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AGRICULTURAL PRICE STATISTICS
TAKING ACCOUNT OF QUALITY DIFFERENCES

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Introduction

1.   Prices are critical to the policy makers, the farming and food industry. Often the trends and comparisons of prices can be distorted by quality differences in both farming products and inputs required by the industry. This paper explores the nature of these quality differences, their importance and the methods available for dealing with this. With the very much faster pace in which products or processes are changing, this could be a much more important issue for us all in the future. It is conceivable that price statistics will become of even greater importance as EU markets are opened up to greater world competition. Examples are used from the UK, Bulgaria and Kazakhstan to explore the issues.

What Do We Mean By Quality?

2.   Broadly speaking, quality is an indication of how well the product or service meets the "customer's" needs and expectations. There is the perception/value placed on this by either the producer or the customer, for which they are prepared to pay extra. There are a number of dimensions to this. There is the enjoyment or usefulness of the final product: how well it conforms to the agreed specification; whether it makes it possible/easier to produce the final quality product e.g. bread making wheat into final wheat. In many cases it is a relative measure of value-based judgements.

3.   Within agriculture the **quality of a product** can relate to such things as:

- perceived quality/preference by the consumer e.g. a good year for wines, local branded produce;
- quantity of the key ingredient, e.g. moisture content, protein content, fat content;

- what the product can be used for, e.g. bread making, animal feed;
- guaranteed supply;
- how it was produced, e.g. organic, quality assurance scheme;
- ease of production, e.g. genetically modified foods;
- when produced, e.g. early potatoes versus main crop potatoes;
- freshness;
- the amount of processing/packaging in the product;
- location of product to the markets, e.g. proximity of wheat to a port.

4.   **Input quality** can relate to:

- the fertility/location/steepness of the land;
- skills and output of the workers;
- durability of the machines;
- ability of seeds to resist disease;
- effectiveness of fertilisers/pesticides, e.g. lower quantities now need to be applied to get the same active ingredients.

5.   It is interesting to reflect on how quality varies with an agricultural output (say potatoes) compared with other industrial products (e.g. a car). The good news for the agricultural statistician is that in many instances agricultural outputs do not fundamentally change as fast as outputs in other sectors. For example, a car today is very different from the ones produced 20/30 years ago. A potato is much more similar. The bad news is that the quality of agricultural outputs can vary much more within or between individual batches and is characterised by greater irregular variation over time, e.g. affected by nature, climate, disease etc. The quality differences in many cases may be hidden, not readily observable or be subject to judgement. More and more agricultural products have different added elements, e.g. pre-washed salads.

Why Is Measuring Quality Important?

6.   Price information is used for:

a)   informing the market operators (including comparisons with other countries).
b)   valuing agricultural output;
c)   deflating value series to get to volume indicators;

7.   Many agricultural surveys provide information on the quantity of agricultural products being produced. Provided there is a correspondence with the price information being produced, it is possible to produce an accurate valuation of the output. The unit value is required for this – not one adjusted for quality. Similarly calculations can be done on the inputs.

8.   In assessing the economic state of agriculture, it is important to measure how the value of the sector is changing, using constant prices. Price indices are used to deflate the value series, which have been produced. To do this effectively, the price indices have to match the accounts with respect to their coverage, and each price series has to be representative of the accounts item for which it is being used to deflate. The price indices should reflect the changes in prices of an unchanging product. It should standardised for quality changes; both quality changes to a particular brand/variety and quality changes as a result of substitution from one brand/variety to another. If a priced index includes a disguised quality improvement, the deflated value series will understate growth in the sector.

9.   Market operators and policy makers need to have a very clear understanding of the trend in prices, why they are changing and how they compare with other countries. Examination of the prices is critical to the policy makers in judging the sustainability of farming and forecasting future trends. Expected movements in prices are key variables in the economist's tool kit and models of the farming sector. Farming is a business. Like any business, the farmer needs to understand what is happening to the prices of inputs and outputs in order to take the right business decisions. The business decisions related to a significant increase in the price of an output, purely related to quality changes, will not be the same as an increase in price for the product of the same quality. International comparisons in prices could relate to different products.

10.   How confident are we that the price differences/movements shown in the tables below are for the same products?

Table 1: Prices in 1998
ECU

	Soft Wheat per 100kg	Main Crop Potatoes per 100kg	Pigs Class 2 per 100kg	Cows' Milk 3.7% fat content per100kg
Belgium	10.41	11.14	109.43	26.98
Denmark	11.31	19.38	96.41	30.80
Germany	11.07	10.22	118.83	29.51
Greece	14.70	33.21	142.30	32.72
Spain	14.06	17.82	130.53	27.99
France	11.30	11.78	-	-
Ireland	10.15	-	-	-
Italy	14.54	23.83	148.96	34.84
Luxembourg	11.00	14.28	149.19	29.81

Holland	10.54	14.64	-	30.59
Austria	10.50	10.47	95.13	27.50
Portugal	13.14	17.57	121.25	28.39
Finland	14.22	23.23	-	31.03
Sweden	11.20	18.42	130.10	32.75
UK	11.24	18.21	90.86	26.76

Source: Agricultural Prices 1999.

Table 2: Deflated Index of Producer Prices (1990 = 100)

	Soft wheat	Main-crop potatoes	Pigs	Cows' milk
EU15	55.8	n/a	53.6	78.2
Belgium	52.9	75.5	50.3	77.8
Denmark	52.4	n/a	48.3	75.1
Germany	59.1	127.3	53.5	79.5
Greece	55.8	n/a	66.3	75.0
Spain	62.9	74.8	62.7	87.6
France	55.7	121.8	53.0	85.1
Ireland	60.8	143.0	54.2	90.4
Italy	64.2	98.1	62.3	78.0
Luxembourg	58.6	74.0	46.1	72.2
Netherlands	54.2	105.7	48.9	68.8
Austria	34.7	42.1	47.5	60.6
Portugal	32.4	93.5	47.6	63.1
Finland	28.3	120.0	32.6	68.2
Sweden	61.5	n/a	55.4	80.3
UK	53.5	92.6	53.0	75.2
Bulgaria	31.3	50.3	50.7	45.3
Kazakhstan	tbc	tbc	tbc	tbc

Price and Quality

11. What we are aiming to do is to compare and chart the movement of prices for a homogeneous product. In trying to achieve this we need to be aware of the different concepts of prices. These are:

Market price – what is observed in the market for single produce

Basic price – true price of the product less taxes plus subsidies

Unit value – average price for a group of products. It is the total revenue divided by quantity.

Market prices could be affected by changes in the rate of tax or subsidies. The unit value could be affected by differences in the product mix of items included in the "basket". It is more difficult to assure quality in these circumstances. There may be hidden quality differences.

12. The observed price in the market is the equilibrium of supply and demand. In the short term, the supply is often fixed with agricultural produce with the price adjusting to the level which can clear the market. For a given price, the demand for a product will be higher the better the quality of that product. Observed price changes can then be both a supply/quality shift and a demand shift. The real price change is how the price of a product of a similar quality has changed. Ideally in measuring price change (over time) or differences (with other countries) adjustments should be made for quality changes/differences.

13. A significant quality change can imply a different product. There is a quality difference (an improvement or deterioration) on which a price could be put (either by the producer or the consumer). In extreme cases where the products are withdrawn from the market, this could affect the ability to observe the prices over a long period of time.

What Methods Are Available To Account For Quality Changes?

14. These include:

Most commonly used:
- matched targeted items
- quantity adjustments
- cost adjustment
- overlap/replacements.

There are other approaches:
- theoretical.

Matched Targeted Items:

15. This involves tracking the price of a common item over time. In submitting prices to the EU, Eurostat have laid down target definitions as follows:

Product	Target Definition
Soft wheat	Grain of sound and fair marketable quality free of live pests. Destined for human consumption only. Prices from producer to co-operatives or to the trade (ex-farm).

	Prices per 100kg, excluding VAT. Co-responsibility levy taken into account (i.e. subtracted from the price), but not the additional co-responsibility levy. Excluding 1992/93 CAP reform compensatory payments for arable crops. 14% moisture content. 2% broken grains. 1.5% grain impurities. 0.5% miscellaneous impurities. 76 kilograms per hectolitre.
Potatoes main crop	Potatoes from producer to the trade for sale fresh to the consumer, i.e. potatoes for processing and potatoes sold direct from the producer to the consumer should both be excluded. Prices ex-farm for sales in bulk. Prices per 100kg, excluding VAT. Diameter 35-85mm.
Pig carcasses: grade 1	Carcasses with head. Grade U (lean meat represents 50 per cent or more but less than 55 per cent of carcass weight). Prices from producer or buyer to the slaughterhouse; delivered to the slaughterhouse. Price per 100kg by carcass weight, cold weight, excluding VAT.
Raw cows' milk, 3.7% fat content	Prices from producer to the dairy (ex-farm). Prices per 100kg, excluding VAT. Co-responsibility levy taken into account (i.e. subtracted from the price), but not the super-levy. Prices taking into account bonuses and refunds. Fat content by weight 3.7%, all deliveries of milk to the dairy. Protein content standardised on national level.

Comparisons between countries can be informed by reporting deviations from the target definitions.

16.   Breed or variety can distinguish market observation, e.g. for animals and crop products. When assessing, experts make price judgements.

For example, in Bulgaria and Kazakhstan agricultural produce deviating from the set standards are not included in the price surveys.

There may be a difference in the quality of produce for which price information is available and for total production. For example, in Bulgaria it is not possible to survey all private unregistered farmers which account for over 90% of vegetables and fruit and a significant proportion of grain. In Bulgaria estimates are made for producer prices by making deductions from consumer prices.

The adoption of common quality standards is backed up by EU regulations including cereals, milk, fruit and vegetables and livestock.

In the UK, EU marketing standards are used for fresh fruit, vegetables, flowers and bulbs as follows:

- extra class - excellent quality and usually only very specially selected and presented produce;
- class i - good quality produce with no important defects;
- class ii - reasonable good quality, sound but deficient in one or two requirements such as shape, colour, small blemishes and marks.

The following categories are used for livestock:

- first quality;
- second quality;
- other.

The allocation of livestock is based on the subjective judgement of market price reporters. Taking observations from a small number of markets using the same observers helps to preserve consistency. The application of consistent quality standards over time by a reporter will ensure that price trends exclude quality changes. However, absolute prices and comparisons between markets will be more difficult to interpret. Differences between markets in the average prices of each band can provide a measure of quality.

As the candidate countries adopt regulations, price information should become more comparable. For example, in Bulgaria there are marketing standards in the trade of vegetables and fruit, grain and raw milk. Three levels of quality of milk are used – excellent, first and second. Marketing standard of first quality milk in Bulgaria is 3.6% compared with 3.7% in the EU.

The graph below shows the average price received by farmers for Charolais yearling heifers of first and second quality at eleven markets in the UK in a typical week. In general, there is little overlap between the prices for the first and second quality cattle. This suggests that most market reporters use common standards when categorising cattle. However, at market K the price of first quality cattle is lower than the price for second quality cattle recorded by other market reporters. It is important that this kind of analysis is undertaken so that anomalies can be investigated and, where necessary, corrected.

Average price for Charolais yearling heifers (w/e 21/4/2000)

Price (£ per head)

Market

First quality — ×— Second quality
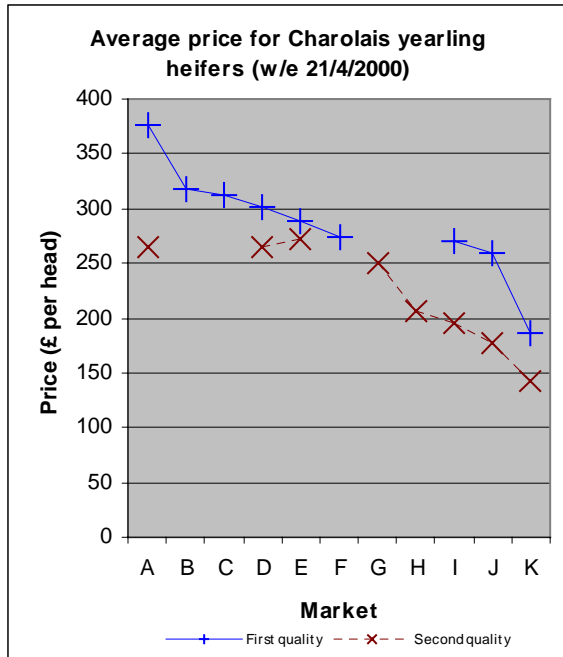
17.   In compiling price indices, quality effects can be minimised by defining the price series very tightly.

The difference in the price indices between loosely defined and tightly defined commodities is illustrated below for pears. Two price indices are shown. In one, the price is the average price for all varieties and all classes. In the other, the price is calculated using fixed weights for each variety and each class. There is limited divergence in the indices. For the effect to be large, the different elements within the commodity group need to show different price trends and the relative shares of the elements need to vary over time.

Figure 1: Price index for pears (52 week moving average)
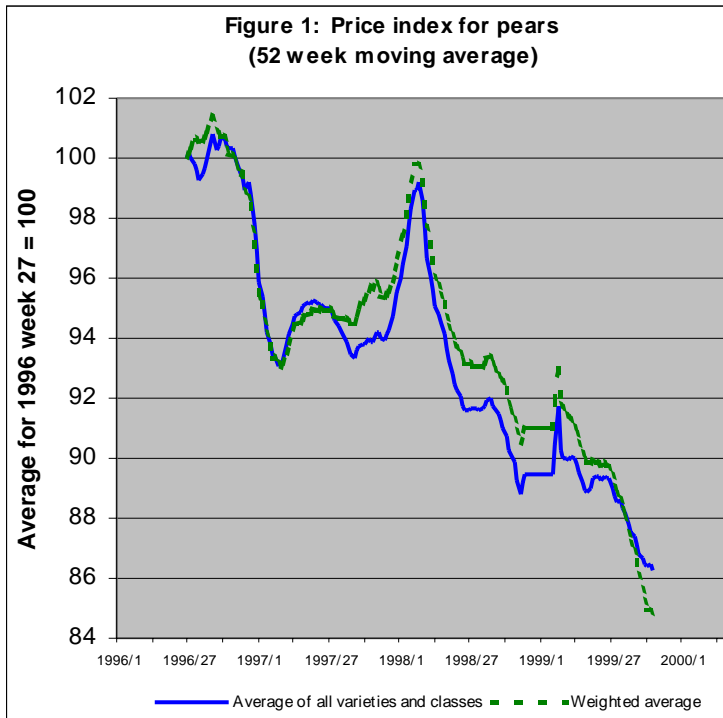
Quantity Adjustments

18. The most typical adjustments made in agriculture are:

a) **Moisture Content e.g. Cereals**

For example, if 1,000 tonnes of wheat (20% moisture content) are priced at £10 per tonne, what is the price at 10% moisture content?

800 tonnes of wheat (0% moisture content) is £10 per tonne.

1,000 tonnes of wheat (10% moisture) is equivalent to
900 tonnes of wheat (0% moisture).

Price of 1000 tonnes of wheat (10% moisture)
= 900/800 *10 = £11.25.

(Note: moisture content of 0% and 20% will not occur in practice. Used here to explain stages in calculation.)

b) **Fat/Protein of Milk**

To take account of quality in monitoring the price of milk, we can estimate a price for a given fat content. In Bulgaria, this is done using the formula:

$$\text{Estimated price} \ = \ \text{Observed price} \ * \ \frac{\text{Fat content for which price is required}}{\text{Fat content for observed price}}$$

An alternative approach is taken in the United Kingdom, where the price of 3.7% fat milk is estimated using the formula:

$$\text{Estimated price} \ = \ \text{Observed price} \ * \ \left(\left[\frac{3.7\%}{\text{actual butterfat percentage}} \ - \ 1 \right] \ * \ \text{fat:non-fat value ratio} \ + \ 1 \right)$$

This takes into account the relative values of the fat and non-fat components of milk.

c)   Fertiliser (Cost of Active Ingredients)
15-20 kg per dka Nitrogenous are needed for main and additional fertilising. Each 100 kg ammonia selitra contain 33 kg active ingredients. That means that 61 kg ammonia selitra is needed to provide for 20 kg N per dka to the soil. There are many kinds of Nitrogen fertilisers. The share of active ingredients is different and the prices are different too. It is possible to measure the price changes in cultivating wheat according to the price differences of fertilisers. Each replacement of one kind of fertiliser with another leads to changes on the wheat price and on the grouping or total index.
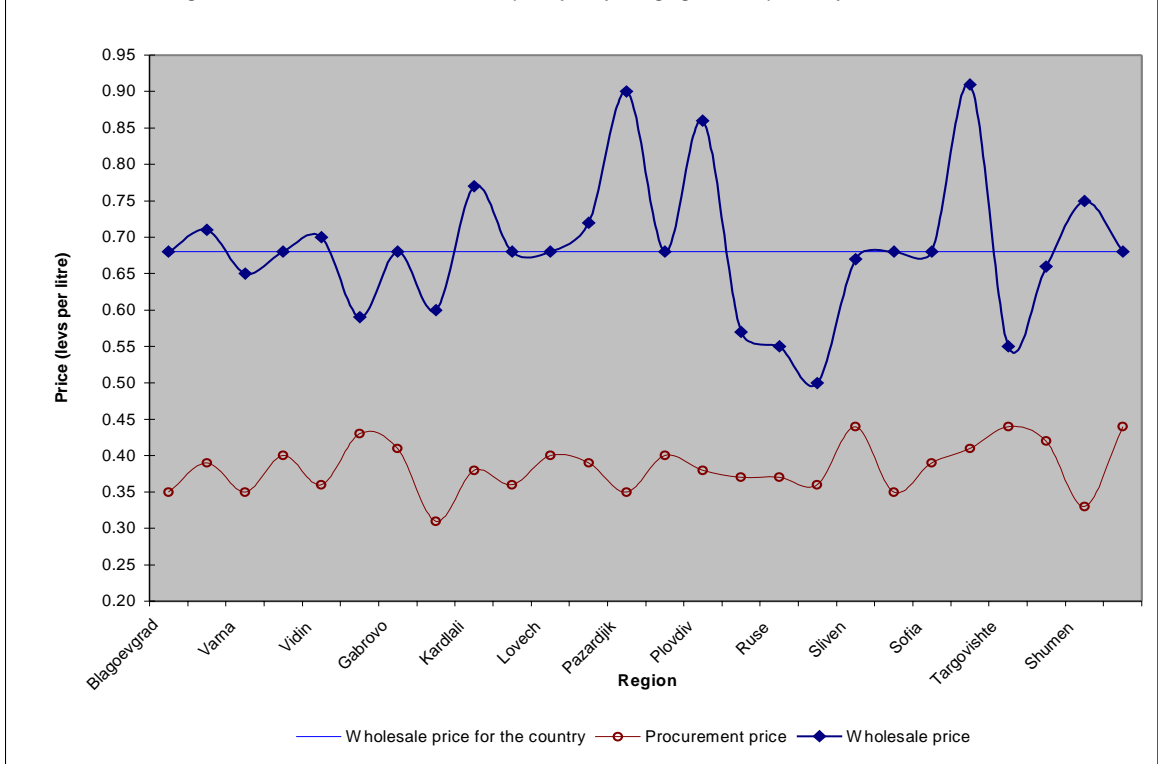
Another example would be the nutrient content of feedingstuffs.

Cost Adjustment

19.   This involves making allowance for additional factors, e.g. transport, loading, packaging and taxes. Taking into account the cost of options or the cost of producing this option can do this. Agricultural experts can also make more judgmental adjustments for any quality differences.

It is not possible to distinguish the impact of various factors. A project on agri-monetary statistics with other candidate countries is examining how this might be done. Figure 1 compares the influence of additional factors on the price of cow's milk in Bulgaria.

Figure 2: Influence of additional factors (transport, packaging and fees) on the price of cows' milk

Price (levs per litre)

0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20

Blagoevgrad Varna Vidin Gabrovo Kardlali Lovech Pazardjik Plovdiv Ruse Sliven Sofia Targovishte Shumen

Region

—— Wholesale price for the country   —o— Procurement price   —♦— Wholesale price

Overlap Replacement

20.   If a new product replaces an existing one, the trend in prices can be spliced together in the calculation of index numbers, e.g:

                    -------------------------- Old product
                              --------------------------------------- New product
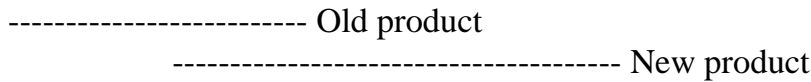
The movement in the price of the new product can be spliced onto the old one. The estimate of difference in price between the old and new product can be used to estimate the difference in quality. This works best when there is a long overlap between the products. It works less well with disappearing and new items.

An alternative (e.g. in index numbers) would be to continue the old price at the same level or assume it follows the path of other similar series or products in the index.

Theoretical Approaches (Heeding Adjustment)

21.   The idea here is to use multiple regression to identify the implicit prices for the characteristics or components of the product. It is rarely used in practice.

22.   More typically the main factors influencing the price of a commodity are taken into account when designing a survey, e.g. designing the annual survey of tenanted land to collect information on annual rents of land. This identified the main important factors as the type of agreement, the type of farming taking place, whether there were any buildings on site and the size of land covered by

the agreement. The work has concentrated on monitoring the actual rents being paid. Future steps could well be to consider, from the information being collected, how to transform this into a pure price index adjusted for quality.

Conclusions

In conclusion:

i)   measuring and adjusting for quality is important;
ii)   need to work to common standards;
iii)   users need to be aware of the significance of differences;
iv)   various techniques available for making adjustments;
v)   issues for candidate countries.

Issues for Discussion?

1.   How important are quality adjustments in relation to other issues?

2.   How easy are these to make?

3.   Issues for candidate countries.

4.   Should more work be put into understanding the difference in prices provided by different countries?

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