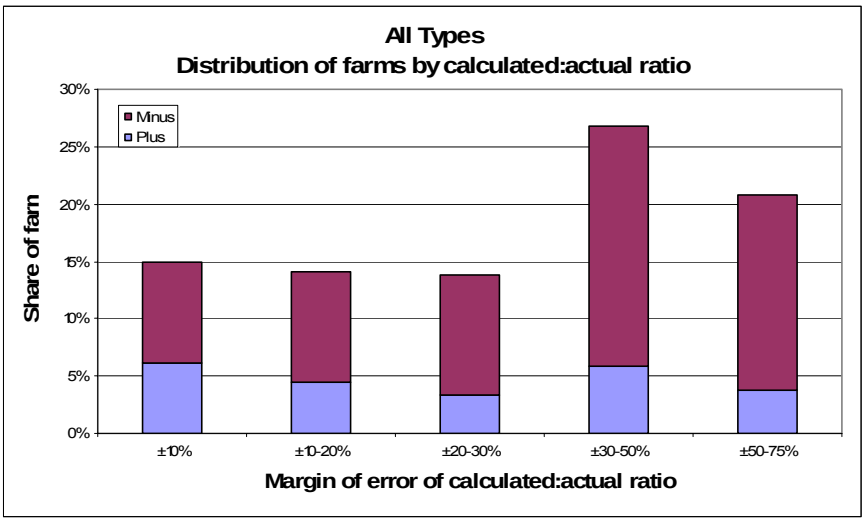
Chart 2: Relationship between farm size and calculated:adjusted time



[8] The June 2000 Census data and the FBS/FAS 2000/01 data have been used; the pattern of results is observed if data pertaining to a different year is used.

There is also a range of fits between calculated and recorded labour time as shown in the chart below:

Chart 3: Percentage of farms (England, FBS) by goodness of fit.



6.11 Overall though given that the coefficients are designed to provide a broad brush estimation of labour requirement on the average farm and there are margins of error in the Census and farm business data, it is concluded that the SLRs provide a reasonably good proxy for the recorded labour.

A part-time / full-time threshold

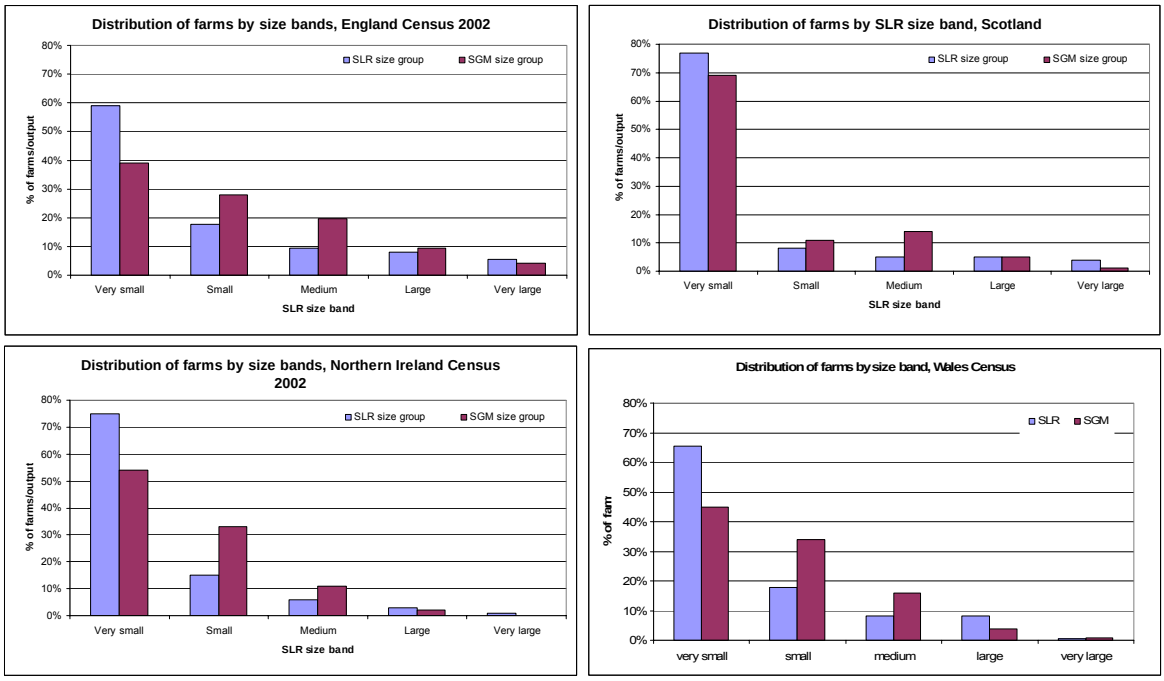
6.11 The calculated SLRs give an estimate of the annual hours required for the annual agricultural production taking place on farm. This measure has the advantage of translating easily and transparently into a full-time equivalent (FTE) and size bands based on FTEs would seem more appropriate for presentation of results. The Working Party agreed that the definition of the annual hours of a full time worker should be taken from the rounded average of the basic hours as laid down by the UK Agricultural Wages Boards. This is calculated to be 1900 hours, based on a 39 hour week. The following definitions of size bands were agreed:

Size Band		SLR-based definition (hours)	SGM based definition (1 ESU = 1200 SGM)
Very Small	Spare time	< 0.5 FTE (1 – 949)	0 to 8 ESU
	Part time	0.5 to < 1 FTE (950 – 1899)	
Small	Full-time	1 to < 2 FTE (1900 – 3799)	8 to 40 ESU
Medium	Full-time	2 to < 3 FTE (3800 – 5699)	40 to 100 ESU
Large	Full-time	3 to < 5 FTE (5700 – 9499)	100 to 200 ESU
Very Large	Full-time	5 or more FTE (>=9500)	over 200 ESU

6.12 Chart 4 below shows the distribution of the Census population of farms[9] by size band. For England, using the SLR based measure of size almost 60% of farms are part-time (defined as requiring less than 1900 hours per year); of which 25% are spare time (defined as requiring less than 950 hours per year but more than 1). A further 18% are in the category of between 1 and 2 full-time equivalents (FTE). A similar distribution is observed for the other UK countries but with a greater preponderance of very small farms; around three-quarters of farms in Scotland, Northern Ireland and two-thirds in Wales fall into this size band.

6.13 Compared with the SGM-based measure of size, the SLR-based measure moves farms from the small and medium categories into the very small category. This is not surprising given that the threshold of 8 ESU represents the minimum size at which a holding could be expected to provide sufficient work to occupy a person fulltime and it is reasonable to expect some farms operating above this threshold to require less than 1 FTE. This analysis shows that around a fifth of farms were over 8 ESUs but less than 1 FTE.

Chart 4: Distribution of farms by size band



6.14 In conclusion, the proposed SLR coefficients provide a reasonable approximation to the labour requirement of the agricultural activities on the "typical"

[9] For England, only farms falling within robust types 1 to 8 are included.

farm. SLRs provide a measure of agricultural size that can be readily translated into full-time equivalents and that is transparent and should be readily understood by users.

Standard Outputs

7.11 The choice between a volume or value based measure of output is perhaps less clear cut than that for labour input. Volume based measures of output remove the impact of market prices which differ between producers and over time. However, the use of a standardised measure which is averaged over several years and updated periodically also helps to circumvent this problem. A volume based measure of agricultural production presents a problem of additivity – can tonnes of wheat be added to numbers of eggs for example. A value based measure also has the additional advantage of being readily available through calculations already undertaken for Standard Gross Margins. Therefore, a measure of the standard value of output was considered and derived from existing SGMs.

7.12 The most recent SGMs calculated in the UK are "1996" centred. A five year average was felt to provide a more stable measure of output and therefore a set of Standard Outputs were calculated that cover the period 1993 to 1997. If Standard Outputs were implemented as the new measure of size they would be updated to cover 1998 to 2002[10]. There is a standard output for each agricultural activity for which an SGM coefficient is calculated and these are given, for the England EU regions in the table below.

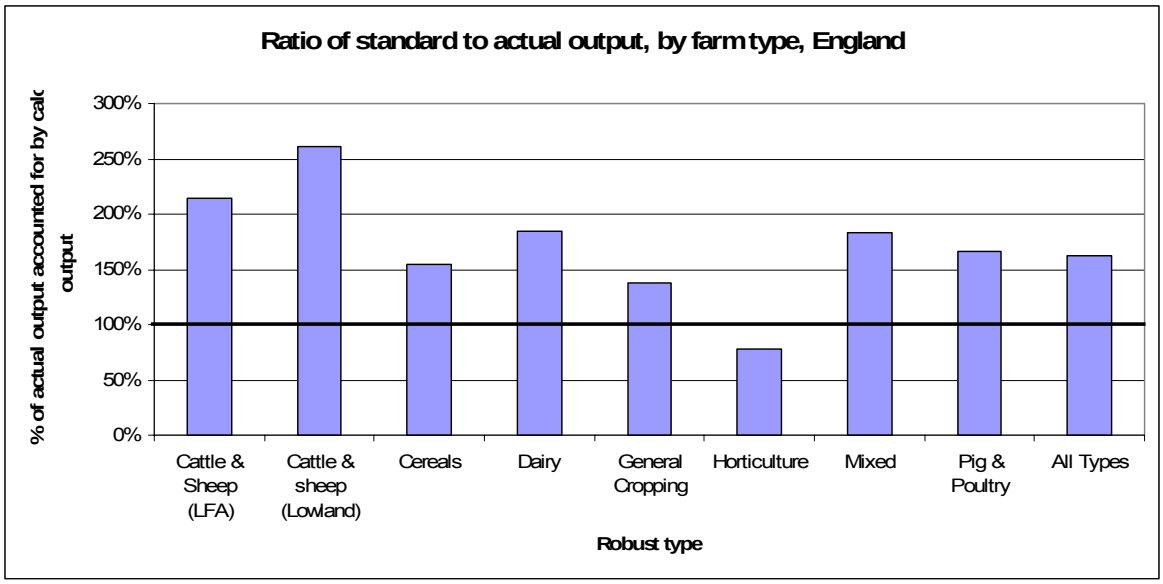
[10] A provisional set of "2000" Standard Outputs were forecast for England using changes in market prices; analysis using these coefficients does not differ notably from that using the "1995" coefficients reported here.

Table 2: Standard Outputs for England

£/ha,hd.	1993 – 1997 Standard Output		
Crop/Livestock	**North**	**East**	**West**
Wheat	1080	1060	1050
Rye	770	770	770
Barley	950	920	900
Oats	950	950	930
Other cereals	820	820	820
Peas and beans harvested dry	800	810	780
Pure crops for fodder	810	810	810
Other	890	840	820
Potatoes	3510	3830	4100
Sugar beet	1810	1630	1840
Fodder roots and brassicas	1	1	1
Hops	5370	5370	5370
Oilseed rape	930	910	830
Sunflowers	700	700	700
Linseed	700	680	690
Field scale vegetables including strawberries	4530	4650	6950
Market garden scale vegetables including strawberries	6950	2920	6720
Vegetables under glass including strawberries	206700	203900	193200
Outdoor flowers	8740	8740	8740
Flowers and pot plants under glass	288600	288600	288600
Temporary grass	1	1	1
Other forage crops	1	1	1
Grass and clover seed	1030	1030	1030
Other arable crops	700	700	700
Fallow	0	0	0
Permanent grass	1	1	1
Rough grazing	1	1	1
Top and soft fruit excluding strawberries	8080	5390	4830
Wine grapes	1730	1730	1730
Hardy nursery stock	36300	36300	36300
Mushrooms	24900	24900	24900
Mushrooms recorded in FBS/FAS	4010	4010	4010
Set-aside	310	310	310
Horses and ponies	810	810	810
Cattle <1 year	600	610	600
Male cattle 1 < 2 years	2190	1290	1300
Female cattle 1 < 2 years	1000	1010	1000
Male cattle 2 years and over	1300	1250	1470
Heifers 2 years and over, not yet calved	1370	1380	1380
Dairy cows	1800	1840	1760
Beef cows	610	610	610
Beef cows in LFA	640	640	640
Ewes	115	105	105
Ewes recorded in FBS/FAS	110	105	100
Ewes in LFA	100	100	90
Ewes in LFA recorded in FBS/FAS	95	95	90
Other sheep	5	6	7
Other sheep recorded in FBS/FAS	55	55	55
Other sheep in LFA	3	3	4
Other sheep in LFA recorded in FBS/FAS	20	20	20
Goats	175	175	175
Piglets	145	145	145
Breeding sows	750	750	750
Other pigs	250	250	250
Broilers	9	9	9
Laying hens	13	14	13
Ducks, turkeys, geese and guinea fowl	35	35	35

7.13 A provisional set of standard outputs for 1998-2002 were produced[11] to compare total standard output to the actual value of output as recorded on farms in the FBS. This shows that in general the standard output coefficients provide a much higher level of output than the actual value of agricultural output recorded (see Chart 5). Whilst this overestimation can be taken into account when defining the size bands it does cast some doubt over standard outputs as a reliable measure of agricultural size.

Chart 5: Comparison of standard output to actual output, FBS 2000/01 England



Output-based size bands

7.14 The value of output on a farm does not intuitively translate into definitions of small, medium and large farms. Therefore, a definition of the size groups was determined by comparing the distribution of farms in the FBS (England) as given by SLRs with that given by Standard Outputs (SOs). The scatter diagram below shows that there is a close positive relationships between agricultural size as measured by SLRs and as measured by SOs. Although a single regression line is plotted on the graph, the pattern in the data suggest two distinct relationships; one roughly along the diagonal which is predominantly made up of horticulture farms and a flatter one along the lower part of the graph accounting for most other farms.

[11] Annual gross margins are produced by Defra for the main enterprises. These trends were applied to the 1993-1997 standard outputs to adjust them to 1998-2002 levels.

There are high correlations between these two measures for each robust farm type in the FBS of around 0.8 to 0.9 as shown in Table 3.

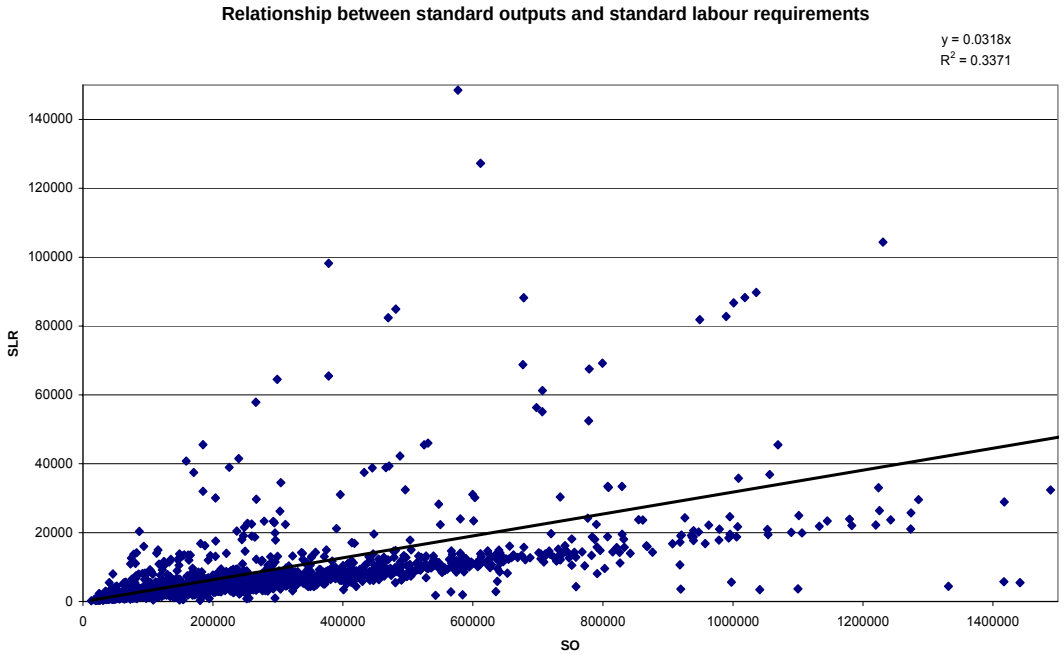


Table 3: Correlation between SLR size and SO size for FBS farms

Robust Type	Correlation between SLR and SO	Slope coefficient for regression equation
Cereals	0.97	0.0192
General Cropping	0.74	0.0252
Horticulture	0.78	*0.0868*
Pig & Poultry	0.80	0.0163
Dairy	0.98	0.0194
Cattle & Sheep (LFA)	0.90	0.0287
Cattle and sheep (Lowland)	0.85	0.0203
Mixed	0.89	0.0196
ALL TYPES	0.59	0.0318

7.15 As Standard Outputs and Standard Labour Requirements seem to be providing similar measures of agricultural size, the size band criteria for SOs were generated by minimising the number of farms in the FBS that switch size bands under the two measures. The resulting standard output size bands are shown in Table 4 below.

Table 4: Definition of Size bands using Standard Outputs

Size Band	£'s Standard Output
Spare time	1 – 50,000
Part time	50,001 – 100,000
Small	100,001 – 200,000
Medium	200,001 – 300,000
Large	300,001 – 400,000
Very Large	>400,000

7.16 Consequently, the distribution of farms by size group as defined by SOs and SLRs look very similar (see Chart 6). The one notable difference is that Standard Outputs lead to more farms classified as spare time using Census data.

Chart 6: Distribution of farms by size, England FBS & Census

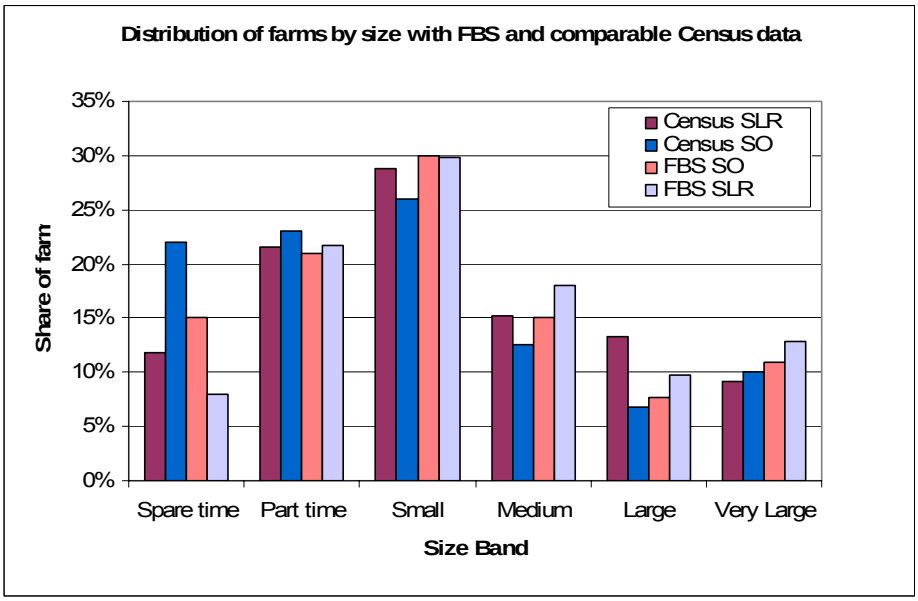


Table 5 below shows that around three quarters of farms in the June Census (2002) fall into the same size groups using a Standard Output and an SLR size classification.

Table 5: Cross tab of census data by Standard Output and SLR size groups

STANDARD LABOUR REQUIREMENT SIZE GROUP	STANDARD OUTPUT SIZE GROUP						
	Spare time	Part time	Small	Medium	Large	Very Large	**All sizes**
Spare time	79959	2002	188	74	33	1157	**83413**
Part time	9865	8526	1842	143	76	833	**21285**
Small	3395	4842	11512	1254	235	1374	**22612**
Medium	627	628	3382	5045	708	982	**11372**
Large	274	327	804	2219	3420	2808	**9852**
Very Large	12	112	269	273	395	5652	**6713**
All sizes	**94132**	**16437**	**17997**	**9008**	**4867**	**12806**	**155247**

Note: Based on the number of holdings in each category from farms greater than 8 ESU, excluding the farm type 'other'.

Which measure of size?

7.17 This report has so far looked in detail at two measures of size, Standard Labour Requirements and Standard Outputs. They both provide a potential measure of the size of the agricultural production taking place on farm and are highly correlated with each other. SLRs have an additional advantage of providing a direct measure of the full-time/part-time threshold and it is felt that users would have a greater intuitive understanding of the difference between a one person farm and a two person farm than between a £100,000 and £200,000 standard output farm. The initial analysis also suggested that outputs may not be as appropriate for agriculture given the annual fluctuations observed due to shifts in market prices and subsidy payments. However, output based measures (e.g. turnover) are generally used by other industries.

7.18 Consideration was also given by the Working Party to the possible impact of the recent CAP reform agreement (of 26th June 2003) on these measures. A key component of the reform agreement will lead to at least some of the current production-linked subsidies being decoupled from agricultural activity. This means that a standard output measure (which currently includes the value of production subsidies) will produce significant future step changes in agricultural size. This could be avoided by recalculating the Standard Outputs to remove all production subsidies.

7.19 Whilst recognising the advantages and disadvantages of each measure it was agreed that on balance **SLRs should be the recommended new measure of the size of agricultural production of farms**.

7.20 Some initial analysis of the FBS has been undertaken to see how changing the size measure from SGMs to SLRs may affect the main results. Table 6 below shows the average net farm income by farm type based on the current size measure (SGMs) and what the 2000/01 data would have looked like if the new size measure (SLR) had been adopted.

Table 6: Average Net Farm Income by farm type and size, England 2000/01

£/ farm	Small		Medium		Large	
	SGMs	SLRS	SGMs	SLRS	SGMs	SLRS
Cattle & sheep (LFA)	1390	969	13722	9527	16104	18123
Cattle & sheep (lowland)	-1248	-1364	936	-439	13583	8784
Cereals	811	3817	7376	9922	13091	18895
Dairy	1394	4876	8963	11508	26144	26516
General cropping	4771	6878	9066	17998	31188	34156
Horticulture	10974	8191	17890	5799	73807	43483
Mixed	2156	4970	7867	9924	12370	9678
Pigs & poultry	19894	21273	14021	21028	73088	57099
All Types	1903	3549	8661	10331	25387	26174

8. MEASURING FARM BUSINESS SIZE

8.1 Up to this point we have not addressed how these measures could be extended to measure the size of the *whole farm business*. Modern farming covers the range of activities which depend on farm resources. Whilst this clearly includes agricultural production it may also encompass other activities such as farm diversification[12] and farmers as managers of the countryside environment. Therefore, to provide a fuller picture of the current and likely future structure of farming, consideration needs to be given to a measure of farm business size that enables diversification and environmental activities to be combined with agricultural production.

[12] The definition of farm diversification is a much debated area. For the purposes of this report, diversification has been taken as non-agricultural activities involving the use of resources (capital or labour) that were previously utilised by the agricultural business. Excluded from this definition is income entering the farm household through off-farm employment.

8.2 Labour input: It is fairly easy to see how a labour input measure could provide a good indication of the scale of diversified activities *("does the diversified activity employ one person full time?" etc*). Generating a standardised measure would be more difficult as the physical units to apply it to are less clear and little data are available to calculate SLRs for diversification. It would also require a list-based definition of diversification which does not seem to be the most appropriate approach[13]. Some aspects of environmental activities could be measured using actual labour input, for example hours per metre of hedgerow or stone wall. However, there are two main disadvantages to a labour input based measure of environmental activities. Firstly, applying environmental SLRs would place significant additional requirements on data collection. Second, there are some environmental activities for which labour requirements are reduced, for example, reduced crop spraying and lower stocking densities. That is, there is probably a poor correlation between labour input and the scale of environmental activity.

8.3 Output: A measure of the value of output for diversification activities is conceptually quite straightforward, although generation of standardised output values face the same difficulty as for standard labour requirements. Measuring the environmental output of agriculture (positive and negative) is an extremely complex area and a separate work stream is ongoing within Defra Economics & Statistics Directorate to develop environmental accounts for agriculture. If we take a shorter term pragmatic view, then information related to environmental activities which is more readily available are the payments made to farmers under various environmental schemes, many of which fall under the umbrella of the Rural Development Programmes. The payment rates under these schemes could be seen as a proxy for the value of the environmental output.

8.4 Whilst neither labour input nor output values provide a good measure of the size of the non-agricultural activities of the farm business, it is felt that perhaps, on balance, output values provide a slightly better measure than labour input. The derivation and application of standard output values is not currently possible and therefore the value of *actual* output could be used as a measure of the size of

[13] For example, the Defra Diversification Working Party views diversification as being as non-agricultural activities involving the use of resources (capital or labour) that were previously utilised by the agricultural business. These activities may therefore vary from farm to farm.

diversified activities and environmental activities (as approximated by scheme revenue). Combining this with the output value of agricultural production may give an indication of total farm business size.

8.5 However, there are significant practical limitations with applying such a measure of farm business size to the population of farms. Those surveys that enable analysis of the population (primarily the June Census and Structure Surveys) do not record output values and the Working Party does not consider it practical to recommend that they do in the future. This would place significant data collection burdens onto both farmers and Departments and there are concerns over both the legal and data quality issues.

8.6 The Farm Business Surveys do record the value of output of agricultural and diversified activities and the revenue accrued from scheme payments for a sample of full time farm businesses. Therefore it is recommended that future analysis and publication of FBS data considers presenting key data grouped according to farm business size. Farm business size should be proxied by the sum of standardised output from agricultural activities, the actual output from diversified activities and the revenue accrued from environmental schemes.

9. FARM TYPE CLASSIFICATION

9.1 We turn now to consider the grouping of farms into different types depending on the nature of the agricultural and/or other activities taking place on farm. First the agricultural types will be considered and then farm business type.

Agricultural Type

9.2 The agricultural type of a farm is a simple description of the agricultural production taking place on the farm. Where more than one enterprise is undertaken, the relative contribution made by each to the farm business needs to be reflected in determining agricultural type. Theoretically, the metric used as a basis to assess relative contributions could be any of the measures described in the preceding section on farm size. However, given that the farm business management decisions of the farmer are, in principle, economically rationale and made to optimise the profit, or margin, of the farm, it would seem logical to use an economic basis for the relative weightings of enterprises. The current typology

system takes precisely that approach by using Standard Gross Margins to assess farm type.

9.3 It is therefore proposed that the current classification system for agricultural production used in the UK be retained. However, some minor amendments are proposed to enable the system to better reflect the types of production being undertaken in the UK:

a) Under robust type 3, Horticulture, a new constituent main type 'Specialist Hardy Nursery Stock' will be added. This is currently subsumed within 'other horticulture' but given that it is a specific type of production it seems sensible to allocate it to its own main type. The main type 'Specialist Mushrooms' will be moved from robust type 9 (other) into the horticulture type as it is more closely aligned with horticultural production than the types of production falling within 'other' (e.g. specialist grass, goats, horses).

b) Robust type Pigs and Poultry will be subdivided into two robust types; specialist pigs and specialist poultry, as users do not like the combining of these two types of production. Farms classified as mixed pigs & poultry (146 in England June Census) will be moved into the Mixed robust type.

c) Deer farms are not currently allocated within the system and will now be included as 'Various grazing livestock' (EU type 4443)

d) Cattle and sheep farms to be renamed 'Lowland Grazing Livestock' and 'LFA Grazing Livestock'. These are more accurate descriptions as goats and other grazing livestock are also encompassed here.

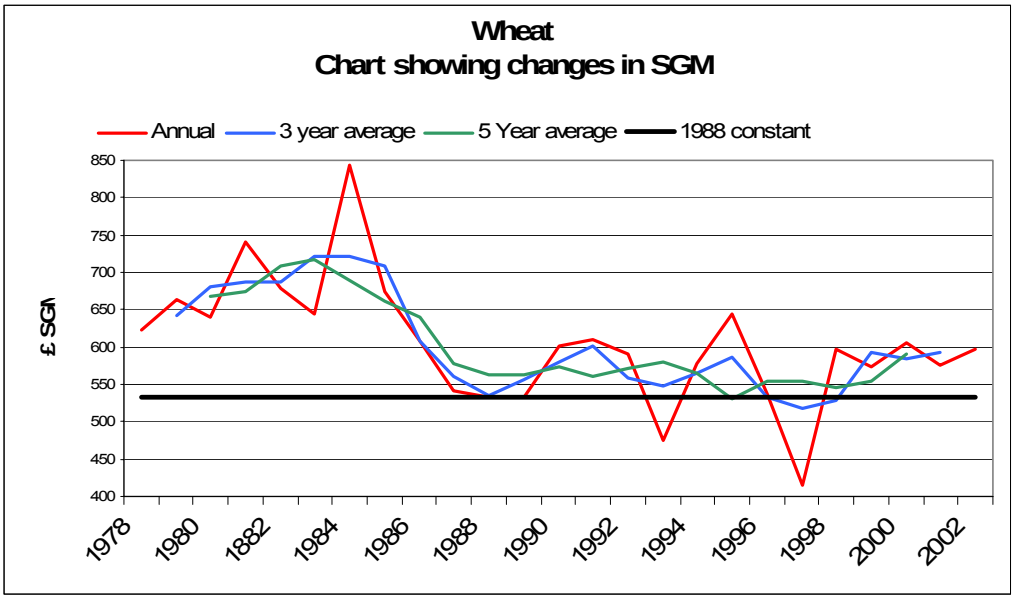
9.4 It is proposed that the metric used to generate this classification is updated. That is, the Working Party proposes to replace the "1988" SGMs that are currently used for agricultural type classification with "2000" SGMs.

9.5 The use of a constant set of SGMs (1988) has provided a consistent time series that reflects the structural change taking place in the industry. However, the 1988 SGMs are now inappropriate because profitability has changed, at different rates for different enterprises, since they were calculated. An up-to-date set of

SGM coefficients is required to provide a more accurate picture of the current structure of the industry.

9.6 It has also been agreed that the SGMs for national purposes should be averaged over five years rather than the current EU practise of averaging over three years. A five year average SGM is more effective than a 3 year average at smoothing out fluctuations caused by short term shifts in market prices and yields. To illustrate this the following charts examine the trends in average coefficients using historical SGMs for two common enterprises. The two charts below show how a five year average of SGMs (green line) would have varied over time in comparison with a three year average (blue line) and each year's actual SGM (red line). The black line gives the "1988" SGM. These charts also show how the profitability of wheat and dairy have changed over time.

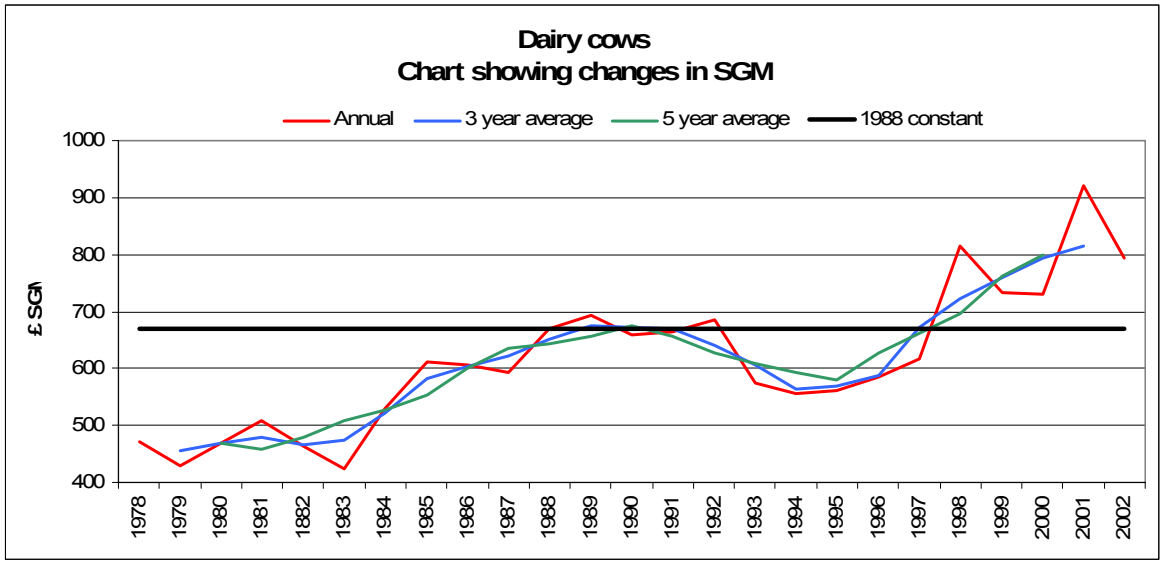
Chart 7



9.4 The chart for wheat shows that profitability was higher before 1988 and is very volatile. The five year average produces a smoother trend (standard deviation = 60[14]), than compared to both the three year average (standard deviation = 66) and the annual figure (standard deviation = 84).

[14] An indication of the average difference between the average SGM and the constant 1988 SGM. A variance of zero implies a constant trend.

Chart 8



9.5 The chart for dairy cows shows that profitability, as measured by a five year average of SGMs, was up to 20% lower at the beginning of the period, and 20% higher at the end of the period when compared to the constant 1988 SGM. Again, the five year average produces a smoother trend (standard deviation = 90), than compared to both the three year average (standard deviation = 105) and the annual figure (standard deviation = 125).

9.6 This brief analysis shows that moving to a set of "2000" SGMs will provide a better picture of the current structure of the agriculture industry and the five year average will be more effective at smoothing out short term fluctuations. However, an important decision is how frequently the SGM coefficients are updated and the extent to which a new backdated time series is calculated. Using a constant set of coefficients has the advantage of allowing good time-series analysis of structural changes within agriculture whilst frequently updated SGMs provide the best snapshot of the current structure of the industry. Although consistent time series data can be produced when SGMs are updated by backdating or chain linking this can have significant resource implications. The Working Party considered four options:

9.6.1 **Option 1 – Status Quo**: Continue using the 1988 coefficients. This would have the advantage of allowing time series analysis over the whole range of data and it requires the least amount of resources of all four options. However the SGMs are out of date and give a misleading picture of farm structure.

9.6.2 **Option 2 – Constant SGMs with regular update:** Update the SGMs every five years and backdate them ten years at each update. Again time series analysis is permitted with this method (but only for a 10-14 year period) although it would require more resources than the status quo, particularly in the backdating of results.

9.6.3 **Option 3 – Five year rolling average, with backdating**: Update the SGMs every year and backdate them ten years at each update. This would produce a very accurate snapshot and time series of the structure of the industry at any given point in time. However the resource implications of backdating the results every year would be significant, particularly for the devolved administrations. This approach would also have the disadvantage of producing many different results for the same year (ten in fact) which would be confusing for users.

9.6.4 **Option 4 – Five year rolling average, without backdating**: Update the SGMs every year without backdating. This would not require too many resources but the time series would reflect both structural change and the effect of changing the SGMs.

9.7 Option 1 was rejected quite readily as the limitations of using the "1988" SGMs in a 2003 world were a key driver for this Review of Typology. Option 4 requires the least resource but consideration of the technical issues (see ANNEX E) meant that this option was rejected: changing the SGMs whilst not producing a back dated data set would introduce systematic bias into the analysis of structural change over time. Option 3 was also rejected on grounds of resource implications and potential confusion for users.

9.8 Therefore it was agreed that "1988" SGMs should be replaced with five year average SGMs centred on 2000 and a new 10 year time series recalculated. The SGMs should then be updated every five years and a new 10 year back series recalculated each time.

9.9 The first year's data this can be applied to are the results of the 2004 June Census and the 2003/4 FBS/FAS. The new time series (for Census and FBS/FAS) will need to extend back to 1994/5. "2005" SGMs will need to be calculated in good time for the results relating to 2009.

A minimum threshold

9.10 The results of the Agricultural Census for England, Wales and Scotland are currently published for all holdings that have a cph (county-parish-holding) number. There is no minimum threshold of agricultural activity applied and thus in 2002 in England there were around 50,000 (40%) registered holdings with an SGM of

zero[15]. Part of the reason for this is that the Census is taken at a point in time and therefore does not capture the seasonality of production on some holdings, but this is also due to the reluctance of registry systems to delete obsolete holdings. This gives a misleading picture of the number of and trends in agricultural holdings. To address both of these issues, the Working Party makes two proposals:

1. The June census should include an additional question to determine for those returns with no production on their holdings at 1st June whether they have or will undertake agricultural production at a different point in the (calendar) year.

2. For the publication of results from the June Census, only holdings with more than zero SGM and at least one hectare of agricultural land or any cattle, sheep, pigs, goats, deer, horticultural crops, mushrooms or more than either fifty poultry or two horses should be included.

Both of these proposals are taken from current practise in Northern Ireland.

9.11 The effect of the second proposal would be to exclude around 32,000 (or around 17%) of registered holdings in England from the publication of June Census results. All of these have an SGM of zero and are currently categorised as robust type 9. Whilst there would be substantive change to the estimated number of holdings, by definition the effect on the physical areas and headage counts would be very small. There would be implications for the labour figures but these are likely to be small given the current criteria in place for the inclusion of holdings in the labour analyses.

Farmer Household Type

9.12 A question put to key stakeholders was 'What unit of farming are you interested in?'. All of those that responded to this question stated that it was the wider farm business or household that was their usual focus of study. Also, during the process of this review and discussions with colleagues and policy customers an often expressed desire was to be able to group farms according to the extent to which the farm (household) was dependent on the agricultural activity of their farm business.

[15] The 2002 Census for Wales show just over 11,000 holdings with zero SGM, around 30% of the population.

9.13 The main potential types of activity that can be undertaken by the farm household can be broadly described as agricultural, environmental, diversification and other gainful activity (e.g. off-farm employment). As for the proposals related to farm business size given in Section 8 (page 21) above, information beyond the agricultural activities is only realistically available through the FBS/FAS; it is not envisaged that this type of data should be collected for the population.

9.14 The FBS/FAS currently collects some data on the other gainful activities of the farmer and spouse. Within broad bands the income accruing to the farmer and spouse from off farm employment, self employment, investments, pensions and social payments is recorded. From the FBS account it is also possible to separately identify income arising from agricultural activities and diversified activities (from 2003/4). The payments for participation in agri-environment schemes are also recorded; some rough estimation could be made as to how much of this revenue translates into income (much of it will be for costs incurred). Given these four categories of income generating activities it would be possible to group farms according to the extent to which they are dependent on the income arising from agricultural production.

9.15 It is proposed that FBS farms should be assigned to a 'farmer household type' category based on the type of activity that is generating more than half of their total income and that key results should be published using this classification. This would give the following types of farmer household:

Income arising mainly from ….

1. Agriculture
2. Diversification
3. Environmental scheme participation
4. Other gainful activities
5. Agri-diversified (agriculture & diversified make up >50%)
6. Agri-environment (agriculture & environment make up >50%)
7. Agri-other (agriculture & OGA make up >50%)
8. Mixed

9.16 Whilst it is not possible to generate this sort of classification through data collection in the population, some indication may be obtained through requesting voluntary self classification by the farmer. Clearly this will reflect the perception of the farmer and may be subject to bias and error but it at least provides some data.

In order to maintain consistency across surveys it is proposed that a standard question along the following lines could be adopted:

> Which of the following types of activity provide the greatest part of the income of your household? (please only tick one)
>
> Agricultural production □
>
> Participation in environmental schemes □
>
> Diversification (non-agricultural use of farm resources) □
>
> Non-farming activities (including off farm employment) □

9.17 It may be useful to include such a question in other farm surveys (although legal and other constraints would have to be taken into account). Consideration should also be given to including this in the FBS as it would enable a cross-comparison between farmer responses and actual data as recorded by the Investigating Officers.

10 PROPOSED TIMETABLE FOR IMPLEMENTATION

The current aim is that recommendations 1 through to 5 should be implemented for the publication of results from the 2004 June Census and the 2003/4 farm business surveys and associated publications. Recommendations 6 and 7 pertain only to the FBS/FAS at this stage and development work is ongoing regarding implementation. Some aspects of these recommendations may be reflected in the publication of 2003/4 results, but full implementation (particularly where additional data collection is required) will take place over a longer timescale.

ANNEX A

COPY OF LETTER SENT TO STAKEHOLDERS -

"Dear ….

DESCRIPTIONS OF FARM TYPES AND SIZES IN AGRICULTURAL STATISTICS

DEFRA and the other UK Rural Affairs Departments have for many years collected information about the physical and financial characteristics of farms through a range of surveys including the June Agricultural and Horticultural Census, the Farm Business Survey and the Farm Structure Survey. When the findings of these surveys are analysed and published, it is useful to group farms into particular types of agricultural production (e.g. dairy, cereals) and/or size of farm. The standard farm classification system that is used for doing this was developed from the EU system and has been in operation in largely the same form for around 15 years. A brief summary of the current system is attached.

We now feel that the time has come to review and probably revise the current system to enable it to better reflect the current (and future) structures of farming and the interests of the principal stakeholders. In particular, the use of "Standard Gross Margins" has proved difficult to understand and to explain to users. We are therefore writing to a selection of stakeholders to seek views on the type of classification system that you would like to see in place and we would be grateful for ideas and comments you may have. In particular –

- For what purposes do you distinguish between different types and/or sizes of farm? What criteria do you use currently in doing so?
- What 'unit' of farming (e.g., the agricultural holding, the agricultural part of a farm business, the wider farm business including other enterprises and activities) are you interested in?
- In what ways does the current classification system meet your requirements?
- If the existing system does not meet your requirements, what other characteristics of farms would you like to see a future classification system taking into account? (Current suggestions include environmental management, diversification, tenure and socio-economic types, as well as a measure of size based on, for example, standardised labour input requirements.)
- Do you find the present system too complex and would like to see a simpler version?

While we will consider fully all viewpoints, it may be that practical constraints limit the extent to which revisions can be put in place in the short term. If you would like further information or to discuss the issues raised, please feel free to contact me. Written responses would be appreciated by Friday 20th September.

Yours sincerely,"

SUMMARY OF STAKEHOLDER RESPONSES

Replies from

- NFU
- NFU Wales
- Stuart Platt (ESD)
- Judith Marsden (ARBR)
- Farmers Union of Wales
- ADAS Wales
- Education and Learning Wales (ELWa)
- Highlands and Islands Enterprise
- Scottish Landowner's Federation (SLF)
- Lloyds TSB Scotland
- Scottish Agricultural College (SAC)
- University of Aberdeen - Department of Agriculture and Forestry

Thoughts on current system

- Concerns over the grouping of pig and poultry farms in the robust type
- Horticultural statistics could be improved
- Current system is not particularly user-friendly
- Some respondents thought the current system is adequate

Thoughts on new system

- Support given for a system that reflected the additional dimensions of farming - in particular environmental and diversification activities
- Some concern (by NFU) over the use of SLRs as a size measure
- Desire for consistency across datasets (e.g. FBS/FAS, Census and Survey of Personal Incomes) and UK countries
- Support for using the whole farm family/business operations as the unit of classification
- Some breakdown of farms into regions would be desirable

Additional dimensions of interest

- Levels of vertical integration/marketing arrangements
- Organic farming

ANNEX B

Agricultural Classification in the United Kingdom

Introduction

To assist in the analysis of data on UK farming, the results of the June Agricultural Census and the Farm Business Survey (FBS/FAS) are classified by type of agriculture and size of business. By agriculture we mean the science, art or practice of cultivating the soil, growing crops and raising livestock, as opposed to farming which is the business of agricultural and a range of other activities that depend on the farm. The system currently used in the UK is based on that used by Eurostat and was first introduced after the EC Directive of 1985[16] establishing a Community typology. The reasons and aims for classifying agriculture are explained in Section A. In Section B the agricultural classification as used in the UK is outlined which also details how the size of a farm is determined. Section C describes the most commonly used agricultural types in the UK system, called 'Robust' types.

A. Why classify agriculture at all?

Agriculture is a diverse sector which is likely to become more diverse still. Analysis of each individual farm is not practical, so farms are grouped together into types according to their common characteristics.

The aims of agricultural classification:

1. To identify where market trends or economic conditions affect a particular group of farmers more than others
2. To help plan government policy
3. To help assess the likely and actual impact of government policy
4. To enable comparative analysis (benchmarking) of the relationship between agricultural type (or size) and aspects of performance (e.g. efficiency and profit)

Who uses the agricultural classification system?

Essentially given enough information about a farm anyone could determine the type and size of that farm using the UK's agricultural classification system. However the classification system does have a number of primary users:

1. Farm Business Survey (FBS) in England and Wales or Farm Accounts Survey in Scotland

The FBS collects data on costs, outputs, subsidies and investment from individual farms across the financial year. The results are then presented by robust

[16] Official Journal of the European Communities L220 Volume 28, 17 August 1985.

agricultural type. Information collected by the FBS is published in *Farm Incomes In The UK*.

2. The June Agricultural and Horticultural Census

The June Census collects a snapshot of data on the agricultural activity on farms. The area of various types of crop and the number of various types of livestock farmed is recorded at a particular point in time. The results are then presented by agricultural type. Information collected by the June Census is published in *Agriculture in the United Kingdom*.

3. Research

Research is often carried out on a particular type of agriculture. Where research is carried out across the entire sector it is commonly presented by agricultural type and size in order to isolate any groups of the sector that have significantly different results.

4. Sampling

The typology is used to ensure that samples of the agricultural sector represent the make-up of the agricultural sector as a whole.

B. How does the UK agricultural classification system work?

The UK system is an activity based classification. It attempts to measure the share of total gross margin that is due to each agricultural activity, or enterprise. The farm is allocated a type depending on the relative contribution of each enterprise to total gross margin. The UK method is similar to the Eurostat method which is based on Standard Gross Margins (SGM) per hectare of crops and per head of livestock (exceptions to this general rule are found here). The Eurostat system is described in Commission Decision 85/377/EEC[17] as amended by Commission Decisions 94/376/EC, 96/393/EC and 1999/725/EC[18].

What are Standard Gross Margins (SGMs)?

SGMs are a means of weighting together different areas of crop production with different units of livestock production. A hectare of wheat production cannot be directly compared with a hectare of broiler production. This is because the value of inputs required and outputs produced by each enterprise differ considerably. SGMs are a method of overcoming this problem.

The SGM is a financial measure founded on the concept of the gross margin for farming enterprises. The gross margin of an enterprise is the value of its total output (the goods which it produces) less the variable costs[19] which are directly attributable to it. A variable cost is a cost which can both be readily allocated to a specific enterprise and which varies in approximately direct proportion to changes in the scale of that enterprise. Examples of variable costs are seed, fertiliser, pesticide, feedingstuff and veterinary and medicine costs.

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[17] Official Journal of the European Communities L220 Volume 28, 17 August 1985.

[18] Official Journal of the European Communities L171 Volume 37, 6 July 1994, pages 30 to 36, Official Journal of the European Communities L163 Volume 45, 13 June 1996 and Official Journal of the European Communities L291 Volume 28, 22 October 1999.

[19] See Commission Decision 85/377/EEC for a more detailed list of the costs deducted.

Because information on gross margins is not available for each farm, standards or norms have been calculated[20] as the average for the three years 1987, 1988 and 1989. Separate SGMs are calculated for all of the major enterprises for the three European Community (EC) regions of England (North, East and West) and for Wales, Scotland and Northern Ireland. SGMs for England can be seen here. These standards are representative of what could be expected on the average farm under 'normal' conditions (i.e. no disease outbreaks or adverse weather conditions).

The total SGM for each farm is calculated by multiplying its crop areas and livestock numbers by the appropriate SGM figure and then summing the result for all enterprises on the farm.

Farms in the Farm Business Survey are classified using the same SGM coefficients as are used to classify the June census with some exceptions to reflect the different way in which numbers and area data for some enterprises are calculated in the Farm Business Survey. The FBS uses a yearly average of livestock numbers and basic hectares farmed whereas the June census uses figures for the appropriate point in time. In some cases the numbers collected in the June census differ from the averages used in the FBS. This discrepancy is small for most crops and livestock, except for sheep and mushrooms. Where livestock are only kept on a farm for part of the year, as is the case for sheep, the FBS annual average will be significantly less than the number recorded in the June Census.

Why use Standard gross margins to classify agriculture?

The choice of the most appropriate classification system is largely determined by its proposed use. An agricultural classification system needs to take into account the quality and intensity of farmed land. This rules out certain physical measures such as area for determining size and type.

Agriculture is characterised by the purchase and sale of intermediate goods. Intermediate goods are goods which are used as an input in the production process by other firms, for example calves are sold to other farmers who rear them. When classifying farms we aim to only take account of the value added at each stage of production. If sales are used as a basis for a classification system then the problem of double-counting occurs. The use of SGMs avoids this problem since it takes into account the variable costs associated with each enterprise. It is therefore, similar to a narrowly defined value-added measure.

Why do we still use 1988 SGMs?

[20] Based on data from the special studies of crop and livestock enterprises in the Agricultural Economics Commissioned Work Research Programmes undertaken by the four Agricultural departments, on the results of the FBS in England, Wales and Northern Ireland, on the results of the Farm Accounts Survey in Scotland and on advice from Agricultural Development and Advisory Service (ADAS) and other specialists.

SGMs are revised from time to time (most recently in 1996) to reflect changes in the relative economic importance of the various types of crops and livestock. These revised SGMs are produced for use by Eurostat in the Structure Survey. The structure survey is an agricultural census conducted for all EU member states. However for UK classification purposes we still use 1988 SGMs.

In the UK, the constant set of 1988 SGMs has been used for classification purposes. By keeping SGMs constant it provides for stability in the classification system and allows comparisons to be made between different years. Since the basis for defining and calculating size and type of farm has not changed it means that any changes in the number of farms within size bands and type categories must have come about by changes in cropping and stocking patterns and rates. This continuity in time aids trend analyses.

Farm Size

Farm size is also measured with the use of SGMs but the actual unit of size is called the European Size Unit (ESU). One ESU is defined as 1,200 Euros[21] (previously European Currency Units) of SGM. It is a measure of the economic size of holdings in terms of the value they add to variable inputs and thus differs from physical measures, such as area, which take no account of the intensity or quality of production. It is calculated by summing the total SGM across all enterprises on a farm and then dividing by 1,200 to produce the more manageable ESU figure.

ESU do not provide a direct measure of labour use, but the threshold of 8 ESU probably represents the minimum size at which a holding could be expected to provide sufficient work to occupy a person fulltime. That said, many holdings of 8 ESU and over are recorded as having a labour input of less than one annual work unit.

To put the measure in context, 8 ESU is the threshold for inclusion of farms in the Farm Business Survey for England and Wales[22]. The same threshold applies to the UK for the Farm Accountancy Data Network. For England and Wales the EU Structure Survey covers main holdings only.

The size groups below form the basis of the analysis of the June census and align with those used by Eurostat:

very small	0 < 8 ESU
small	8 < 40 ESU
medium	40 < 100 ESU
large	100 < 200 ESU
very Large	200 ESU and over

[21] Actually 1000 ECU of SGM at 1980 levels multiplied by an agro-economic trend coefficient (AETC) of 1.2 representing agro-economic inflation at the EU level.
[22] For Scotland farms are only recruited if they are over 16 ESU, although some farms of 8-16 ESU are still included. Northern Ireland includes some farms in the FBS which are less than 8 ESU.

C. Agricultural types

The UK system has 9 *robust* types. The *robust* types split agriculture into broad groups. It is these *robust* types that are most commonly used to present results, when analysing agriculture.

Where they are required there are a further two tiers to the classification system. The robust types are split into 20 *main* types and 7 *other* types. For an extra level of detail a further subdivision into *specialist* types is made, providing a total of 75 types. The additional two tiers of the classification system can be seen here.

The UK system differs from the EC system upon which it is based in order to make the classification more appropriate for UK agriculture. Some agricultural types are excluded because the required crops are not commercially grown in the UK, e.g. rice, tobacco, cotton, citrus fruit and olives. Additional *specialist* agricultural types (click here) have been created so as not to group together farms that could usefully be separated.

A farm is allocated to a type when a crop or livestock enterprise or group of crop or livestock enterprises comprises more than two thirds of the total SGM. Where a farm comprises both crops and livestock which separately account for one third, but less than two thirds of total SGM, it is allocated to a mixed category. The chief characteristics of the robust types are as follows:

1. Cereals
Holdings on which cereals and other crops generally found in cereal rotations (e.g. oilseeds, peas and beans harvested dry and land set-aside) account for more than two thirds of their total SGM. These crops are all harvested with a combine harvester, are readily interchangeable with little impact on the capital and labour required and constitute a relatively homogenous group. Holdings on which land set-aside accounts for more than two thirds of their total SGM - s*pecialist set-aside* holdings - are excluded from this type and included in the *other* robust type.

2. General cropping
Holdings on which arable crops (including field scale vegetables) account for more than two thirds of their total SGM excluding holdings classified as *cereals;* holdings on which a mixture of arable and horticultural crops account for more than two thirds of their total SGM excluding holdings classified as *horticulture* and holdings on which arable crops account for more than one third of their total SGM and no other grouping accounts for more than one third.

3. Horticulture
Holdings on which fruit (including vineyards), hardy nursery stock, glasshouse flowers and vegetables, market garden scale vegetables

and outdoor bulbs and flowers account for more than two thirds of their total SGM.

4. Pigs and poultry
Holdings on which pigs and/or poultry account for more than two thirds of their total SGM.

5. Dairy
Holdings on which dairy cows account for more than two thirds of their total SGM. A holding is classified as a Less Favoured Area (LFA) holding if 50 percent or more of its total area is in the LFA and a lowland holding if less than 50 per cent of its total area is in the LFA.

6. Cattle and sheep (LFA)
Holdings on which cattle and sheep account for more than two thirds of their total SGM except holdings classified as *dairy.* A holding is classified as a Less Favoured Area (LFA) holding if 50 per cent or more of its total area is in the LFA. Of holdings classified as LFA, those whose LFA land is wholly or mainly (50 per cent or more) in the Severely Disadvantaged Area (SDA) are classified as SDA; those whose LFA land is wholly or mainly (more than 50 per cent) in the Disadvantaged Area (DA) are classified as DA.

7. Cattle and Sheep (Lowland)
Holdings on which cattle and sheep account for more than two thirds of their total SGM except holdings classified as *dairy.* A holding is classified as lowland if less than 50 per cent of its total area is in the LFA.

8. Mixed
Holdings on which crops account for one third, but less than two thirds of total SGM and livestock account for one third, but less than two thirds of total SGM. It also includes holdings with mixtures of cattle & sheep on the one hand and pigs & poultry on the other and holdings where one or other of these two groups is dominant, but does not account for more than two thirds of the total SGM.

9. Other (including Non-classifiable)
Holdings which either do not fit in well with mainstream agriculture, such as specialist mushrooms, specialist goats and specialist horses, or which are of limited economic importance, such as specialist set-aside, specialist grass and forage and non classifiable holdings. Specialist grass, and forage holdings are holdings consisting only of fodder crops, or only of grass or rough grazing and having no livestock.

Non classifiable farms are farms that fit into none of the above categories. Non classifiable holdings are holdings consisting of fallow

or buildings and other areas only, for which no SGM coefficients are calculated.

The definition of agricultural types is kept under review. From time to time it may be necessary to change them to reflect changes in agricultural policy, changes in policy interest and changes in the types of crops and livestock produced.

If you would like to find more information about the value of SGMs and their application in the typology system, click here.

ANNEX C

Table 7: FINAL STANDARD LABOUR REQUIREMENTS

	Proposed coefficient	**June census items, England**	**England FBS items**	**Herd/crop size implied by SLR***	**Standard hrs - Nix (32nd)**	**1976 SLRs**
Cereals**	20	A1:A7, A23, A31	C(1:52)[21:22]	95	10-16	20
Oilseeds**	15[e]	A24: A27, G8:G10	C(91:100+103:106)[21:22]	125	10	20
Hops	60a	A28	C(101)[21:22]	30	60	240
Sugar Beet	33	A12	C(81)[21:22]	60	24	88
Field peas & beans	10	A21, A22	C(61:64)[21:22]	190	12	20
Maincrop Potatoes*	90	A11	C(72:74)[21:22]	20	80-160	240
Early Potatoes	120	A10	C(71)[21:22]	15	80-160	200
Outdoor Vegetables and salad**	100	B21	C(127+131:159+170:181+233:235 +250:264)[21:22]{1:4+6:8}	19	-	-
Other peas and beans	500	B1:B4	C(160+162+163)[21:22]	3.8		
Vining Peas	25[d]	B5	C(161)[21:22]	75	-	-
Top and soft fruit	450	C99	C(190:205+222+230+238:243+24 6:247+ 214:220 +223+232+ 244:245)[21:22]	4.2	-	480-1680
HNS	1500	D99	C(111:116+120:125+129+224:225 +265)[21:22]{1:4+6:8}	1.25	-	2400
Vegetables under glass	5000	F1/10000	C(127+131:160+162:181+233:235 +250:264)[21:22]{5}	-	-	-
Flowers & plants under glass	25000	F2/10000	C(111:116+120:125+129+190:205 +214:220+222+223:225+230+232 +238:247+265)[21:22]{5}	-	-	21600
Mushrooms	7220 (or 0.044 hrs/lb)	R1	C(126)[21:22]	0.25	-	-
Set aside	1	G11, A32	C(422)[21]	1900	2	-
Dairy cows	39	K1	E(4)[18]	50	34	56

	Proposed coefficient	June census items, England	England FBS items	Herd/crop size implied by SLR*	Standard hrs - Nix (32nd)	1976 SLRs
Beef cows	12	K6	E(12+74)[18]	160	11	20
Other cattle	9	K8:K19, K4, K5	E(10+3+13+14+16:21)[18]	210	11	12
Ewes and rams (lowland) 1	5.2	M1, M4, M7,M9	E(29+28+75)[18]	365	4	4
Ewes and rams (lfa)1	4.2[f]	M1, M4, M7,M9	E(29+28+75)[18]	450	3.2	4
Other sheep (lowland)1	3.3[b]	M13, M14	E(32:36)[18]	575	2.4	-
Other sheep (lfa)1	2.6[f]	M13, M14	E(32:36)[18]	730	2.4	-
Sows	16	L1:L5	E(43+44)[18]	120	24	28
Finishing & rearing pigs	1.3	L7, L10:L13	E(42+45+46+50+51)[18]	1460	2.4	4
Piglets (<20kg)	1	L14	E(47)[18}	1900		
Table fowl	0.03[d]	N10	E(57:59)[18]	63000	0.016	0.24
Laying hens	0.3[d]	N3	E(54)[18]	6335	0.14-0.48	0.32
Growing pullets	0.12[d]	N5, N6, N7, N2	E(55)[18]	15800	0.04	3.2
Other poultry	0.045	N13:N16	E(60)[18]	42000		
Fodder crops**	6c	A15:A18	C(400+415:417)[21:22]	315	7	-
Horse	150	P1+P2	C(65)[18]	13		
Goats	20	P5:P7	C(67)[18]	95		
Deer	15	P10	C(69+71)[18]	125		
Grassland**	4[a]	G1, G2	C(402:403+409)[21:22]	475	4	-
Rough grazing**	1.5[a]	G5	C(404:407)[21:22]	1265	1.6	-

** For Northern Ireland data, the SLRs for these items are multiplied by a factor of 1.5 to take account of different field sizes. For mushroom production in Northern Ireland an SLR of 1,050 per tunnel is used.

COEFFICIENTS ARE PER HEAD or PER HECTARE PER YEAR

*Working year = 1900 hrs.

(1) Based on farm type classification – e.g. for LFA Cattle & Sheep farms the LFA coefficients are applied to all relevant livestock on the farm.

(a) Figure from NIX

(b) Special study SLRs have been adjusted using the ratio between the relevant Nix figures.

(c) Best estimate

(d) Nix and NFU data

(f) LFA sheep coefficients generated by regression analysis of FBS LFA Cattle & Sheep farm labour after application of cattle coefficients

ANNEX D

Northern Ireland: Measurement of agricultural size using SLRs

The issue

1 The Working Party considered whether agricultural size should be measured using the same Standard Labour Requirement (SLR) units and the same size bands for all regions and all countries.

2 The GB countries agreed that a common basis was preferable but farm structure in Northern Ireland is sufficiently different to merit further consideration.

3 For Northern Ireland the need for structural change has long been an important issue and structural statistics have played a key role in monitoring agricultural development. The number of active farms fell by an average of 1.9% per year during 1992-2002 when average farm size increased from 31 ha to 37 ha, still small in a UK context. The UK average for 2002 was 72 ha.

Past and current practice

4 Up to 1980 agricultural size of farm businesses was measured by Standard Man Days (smds) with each country having its own set of values. Below 50 smd farms were deemed so small as to be disregarded and the remaining farms were classified either as "full-time" or "part-time" with variations in the cut-off points --- 275[23] smd in England and Wales, 250 in Scotland and 200 in Northern Ireland.

5 Since 1980 measurement of farm size has been based on Standard Gross Margins (SGM) with each country using different values as appropriate for their circumstances[24]. In some cases these differences were large and examples of the range are shown below:

Selected Standard Gross Margins (1987-89 values) €

	England North	England East	England West	Wales	Scotland	Northern Ireland
Barley (ha)	583	569	552	556	559	582
Potatoes (ha)	2,607	3,198	2,697	2,773	4,153	2,111
Dairy cows (hd)	978	958	1,012	944	933	958
Beef cows (hd)	248	248	248	248	328	316
Ewes (hd in LFA)	49	49	42	43	43	62
Sows (hd)	232	232	232	232	232	185
Hens (100)	211	205	206	206	211	107

Future practice

6 There are two key reasons why it may be appropriate to use different Standard Labour Requirements for Northern Ireland. These are:

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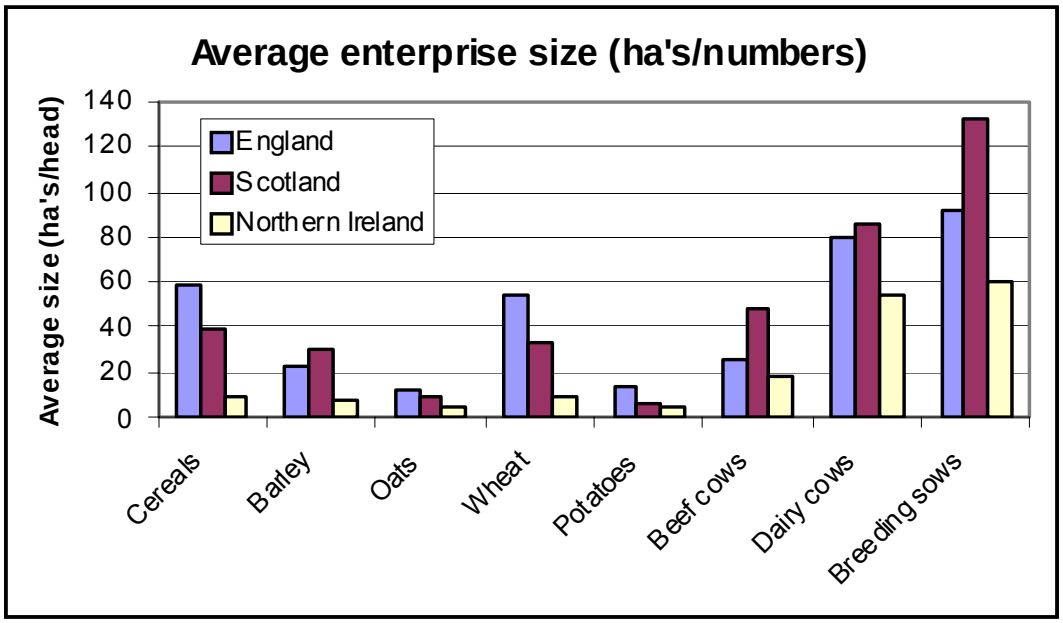
[23] Based on 1968 SMDs; for 1976 SMDs in England the cut-off was 250.
[24] Different SGMs are applied to each of 3 Regions in England ---North, East and West.

(a) economies of scale (average enterprise size is generally lower in NI than elsewhere in the UK);
(b) the effects of field size (average field size in NI is much lower than in the rest of the UK).

Economies of scale

7 The SLRs are, in the main, based on data taken from DEFRA special studies of farms in the FBS size range, i.e. excluding the smallest enterprises. If they represented *average* enterprise size then, as illustrated below, they would be inappropriate for use in Northern Ireland where average enterprise size is generally much lower than in England. There would be a case for adjusting SLR values to reflect the associated economies of scale.



8 The Working Group considered the E&W data for some key items and compared the average labour input per head or per hectare for a range of enterprise sizes. Comparing the labour requirements for the average NI size with the average English ones indicated that the NI factors should be increased by factors of 30% (cereals), 25% (beef cows) or 20% (potatoes, dairy cows).

9 While recognising these differences, the view was taken that the SLRs represent *aspirational* levels of labour efficiency rather than *average* ones and that **no adjustment should be made for economies of scale**. One of the main uses of the measurement is in the Farm Business Survey (FBS) where average incomes for farms of the same size and type are compared. If the NI factors were to be increased by 20-30% this would result in average FBS incomes for, say, Small Cattle & Sheep farms in Northern Ireland being 20-30% lower than those of that description in England, simply because they represent farms with 20-30% less earning potential as indicated by

livestock numbers. Different SLRs for different countries would reduce the value of the size measurement for comparing between areas.

Difference in field size

10 The second possible reason for adjusting SLRs is that fields in Northern Ireland are, for the most part much smaller than in the rest of the UK. Information from IACS suggests an average field size of 2ha in NI compared with around 8 ha in England. For environmental reasons there are restrictions on increasing field size through the removal of hedges. Therefore, a distinction can be made between the additional labour requirements per hectare because of small *enterprise* size and those due to small *field* size. Structural improvements can address the former but not the latter.

11 For small fields more time is spent negotiating corners, opening up fields, cultivating end-rigs and travelling from field to field. In "Choosing and Using Farm Machinery" by Brian Whitney it is suggested that 37% of time spent in field work for a 2 ha field is productive time compared to 57% for fields of 8 ha. On this basis the productive work needed to cultivate 4 fields of 2ha each is 50% more than that for a single field of 8 ha.

12 For the above reason it is proposed that the SLRs for field enterprises in Northern Ireland (cereals, potatoes, grass/forage) should include **an increment of 50% above the GB figures.**

Impact on use of data

13 For some potential data uses, e.g. identifying farms which are likely to keep someone fully occupied, it would probably be more appropriate to have SLR values which represent current conditions in Northern Ireland. For others, e.g. identifying farms which are likely to be potentially economically viable, the argument may favour common UK factors. Thus the proposed modification is, to some extent, a compromise solution.

14 It is suggested that data users should be alerted to the dangers of misusing SLR structural statistics for Northern Ireland and that relevant statistics, such as tables showing the numbers of farms classified as Spare Time, Part Time etc should include a footnote: "SLR values represent efficiency levels of full time farms in England. Farms in Northern Ireland are generally smaller and, reflecting economies of scale, those with an SLR 25% below the threshold for full-time farms may provide full-time occupation for one person."

DARDNI
July 2003

ANNEX E

IMPACT OF WEIGHTING ON CHANGES IN FARM TYPE OVER TIME

Background

1. The single most debated issue in various EU working groups involved with farm typology over the years is whether to update the base Standard Gross Margin (SGM) coefficients every 2/3 years (the frequency of EU Farm Structure surveys), every five years or every ten years.

2. While it is understandable to wish to use the most up to date coefficients available, arguing for a 2/3 year frequency, this imposes a significant burden in maintaining a time series. The procedures adopted by the EC Commission ignore this burden by dispensing with typology time series altogether. However it could be argued that the time dimension, important for most issues, is particularly important when considering farm structures. Their evolution is arguably of greater significance than comparisons between regions at a snapshot in time.

3. As every index number practitioner knows (and of course index numbers are used almost exclusively for time series) whenever the price base is changed, typically every five years, some of the previous indices have to be recalculated on the new base to allow the new series to be linked to the old. The reason is that the change of price base would otherwise cause a discontinuity in the series. In the month (or year) when the change is made, the difference from the previous period consists of two components, the real change in whatever the index is measuring and the artificial change induced by the change of price base. These two components may be in the same direction, overestimating the true change, or in opposite directions which results in an underestimation of the true change or, if the artificial component is dominant, in the wrong direction altogether.

4. The situation with farm typology is analogous – instead of unit prices we have SGM coefficients and the volumes are crop areas and animal numbers. If there is a difference, it is that most index number series are price indices whereas farm typology is equivalent to (the minority of) volume indices. Ignoring indices for the moment, farm typology is analogous to a constant price series.

5. The problem with EC Commission publication policy is that each set of Farm Structure Survey results uses a different SGM (price) base. While these results are very suitable for cross-sectional analyses, such as comparing farm types across member states, this published series of snapshots gives a misleading representation of evolution through time. It has been suggested by one member state which follows the Commission procedure that, while changing the base for each time period may make the time series less accurate, it may nevertheless give a useful indication of structural change, even if approximate. In other words, results may still be fit for purpose.

6. This is a potentially dangerous argument. It can be justified only if the change attributable to rebasing is 'small' in relation to the real structural change. How small depends on how much approximation is acceptable. The weakest possible requirement is that the change due to rebasing should be less, in absolute terms, than the real change. For most purposes, one might require a stronger condition.

7. Unfortunately, the extent to which these conditions hold in practice has either not been studied or any such studies have not been given prominence. The reason perhaps is that most data providers circumvent the argument by providing linked information as a matter of course, rather than rehearse the process of proving it necessary to do so.

Review of UK Typology

8. The UK is currently reviewing its own national typology and its application, and is considering whether to move away from the base weighted system used for many years to a current weighted system. The question then arises as to whether to revise previously published series each time the base coefficients change[25]. The burden of updating is made more acute by the frequency implied by using a current price base. Or do we do what the EC Commission does and dispense with the burden of updating? If so, given that time series are important in the UK context, we need some assessment of how closely a series of snapshots approximates to a time series.

9. The purpose of this note is to throw some light on this last question.

Approach adopted

10. We start with the simplest case of one farm, two commodities A and B, two farm types mainly-A and mainly-B, and two points in time X and Y which could be one year apart or several. The notation for the relevant SGM coefficients and quantities of A and B for these two points in time is given in the following table.

Table 8: Notation adopted for two-type model

	SGM coefficients		Quantity	
	Commodity:		Commodity:	
Year	A	B	A	D
X	P(A,X)	P(B,X)	Q(A,X)	Q (B,X)
Y	P(A,Y)	P(B,Y)	Q (A,Y)	Q (B,Y)

11. The differences between the base-weighted (Laspeyres) typology model in use in the UK for many years, the current-weighted (Paasche) typology not to our knowledge used anywhere, and what we may term the mixed model (current to the year in question) are down to the choice of which price base to apply at each point in time. The farm type is derived from the ratio SGM(A)/SGM(B). In this simple two-commodity example, the farm is 'mainly-A' if this ratio is less than 1 or 'mainly-B' if greater than 1.

12. The change in farm type between time periods X and Y is indicated by the change in the ratio SGM(A)/SGM(B)and is absolute if it crosses the boundary value of 1.

[25] Chain linking, as used for the retail Price Index for example, is considered infeasible for typology analyses

Table 9: Ratio of SGM(A) to SGM(B)

Time period	Base weighted (Laspeyres)	Current weighted (Paasche)	Mixed weighted
X	$\frac{P(A,X).\ Q\ (A,X)}{P(B,X).\ Q\ (B,X)}$	$\frac{P(A,Y).\ Q\ (A,X)}{P(B,Y).\ Q\ (B,X)}$	$\frac{P(A,X).\ Q\ (A,X)}{P(B,X).\ Q\ (B,X)}$
Y	$\frac{P(A,X).\ Q\ (A,Y)}{P(B,X).\ Q\ (B,Y)}$	$\frac{P(A,Y).\ Q\ (A,Y)}{P(B,Y).\ Q\ (B,Y)}$	$\frac{P(A,Y).\ Q\ (A,Y)}{P(B,Y).\ Q\ (B,Y)}$

The issue is how poor an approximation the mixed weighted value is to the other two.

13. This may be illustrated by a simple numerical example.

Table 10: Hypothetical example showing changes in the proportion of SGM(A) to total SGM for three typology models: base-weighted, current-weighted and mixed weighted

	SGM coefficients		Quantity		Percentage of SGM(A) to total		
	Commodity:		Commodity:		Base	Current	Mixed
Year	A	B	A	B	weighted	weighted	weighted
X	80	220	300	100	52%	57%	52%
Y	90	200	250	150	38%	43%	43%
% change					-28%	-25%	-18%

For all three typology models, the farm changed from mainly-A to mainly-B. However, crossing the 50% line is of no particular significance. Farm types may be defined by a one-third or two-thirds criterion, as in the EU typology, or by some other convention. Since we are considering only one farm, it is enough to identify an increasing or decreasing tendency to A, in the knowledge that in a many-farms situation, a general tendency to increasing-A will translate into an increase in the number of farms of type-A regardless of where the boundary is. In other words, we may consider the percentage change in the table above as the definition of farm type.

14. It is fairly easy to construct examples where the three models, Laspeyres, Paasche and mixed, give similar of differing results. Here are a few. These are only examples. The titles relate to comparison of the mixed model to the others. They all use the same data for time period X.

Table 11: Hypothetical comparison of three typology models: 'opposite'

	SGM coefficients		Quantity		Percentage of SGM(A) to total		
	Commodity:		Commodity:		Base	Current	Mixed
Year	A	B	A	B	weighted	Weighted	weighted
X	80	220	300	100	52%	33%	52%
Y	40	240	350	80	61%	42%	42%
% change					+18%	+27%	-19%

Table 12: Hypothetical comparison of three typology models: 'exaggerated'

	SGM coefficients		Quantity		Percentage of SGM(A) to total		
	Commodity:		Commodity:		Base	Current	Mixed
Year	A	B	A	B	weighted	Weighted	weighted
X	80	220	300	100	52%	57%	52%
Y	90	200	250	80	53%	58%	58%
% change					+2%	+2%	+12%

Table 13: Hypothetical comparison of three typology models: 'under estimated'

	SGM coefficients		Quantity		Percentage of SGM(A) to total		
	Commodity:		Commodity:		Base	Current	Mixed
Year	A	B	A	B	weighted	Weighted	weighted
X	80	220	300	100	52%	57%	52%
Y	90	200	200	85	46%	51%	51%
% change					-12%	-10%	-1%

Table 14: Hypothetical comparison of three typology models: 'spurious change'

	SGM coefficients		Quantity		Percentage of SGM(A) to total		
	Commodity:		Commodity:		Base	Current	Mixed
Year	A	B	A	B	weighted	weighted	weighted
X	80	220	300	100	52%	57%	52%
Y	90	200	240	80	52%	57%	57%
% change					0%	0%	+10%

15. These are only examples to illustrate the possibilities. One might reasonably object that these have been designed to put the mixed model in an inferior light. With less justification, one might also claim that examples could be constructed where the Paasche and mixed models give similar results which were quite different from the Laspeyres model. In fact, it can be shown mathematically that it is impossible to construct a case where the Paasche model moves in one direction and the Laspeyres in the other.

16. From Table 8, an increase in the Laspeyres index but a decrease in the Paasche index would imply

$$\frac{P(A,X).Q(A,X)}{P(B,X).Q(B,X)} < \frac{P(A,X).Q(A,Y)}{P(B,X).Q(B,Y)} \quad \text{and} \quad \frac{P(A,Y).Q(A,X)}{P(B,Y).Q(B,X)} > \frac{P(A,Y).Q(A,Y)}{P(B,Y).Q(B,Y)}$$

The price terms cancel out in each case

giving $$\frac{Q(A,X)}{Q(B,X)} < \frac{Q(A,Y)}{Q(B,Y)} \quad \text{and} \quad \frac{Q(A,X)}{Q(B,X)} > \frac{Q(A,Y)}{Q(B,Y)}$$

Which is clearly contradictory.

The same argument applies with the inequalities reversed.

17. What this means is that, in a two-commodity typology, it is impossible to construct an example, analogous to Table 11, where the base-weighted and current-weighted proportions move in opposite directions. We may also observe that, by changing one of the inequalities above to equality, neither is it possible to construct a 'spurious change' example on the lines of Table 14. The most divergent behaviour possible between the rate of change in Laspeyres and Paasche indices is where one is over or under-estimated relative to the other. Even then, the range of possibilities is generally less than can be achieved with the mixed model.

Illustration by simulation model

18. The conclusion is that, in a two-commodity typology, the base weighted and current weighted models are more closely related to each other than the mixed model is to either. This is illustrated in a simulation exercise based on Table 10 year X data. Random variations were made to the four year-Y parameters to produce 300 alternative behaviours. The results are produced graphically in Annex 1.

19. It is important to note that the result given in paragraph 15 is true only for the two-commodity case. With a many-commodity typology, it is possible for the proportion of the SGM accounted for by one commodity to move in opposite directions through time depending on whether a base or current weighted model is used. However, the degree to which they can moved in opposite directions is far more constrained than for the mixed model. This is illustrated by a four-commodity simulation presented in Annex 2.

20. These charts give a convincing illustration that the mixed-weighted model gives far more approximate time series than either the base or current weighted models. But they have not addressed the claim, made in paragraph 5, that time series results for mixed models might still be fit for purpose.

Quantifying the measurement error of the mixed-weighted typology model

21. One way of quantifying how much of the apparent change is due to the change in SGM base would be to directly measure it for each case in the simulation model. This is easily done and the result, given in Annex 2, appears fairly conclusive – the mixed model over-estimates the true rate of change by a factor of about 2.1. However, this figure can vary widely depending on the simulation. For this reason, such methods are not always convincing; the assumptions made in such models are particular rather than general.

22. The remainder of this note attempts to approach the question from a theoretical standpoint. We will consider aggregate SGM rather than farm businesses so that we can derive an estimate of measurement error which will be independent of particular farm type divisions. We will concentrate our attention on one particular farm type and make the simplifying assumption that it is defined in terms of one commodity 'A' (rather than having several components each with its own SGM coefficient). The parameter to be measured is the proportion of aggregate SGM attributable to A (for the population) to the aggregate SGM attributable to all other commodities. We will see how this proportion changes between two points in time.

23. For the time being, we will assume that the aggregate SGM for commodities other than A does not change between the two points in time, but this assumption will be relaxed in paragraph 29.

24. The real change in SGM(A) between two points in time, measured in terms of base SGM coefficients, is $\frac{P(Q+\Delta Q)-PQ}{PQ}$. Measuring in terms of current SGM coefficients doesn't affect things. Either way, the percentage change is

$$100\times\frac{\Delta Q}{Q} \qquad \ldots(1)$$

This is the 'true' measure of the change in type-A.

25. The apparent change given by the mixed model is $\frac{(P+\Delta P)(Q+\Delta Q)-PQ}{PQ}$ giving a percentage change of

$$100\times\frac{Q.\Delta P+P.\Delta Q+\Delta P.\Delta Q}{PQ}$$

Putting $p=100\times\frac{\Delta P}{P}$ and $q=100\times\frac{\Delta Q}{Q}$ gives the apparent percentage change as

$$p+q+\frac{pq}{100} \qquad \ldots(2)$$

26. We wish to compare this with expression (1) which is q in our notation. The ratio between the percentage change given by the mixed model and the true percentage change is

$$\frac{p}{q}+1+\frac{p}{100} \qquad \ldots(3)$$

Now $^{p}/_{q}$ is the inverse of the elasticity of supply. If we assume that the normal range of supply elasticities is between 0 and 2, expression (3) varies between

$\frac{3}{2}+\frac{p}{100}$ and infinity.

27. This means that the absolute value of the percentage change given by the mixed model is generally higher than the real value. The ratio of the percentage changes (expression (3)) can take the unbiased value of 1 only if the price change in commodity A is $-\frac{100}{elasticity}$, for example with an elasticity of 2 and a price reduction of 50%, or an elasticity of 1 and a price reduction of 100% (zero SGM).

28. Returning to the question posed in paragraph 5, how do we determine from this if the mixed model is fit for purpose? The weakest possible requirement is that the percentage change due the change in SGM base is no larger than the real percentage change; that is expression (2) minus expression (1) ≤ expression (1).

ie that $p + \frac{pq}{100} \le q$ or $p \le 100 \times \left(1 - \frac{1}{elasticity}\right)$

If the elasticity is greater than 1 then any price decrease fulfils the condition but price increases are constrained. If the elasticity is less than 1, a minimum absolute price decrease is necessary. On balance, it would seem than even the weakest requirement on accuracy is met in only about 50% of cases.

29. The foregoing assumes (see paragraph 23) that the aggregate SGM of the remaining commodities has not changed. In practice it will change and the ratio of SGM(A) to SGM(other) will adjust in inverse proportion. The expressions in paragraphs 24 to 28 can be elaborated to include an additional inflationary factor (relative to A) but, although this might increase the allowable ranges for the elasticity and price change in A, it will not change the conclusion that even the weak requirement of the artificial change being no greater than the real change will be met in around only 50% of cases. To see this we need only reflect that the relative inflation of other commodities to A will be positive or negative in roughly equal proportions. This is because the choice of A was arbitrary.

Other considerations

30. It is worth considering, very briefly, if the proposal to average SGM coefficients over a five year period on a rolling basis makes the mixed model more acceptable. The answer is that it does not. Although the rolling average will smooth price changes, supply elasticities will be unaffected. Price changes for short periods, for example over a year or two, will be less than for longer periods but this simply means that the ratio of the percentage change given by the mixed model will be close to $1 + \frac{1}{elasticity}$, derived from expression (3). Given that most supply elasticities are less than 2, the error even for short periods will exceed 50%.

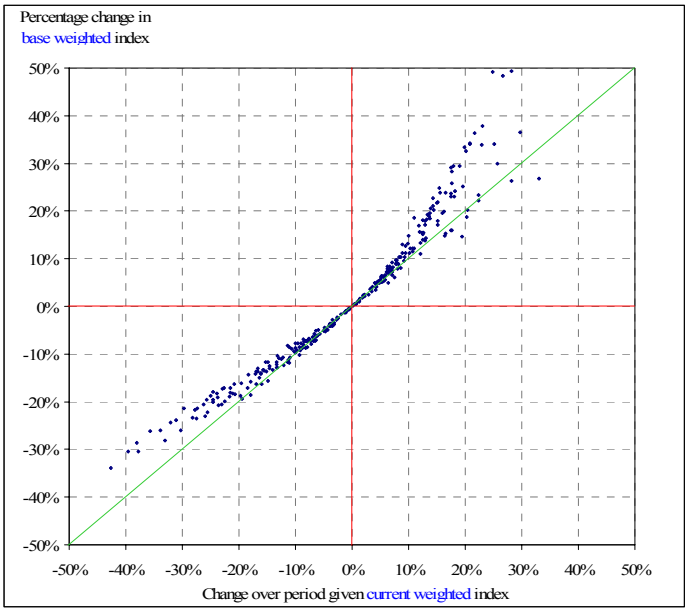
Conclusion

31. Don't.

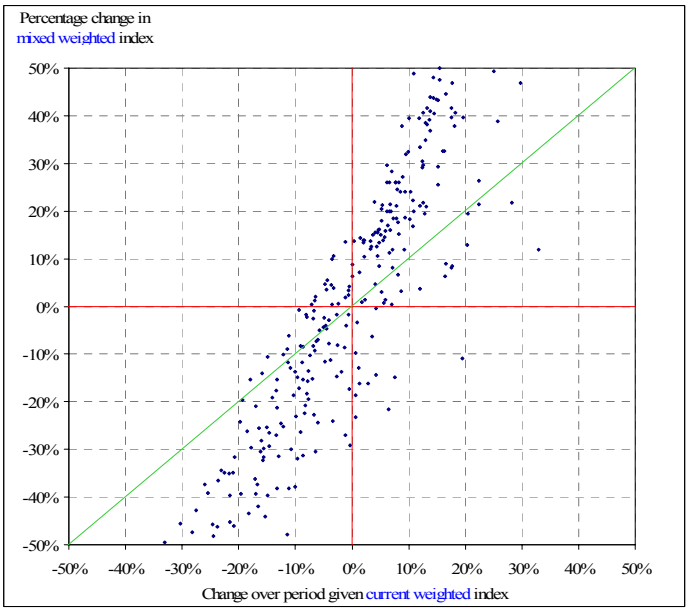
Roger Price
14 July 2003 (Bastille Day)

COMPARISON OF CURRENT, BASE AND MIXED-WEIGHTED INDICES: SIMULATED TWO-COMMODITY MODEL

The two-commodity case, based on the X-year figures from Table 10, was simulated with year-Y values derived from random changes in quantities and SGM coefficients. 300 simulations of year-Y values were produced and the percentage changes of the ratio SGM(A)/SGM(B) for the three indices were plotted pairwise on the diagrams below.



The diagram above illustrates nicely the identity of sign between the base-weighted and current-weighted indices (see paragraph 15).



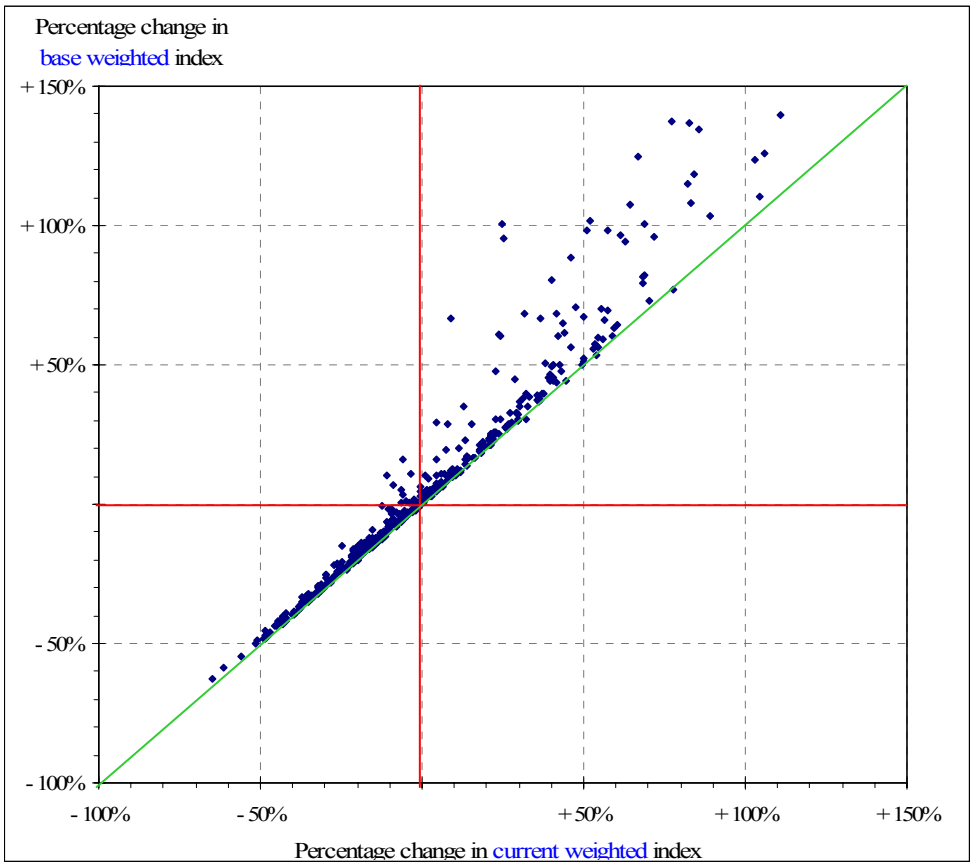
The relationship of the mixed model to the other two is much looser and there is a clear bias indicated by the different angle of data points to the green diagonal.

COMPARISON OF CURRENT, BASE AND MIXED-WEIGHTED INDICES: SIMULATED FOUR-COMMODITY MODEL

The four-commodity case was based on the following figures for the base year.

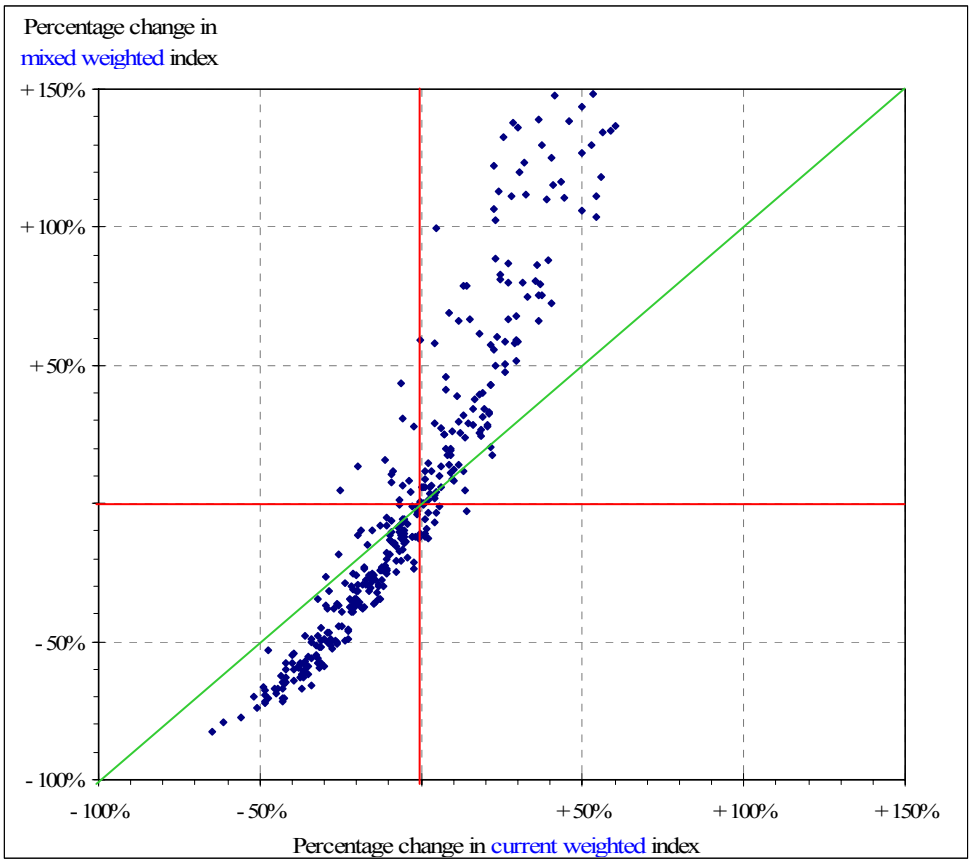
	SGM coefficients				Quantity			
	Commodity:				Commodity:			
Year	A	B	C	D	A	B	C	D
X	80	220	150	110	100	200	85	300
Y	P(Y,A)	P(Y,B)	P(Y,C)	P(Y,D)	Q(Y,A)	Q(Y,B)	Q(Y,C)	Q(Y,D)

P(A,Y), P(B,Y) P(C,Y) and P(D,Y) took random variations from their year-X values varying between 70% and 130% for commodity D and between 30% and 170% for commodity B. Year-Y quantities responded with random elasticities centred around the values 0.4, 0.8, 1.2 and 1.6 for commodities C, A, D and B respectively. 400 simulations of year-Y values were produced and the percentage changes of the ratio SGM(A)/SGM(other) for the three indices were plotted pairwise on the diagrams below.



The shape of the plot is more linear than for the two-commodity simulation. There are instances where the base-weighted index increased while the current-weighted index decreased (top left-hand quadrant) but not, apparently, the other way round. This might be a feature of the particular price change formula and elasticities used.

In fact, there appear to be no cases where the percentage change of the current weighted index exceeded the percentage change of the base weighted index, indicating a small relative bias.



The scatter for the mixed weighted index is less than for the two-commodity case. However, there remains a distinct bias since the angle of plots shows a bigger slope than the unbiased green line.

The straight average of the ratios is 2.1. The regression slope is probably not very different from this.