COMPETITIVENESS CONCERNS AT THE PRODUCTION AND PROCESSING LEVEL: THE EXAMPLE OF THE DAIRY SECTOR

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Part I

Some conceptual issues in the measurement of competitiveness in the primary and processing sectors

Introduction: interpretations of competitiveness

The term competitiveness is frequently used in discussions of performance at the level of the enterprise sector and the overall economy. The general sense is that failure - be it the inability to penetrate markets or the occurrence of large-scale unemployment - can be attributed to lack of competitiveness. Policies to improve performance are then invariably directed at gaining competitiveness. The policy proposals which emerge are quite diverse and can be conflicting. One finds arguments for low cost strategies - controlling input costs - and high cost strategies - improving the quality of service or differentiating the product. There are arguments for reducing the indicative role played by government - the abolition of fiscal incentives perceived as distortionary - and on the other hand suggestions for expanding this role as in the notion that government should be involved in "picking winners". While there is agreement that competitiveness is necessary for success there is a distinct lack of accord on how such competitiveness can be achieved. Thus competitiveness is multifaceted and widely different meanings of the term are in use.

Two factors are therefore important in any discussion of competitiveness. First, it is necessary to recognise the many facets of competitiveness and to identify those facets likely to be important in the application under consideration. Second, it is necessary to be precise in the formulation and application of a measure of competitiveness.

Competitiveness and comparative advantage

The English economist David Ricardo, writing in the early nineteenth century, was, perhaps, the first to attempt a systematic explanation for the pattern of international trade. The pattern of international trade is described by the answers to three questions: what goods do countries trade?, with whom do countries trade?, and how much do countries trade? A theory of international trade is an attempt to provide answers to these questions - the first question, however, is the one that dominates discussion. The basic building block in Ricardo's explanation was the principle of comparative advantage.

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1 This paper is based largely on Boyle G., S. Brown and K. Reagan (2003), The Competitiveness of Irish Agriculture, Irish Farmers Journal, Dublin, Ireland.
When resources are fully employed, the only way to produce more of one commodity is to reallocate resources and so produce less of another commodity. The cost of producing one commodity (say X) can be measured as the reduction in the production of the other commodity (say Y) required to free up the necessary resources. Cost is then measured in terms of opportunities foregone or opportunity cost. For example, we say that country A has a comparative advantage in the production of X if its opportunity cost of X were say “0.5Y” compared with say, “2Y”, in country B.

Trade based on comparative advantage implies that all countries can benefit in terms of enhanced economic welfare by engaging in trade which is based in specialising in the production and trade of those commodities that each country is relatively efficient in producing.

If we go behind the idea of comparative advantage and ask the question as to why countries might enjoy a comparative advantage in the production of certain commodities we get closer to the more popular notion of competitiveness.

Particular theories of trade based on this concept of comparative advantage differ from one another in the factors they identify as determining comparative advantage. The “Ricardian” model attributes comparative advantage to differences in the labour costs of production. In the so-called “Heckscher-Ohlin”, model comparative advantage is related to the abundance of productive inputs. More precisely this model says that countries will export those commodities which use relatively intensively their relatively abundant productive inputs. For empirical testing the Heckscher-Ohlin model is formulated as saying that the pre-trade price of a good in a country relative to the “world” price is inversely related to its relative abundance in each input weighted by the intensity of use of each input. Trade is taken to be inversely related to relative prices. Combining these statements we get a relationship between trade and input abundance.

[An implication of these concepts in an agricultural context is that, for example, Ireland should enjoy a comparative advantage in products that rely for their production on our most prolific agricultural resource which is of course our grasslands.]

For individual agricultural producers and processing firms competitiveness means the ability to outbid rivals in securing customers. Some of the features determining competitiveness can be quantitatively summarised but others, though qualitative and not amenable to such summary, are no less important. Costs and price are the primary quantitative indicators. In the case of processed agricultural commodities a focus on the production costs and prices of primary agricultural products is strongly justified on pragmatic grounds since the cost of raw materials will be a substantial component of the processing costs of these commodities. It is a perfectly legitimate national strategy to pursue competitive advantage on the basis of lower relative input prices.

Qualitative features include the reliability of supply; reputation of the producer; and the quality of after-sales service. All the above determine competitiveness at any point in time. Over time competitiveness will depend on the capacity to vary output levels which depends on current technology and the capacity for scale enhancement, technological and product innovation.
Measuring competitiveness—some country-level measures

Those attempting to devise a measure of national competitiveness adapt the type of inter-producer competitiveness described above. Qualitative features are typically ignored with competitiveness being described in terms of price and cost factors. Competitiveness indicators for national economies are reported by the OECD, the IMF and national central banks and finance/treasury departments. The measures are similar in that all involve a relative price and/or relative cost measure. They differ in the markets chosen for analysis—a country’s export markets, its home market or both—and in the number and range of countries against which competitiveness is measured.

According to the OECD a measure of competitiveness should ideally: cover all sectors and markets exposed to competition; and be compiled using internationally comparable data. In practice data limitations result in compromises with these strictures so that there is no best quantitative measure of competitiveness. The indicators constructed by the OECD are by far the most extensive so we will concentrate our discussion on these.

In general it is not possible to compare price and cost levels across countries for a broad range of goods. Indicators therefore compare relative price (cost) with respect to some base period in terms of common currency movements. Competitiveness is usually measured with respect to trade in manufactures as data are most readily for manufacturing trade. Data for trade in services are not considered as reliable and are in any case not available for all countries. Raw materials, energy and agricultural trade are excluded because price differences tend to be arbitraged away in world competition.

Measurement problems remain even when attention is focused on trade in manufacturing. One problem concerns the price index to be used—an index of export prices is most common. This has the advantage—over the wholesale price index—of being measured on a more consistent basis internationally. As a price index for assessing international competitiveness it has two drawbacks. It excludes “potential exports”—goods not currently traded but which would be traded if relative prices were to move—and it ignores shifts in the value-added composition of a country’s exports.

On the cost side, comparisons of labour costs are normally used in assessing competitiveness. The concentration on labour costs is due to the difficulty of measuring total production costs on an internationally comparable basis. The unit labour cost is the basic ingredient in any measure of cost competitiveness. Unit labour costs are calculated as the ratio of the current value of compensation per hour to the volume of output per man-hour. Some commentators are critical of this measure and suggest that basic hourly rates of pay offer a better basis for comparison. This argument revolves around the appropriate way of treating business cycle fluctuations and accounting for productivity growth. It is simple to adjust the unit labour cost to account for deviations of output from trend. As a consequence this point should not be contentious. While the OECD employs the unit labour cost and so takes account of productivity changes some commentators do, however, favour excluding labour productivity.

The OECD reports three competitiveness indices: import competitiveness; export competitiveness; and overall competitiveness. These are multilateral indices which use a double-trade-weighted scheme for taking account of a country’s importance in markets in which it competes and for weighting the importance of this trade in a country’s overall trade. Basically these indices measure the price for a particular country relative to the “world” price. In this they are identical to the type of equations estimated when explaining trade flows. In other words there is an affinity between tests of comparative advantage and competitiveness.

We argued earlier that net exports were related to relative input abundance. This is a
relationship derived from a supposed inverse relationship between relative prices and trade flows on the one hand and price and input abundance on the other. Relative prices are not calculated because the appropriate price – the pre-trade price - is not observable. When a competitiveness measure is constructed actual prices are used. Apart from this the reasoning is similar.

Measures of competitiveness – industry-based measures

Measures of competitiveness are backward looking. They indicate relative competitiveness in the present which is obviously dependent on what has happened up to the point of measurement. To the extent that the measures are used to explain past events the historical nature of the measure is entirely appropriate. The need for a food sector competitiveness measure, however, comes from a desire to predict the likely impact on the domestic industry of a policy regime change. A measure of how the industry fared in the past may not be appropriate in this context. Therefore if we are to use such a measure it ought to be “general” in the sense that it tells the same story in one policy regime as in another. It should also be supplemented by any additional information that can indicate why the future might deviate from the past.

In regard to this last point there is one piece of information that crucially complements competitiveness measures, namely, evidence regarding scale economies. Scale economies suggest the lowest level of operation at which the unit cost of production is minimised. To the extent that the proportion of producers reaching this level differs across countries a change in policy regime may have differential policy effects. Taking the current measure of competitiveness as the status quo then information on scale economies can be helpful in predicting the likely consequences of certain policies.

This brings us back to the first question concerning the generality of competitiveness measures. We now proceed to illustrate this point and at the same time argue a particular approach in the case of milk production competitiveness which typifies the kind of issues arising in the agricultural sector. Thus while we concentrate on the dairy sector here for illustrative purposes only, the points made generalise to other sectors.

Measures of competitiveness may be used to infer the impact of certain policies. The type of question addressed will clearly depend on the perspective represented. For instance we might ask: will a particular alteration in the EU dairy quota system result in a country’s producers having a larger or smaller market share? An alternative perspective is that of the entire Community and now the relevant question might be: will a policy change reduce the cost of dairy production in the EU? It might be thought that a positive answer to one of these questions implies a positive answer to the other. This need not be the case, however.

Suppose that the policy change contemplated is to encourage inter country transfers of dairy quota within the EU. Quota will flow to those producers who are willing to pay most for them. These will be the producers in countries with the highest quota values. The milk price and marginal cost of production are the important elements in determining the quota value - at the margin a producer will be willing pay more for a quota the higher the price relative to marginal cost.

Under profit maximisation, milk is produced to the point where the net marginal benefit (MNB) falls to zero. A system of national quotas limits total production to a given level in each country. This will result in a difference in the marginal net benefit of producing milk across countries. International trade in quotas would result in a reallocation of quotas across
countries with quotas flowing to those countries with the highest MNBs and from those countries with the lowest MNBs.

As a result of quota trade, total output would remain unchanged but the MNB of the quota would now be equalized across countries. It would be reasonable to measure competitiveness in this case as the MNB of quota prior to the opening of quota trade. The opening of trade would lead to a reallocation of quota production within the Union but the total cost of producing the quota in the union would also increase.

The important conclusion is that the measurement of competitiveness in terms of the marginal quota value may result in conflict with the requirement of cost minimisation for the Union as a whole. In general it shows the limitation of relative profitability as a measure of competitiveness. In the case of milk, profit levels are a false construct due to a particular regulatory environment. As such their use as a measure of competitiveness is limited to the particular example we discussed of allowing trade in quotas.

This example raises a fundamental question: should competitiveness focus entirely on cost comparison or should it also include any product price differences? It was noted above that economy-wide competitiveness indicators can involve cost or (product) price comparisons. At the individual producer level the appropriate measure depends on the nature of the product. Producers of a homogenous product would not be expected to maintain large-price differentials. Cost is the appropriate measure in this case. In the case where the products of different producers are perceived to be different, price differentials can persist. That is, a producer can sell his product for a higher price that a rival if consumers perceive his product to be "worth" the additional expenditure. Cost comparisons alone are now not a comprehensive measure of competitiveness. Comparison of output prices as an indicator of competitiveness is also of limited use, however, unless it controls for the strength of preference for a producer's product.

The food industry is comprised of a primary and a processing sector. Competitiveness in any line of business within this industry will be determined by the degree of competitiveness at the primary and processing stage. It is possible that the degree of competitiveness can differ at each stage. A measure of competitiveness, if it is to be satisfactory, must be capable of assessing performance at each stage. While largely because of data limitations most studies stop at the primary stage it is still worthwhile laying down the conceptual basis for establishing a comprehensive measure of primary and processing competitiveness.

The dairy sector is a particularly good example to illustrate the issues involved.

Milk, the product of the primary stage in the dairy sector, is a relatively homogenous product. While the fat and protein content of milk can differ across countries it is relatively easy to convert milk prices to a normalised product basis. Once this is done milk price differentials contain no information about the difference between milk producers. Price differences give us information about the processor or the relationship between the processor and producer. This point is argued below. Therefore cost comparisons are the appropriate measure of competitiveness.

At the processing stage products can be heterogenous and indeed product differentiation may be an explicit firm strategy. Cost comparisons alone are not sufficient here. Prices contain important information - marginal valuations by consumers - about the difference between producers.
Price differentials for milk do exist. It might be claimed that these price differences contain information regarding the relative competitiveness of primary producers. The differentials are information, within the context of the regulatory environment, about processors. Therefore price differentials for milk need to be considered in the context of analysing the processing sector. For instance, it is true that the geographical scope of the market for liquid milk is limited. In its unprocessed form milk can only be sold in a local market. This does not imply that the milk price will be determined solely by local considerations. Processed dairy products can be traded internationally. The outcome of such trade will have a strong influence on the price paid for milk. [Indeed according to the factor price equalisation theorem there exist circumstances under which trade in outputs alone is sufficient to equalise input prices across countries.] That is, even though inputs are traded in a limited market, their prices are equalised on account of trade in the products they produce. The point here is not to claim that the circumstances in dairy processing are such as to produce equalisation. They clearly are not. Rather it is to suggest that the processor's product mix and the structure of the market in which he operates is an important explanation of milk price differentials.

Issues in the measurement of production costs

Marginal and average costs

Production costs arise because of the need to pay for use of inputs employed. The level of total costs will depend on input prices along with the quantity and mix of inputs used. Technology and relative expenses - relative input prices - will determine these latter magnitudes. Technology is taken as given. Therefore we need only determine input prices in order to arrive at a cost measure. However, this exercise is complicated because the only observed prices will be those for which an explicit payment is made. It might be argued that explicit costs are the only relevant costs for competitiveness. This may be correct in certain cases but it is not true in general.

Once we have calculated total cost we must then decide how to use it in making statements about competitiveness. One set of producers (country) will be more competitive than another if it is better able to win customers. Suppose, for instance, that two producers gain access to a new market which has no domestic producer of their product. Which one will succeed in gaining the lion's share of customers? In the absence of product differentiation and any advantages due to advertising or transport costs, the successful producer will be the one who can provide the additional quantity of output at the lower increment to cost or, in other words, at the lower marginal cost.

All other things being equal a firm will be more competitive the lower its marginal cost. This is a very general result. Indeed it lies at the centre of any argument for using the price mechanism as a means of doing business. Total costs for a society are minimised when production is allocated between firms up to the level at which marginal cost is equalised across firms. This will be the outcome of a market competition between firms when no advantages such as monopoly are held.

For the analyst the difficulty lies in getting an accurate measure of marginal costs. In addition to problems associated with measuring input prices there is the added complication that, in general, the level of marginal costs will vary with a firm's output level. In order to overcome this difficulty we would need data observations at many different points in time. It frequently turns out that data observations are limited. This means that often the best we can do is to measure average costs at this point. Average and marginal costs can diverge and it is therefore necessary to guard against drawing false inferences.
Explicit and implicit costs

Labour costs

Given the data limitations, nonetheless taking account of unpriced or implicit costs - examples would be owned machinery and family labour - in addition to explicit or "cash" costs will go some way towards avoiding such errors.

Typically the share of costs which are explicit varies across countries. The approach to costing inputs can therefore be vital in determining relative cost rankings. The importance of considering implicit costs, however, will depend on the use to which the measure of cost is being put. It is vital that implicit costs be considered if the concern is with predicting the evolution of market share in the wake of a major change in a policy regime. This might be perceived as a long-term or very long-term perspective. In such circumstances there may be large changes in output. Even if past levels of output were comfortably produced by owned resources major expansion may not be possible without hiring additional inputs on the market. The estimated cost level would not be sensitive to this if account was taken of explicit and implicit costs. A very misleading picture, however, would arise if only explicit costs were considered. Major changes will not occur immediately so we will refer to cost measures appropriate in these cases - those that take account of explicit and implicit costs - as resource or "economic" costs. For marginal changes around what is currently produced explicit costs will give a fairly accurate ranking. Such costs will be referred to as "cash" costs.

To illustrate this point consider the following example. Let us say that all agricultural labour in one country is family and in another it is all hired. When comparisons are made on the basis of explicit costs the first country will appear to be the more competitive. If available family labour has been exhausted production can only be expanded by hiring labour. The accurate assessment of competitiveness will, other things being equal, depend on the cost of hired labour in one country relative to the other. If this is higher in the first country the assessment based on explicit costs alone will be wrong. This example demonstrates that average explicit costs will not be an accurate guide to competitiveness. Long-run costs - implicit plus explicit costs - per unit output are the most appropriate indicators of competitiveness. The necessity of this adjustment is all the more important when information is limited to a few data observations.

Every production process involves applying labour to purchased intermediate goods and the producers assets. This immediately gives us three cost categories. It will be useful to subdivide assets into land and capital assets such as machinery, buildings and stock. Complications arise in the measurement of costs when any of these categories involves implicit costs, as noted before, and when the fiscal system results in actual costs differing from measured costs. Implicit costs can be present for land, labour and capital. Distortions due to the fiscal system, for example, interest and other capital subsidies, will be most problematic in relation to capital.

Family members have traditionally provided the labour input to agricultural production in many countries. This means that there is no resort to the labour market and hence no explicit recording of costs. This adds complexity to the measurement of labour costs. Two issues need to be addressed. The first concerns the "volume" of labour employed. Seasonality will mean that the quantity of labour required over the year will vary. The volume recorded must be comprehensive in the sense of including every quantity of labour input used over a given period, no matter how brief the extent of activity. The skill level of labour will also differ and this should ideally be taken into account by the volume measure. Disaggregating labour into categories classified by years of schooling and using the relevant wage rates for the categories
as weights would be a useful way of taking account of skill differentials. The data necessary to perform the kind of adjustment described above are unfortunately often not available and resort to more ad hoc procedures is usually necessary. For example, in the EU analysis of specialist dairy farms that is presented below, the labour input is measured in terms of Annual Work Units (AWUs) which is a work-time-based measure.

The second issue regarding labour concerns the price to be assigned to family labour. Non-family labour will be charged at the going rate for hired labour in the particular country. Assigning a charge to family labour involves constructing a "shadow" wage rate. The term "shadow" implies that the wage is not actually paid. It is usually necessary to calculate shadow prices when performing social cost-benefit analyses. There the objective is to place a value on the resources drawn from the private sector in executing a public project. This gives a measure of social cost.

We are concerned with a private cost - the cost to the farm business - of using family labour. The upper bound is the wage paid to hired labour in the country and the lower bound is zero. This lower bound is clearly unrealistic. The production unit obviously bears costs in providing for the subsistence of the family member. It might be argued that these costs would be present anyway in the case of children even if their labour was not used. Once they get to working age this is no longer valid and it is this latter category which is more significant in terms of work done. The sum of explicit food, heating and clothing costs is an underestimate. It neglects entertainment and bequest costs. This latter would not arise were there no descendants. We might expect people to retire earlier and "consume" the proceeds of the work years by selling off assets.

These arguments suggest that the appropriate shadow wage is somewhere between the lower and upper bounds. The upper bound - the wage of hired labour is a good approximation. This is especially so in view of our justification for using implicit or "resource" costs in a measure of competitiveness. That is, expansion to compete could involve hiring labour.

Capital costs (including land)

Any problems with measuring the quantity of labour pale into insignificance alongside those that arise in measuring capital stocks. Problems arise if: (i) capital assets are used in different proportions across countries; and (ii) different methods of accounting for these assets would give rise to different stock measures for owned capital. In general it will not be possible to assess the extent to which such problems arise.

The capital cost will be affected by the fiscal system - that is, the system of capital taxes and subsidies. The unit cost of capital on an annualised basis will be comprised of three components: the acquisition price of a unit of capital; the interest and depreciation rates; and tax and subsidy parameters. In measuring these components inflation adjustments will need to be made. The interest rate measures the cost of finance and there is some debate regarding whether it is appropriate to assume that all marginal investment is financed by equity, borrowing or a combination. Finally in the absence of fiscal effects, the choice of an appropriate depreciation rate would be the most difficult aspect of this calculation. Depreciation and stock allowances, however, along with any other fiscal incentive or penalty must be included in the calculation.

As information on capital penalties and subsidies is not readily available our measure of capital cost comprises the sum of a real interest rate and an economic depreciation estimate. The economic depreciation rate is assumed is in turn based on assumptions about the average lives of the various forms of capital.
We have separated owned land from other assets. This is due to the fact that costing this asset is likely to be more contentious than other owned assets. From Society's point of view the argument relating to the costing of land is complex. We are concerned, however, with the private cost. Conceptually the appropriate cost is the return to land in its next best use but how is this to be best measured? Alternative uses depend on a host of factors particular to the individual farm, for example, the adaptability of the soil to alternative uses, the skill and labour requirements of the landholder, the mobility of capital stock etc. The simplest and most feasible manner of accounting for opportunity land costs is to use rental values. A rent could have been earned for renting the land rather than using it. This is an explicit payment being foregone. The actual rent will depend on the use to which the land could be put. Market rental costs per unit is the obvious shadow rent that should be applied. It should be borne in mind, however, that land tenure arrangements complicate international comparisons since short leases predominate in some countries and long-term leases are prevalent in others. Moreover the rental market may not be extensive in some countries which may give rise to extreme values.

Thus in summary, where data are available, non-marketed resources are often assigned annualised "resource" or "economic" costs by employing conventions along the following lines:

- Family labour: the hired agricultural wage rate
- Non-land capital: the value of the capital stock times the sum of a real interest and depreciation rate and
- Owned land: the land rental rate.

**Competitiveness and exchange rates**

International comparisons of any relevant economic aggregate ultimately require conversion of national money values to some standard unit. Often, without any comment, studies will convert all economic aggregates denominated in national currencies to a common currency unit by employing the official exchange rate. The choice of numeraire currency is entirely arbitrary as the relative values of the economic entity under scrutiny are independent of the choice of currency numeraire. The choice will invariably reflect the desire that the results are readily communicable. Hence the choice usually in some internationally prominent currency such as US$ or Euro. This type of conversion, while standard, skirts many fundamental issues which become all too apparent in the context of the assessment of relative efficiency, or, competitiveness. Competitiveness as a concept is something fundamental which ought not to be readily buffeted by the often whimsical gyrations of the foreign exchange markets. The international exchange value of a currency is a price which clears the international transactions market involving real and financial flows. Its value will be influenced *inter alia* by relative inflation differentials, relative growth differentials, relative money supply growth rates and by speculative forces. Some of these underlying causal factors which impinge on a currency's value are fundamental while others are clearly volatile in character and often transient in their impact.

When studies infer competitiveness' rankings from indicators quantified in a common currency they are likely to mislead since in the short-term the official exchange rate may "... not necessarily reflect the real purchasing power of the currency on the national territory". In other words the amount of €s spent on a basket of farm inputs when converted into US$ using the official exchange rate may be incapable of purchasing the same basket of inputs in the US. In such a circumstances we say that the € is overvalued relative to purchasing power parity (PPP). In these circumstances the US farmer may enjoy a competitive advantage which ought
to be of a short duration. Thus to avoid any inference that a competitive advantage conferred by a deviation from purchasing power parity (PPP) is fundamental it would be preferable to compare production costs in terms of PPPs. The PPP is thus a synthetic common currency unit. It is the currency value which would hold if the exchange truly reflected relative purchasing powers. This construct should thus reflect the underlying economic fundamentals in the countries under comparison. An added advantage of this approach is that it is possible to compare the divergence in competitiveness yielded by the respective PPP and common currency standards. The difference between the two standards will reveal the extent to which exchange rate policies confer a competitive advantage or disadvantage on a sector.

In deciding on the appropriate PPP standard to employ for our purposes, a number of options are possible. Many agencies produce PPPs based on the relative prices of transactions in the economy as a whole (for example, Eurostat and OECD). However, a number of agricultural economists have criticised the appropriateness of such PPPs in the context of agricultural sector and some have proposed the use instead of an agricultural-specific PPP. A logical extension of this idea is to compute PPPs based on systems or enterprises within the agricultural sector.

In comparing competitiveness across countries it is thus feasible to convert the various indicators into:

(i) a common “official” currency (e.g. € or $),
(ii) a national economy PPP standard, and
(iii) an agricultural-specific PPP standard.

Primary sector competitiveness’ indices

The appropriate indicator of competitiveness depends very much on the perspective represented in any given context. The perspective may be that of primary producers concerned at their capacity to enhance or maintain market share in response to a policy regime change. Alternatively, the perspective could be that of the region, for example, EU production and trade efficiency. The indices will not necessarily yield equivalent answers. To see this consider first the perspective of producers in the home country facing a regime change. Their principal concern will be the impact on their income of, for instance, an output price cut. The flexibility to withstand such a development will depend on the elasticity of supply response (assuming that producers cannot influence the prices received for their products). Specifically the lower the supply elasticity the greater the capacity to absorb a price shock, other things equal. It can be shown that the lower the ratio of production costs to the value of output, the lower the supply elasticity. The latter index implicitly also captures the effect of different output prices that may arise because of differences in the basic quality of the product in question.

The alternative index, reflecting the more traditional view of competitiveness, expresses costs per unit of output volume. This index thus explicitly ignores output prices.

Thus two indices may be constructed reflecting potentially different perspectives. The first index inspired by the producers’ horizon we define as Index 1. This index simply compares input costs to the value of output.

\[ \text{Index 1} = \frac{\text{Input Costs}}{\text{Value of Output}} \]

\[ \text{Index 2} = \left( \frac{\text{Input Costs}}{\text{Value of Output}} \right)^{\frac{1}{\text{Supply Elasticity}}} \]

This is true where the technology is described by a Cobb-Douglas function.
For simplicity we assume just one competitor, which could be the simple average score for a number of competitors, and so set aside any complexities due to weighting. The relative competitiveness measure Index I of Country A (the home country) relative to B is:

$$Index \ I = \left( \frac{PI_a \cdot I_a}{PQ_a \cdot Q_a} \right) \left( \frac{PI_b \cdot I_b}{PQ_b \cdot Q_b} \right)$$

$$= \begin{bmatrix} \left( \frac{Q}{I} \right) \\ \left( \frac{Q}{I} \right) \end{bmatrix} \begin{bmatrix} PI_a \\ PI_b \end{bmatrix} \begin{bmatrix} 1 \\ E \end{bmatrix} \begin{bmatrix} PR_a \\ PR_b \end{bmatrix} \begin{bmatrix} E \\ 1 \end{bmatrix}$$

where,

Q is the volume of output,
I is the volume of input use,
PI is an index of input prices,
E is the nominal exchange rate in units of Country A's currency per unit of B's currency and
PR is the price of the primary producers' output.

If this ratio is less than one, A is said to be more competitive than B. The decomposition of this index is quite informative. Here three elements are seen to constitute the index: relative total input productivity (1); relative total input prices (2) and relative producer output prices (3). Thus Country A will be more competitive than B, if it is technically more productive or, if its input prices are lower, or, if its output prices are higher, or, because of some combination of all three factors. It will be noted that strengths on some factors serve to offset weaknesses in others, for example, relatively high productivity may compensate for relatively low output prices.

From the perspective of the individual farmer it is important to note that he cannot influence either the product or input price or the exchange rate.

This index has several advantages. It is readily calculated in that it is simply costs expressed as a ratio or per cent of the value of output. It is independent of currency factors in that the exchange rate terms cancel and it implicitly accounts for output price differences. It is also independent of the units in which the commodity is measured.
The traditional measure of competitiveness expresses costs per unit of output volume. This we define as Index 2 and it is given by the following expression:

$$\text{Index 2} = \left( \frac{Q}{I} \right)_a \left( \frac{PI_a}{Q} \right)_b \left( \frac{1}{E} \right)^{(2)}$$

In other words, relative costs per unit output are seen to be the product of relative total input productivity (1) and relative input prices (2). Written in this way we see that Index 2 could be termed the real effective exchange rate for Country A relative to B in respect of a particular commodity. This index is therefore comparable to the competitiveness measures used by the OECD which were discussed above. If this ratio is less than one Country A is said to be more competitive than Country B. A comparison of Index 1 and Index 2 indicates that both indices will be equivalent where product prices are similar.

The decompositions shown above for Index 1 and 2 can also be used to illustrate the determinants of a country's relative competitiveness over time.

The exchange rate $E$, as already noted, is an important variable impinging on a sector's competitiveness. The value of the nominal exchange rate reflects the relative evolution of economy-wide price levels in the two countries. It is very unlikely that overall relative prices will match the evolution of relative input prices for a sector like dairying unless agriculture constitutes a significant proportion of national output. Although taking one year with another, we would expect agricultural input prices to closely track economy-wide prices. If the latter were true and if $E$ were determined in accordance with the purchasing power parity (PPP) then the terms $PI_a/PI_b$ and $E$ would cancel. The upshot would be that the competitiveness index would exclusively reflect relative input productivity.

When looked at in this way we can see how the employment of the common currency standard is an attempt to eliminate relative price differences between countries. It also follows that is instead of employing the market exchange rate we employed a synthetic exchange rate $E^* = IP_a/IP_b$ - an agricultural sector PPP in effect - we would exactly eliminate relative price differences. However, while this may be intellectually interesting, it clearly smacks of "throwing out the baby with the bathwater" since part of a country's competitiveness may be precisely due to natural advantages it enjoys in the pricing of inputs - feed costs in the Netherlands are an obvious example. Also deviations from PPP may be long-lived.

However, over the long run we might expect PPP to hold which thus implies that in the long run a sector's competitiveness is ultimately driven by its relative growth in total input productivity. This is a very important result. It points us to the long-run equivalence of productivity and competitiveness.

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7 Technically this involves taking the log of the expressions for Index 1 and 2 and then obtaining the time derivative of each of the right-hand-side components. In other words, the percentage change in the relative value of Index 1 and 2 is (approximately) the sum of the percentage change in each of the right-hand-side components.
A typology of cost aggregates

It's useful to consider competitiveness measures (Index 1 and 2) for a number of cost aggregates. Conventions differ between countries so it will be helpful to adopt a single set of definitions common to all. Our choice of concepts draws on measurement conventions used by the EU Commission in their Farm Accounts Data Network (FADN) and the United States Department of Agriculture (USDA). The typology we adhere to is as follows:

"Cash" costs = specific costs (costs that are directly incurred in the production of a given commodity, for example, fertiliser, feedstuffs, etc.) plus external costs (wages, rent and interest paid).

"Economic" or resource costs = "cash" costs plus imputed resource costs (family labour, equity capital and owned land).

It is worth noting that our proposed Index 1 when computed in respect of "cash" costs and "economic" costs is closely related to the concept of Domestic Resource Cost (DRC) ratio that has been advocated and widely used as a competitiveness measure. The DRC compares the cost of owned resources (land, labour and capital) with the value added to "bought in" inputs (the latter are supposed to be measured at "world" prices). A sector is considered competitive if this ratio is less than one in value. It can be shown that the DRC is related to our proposed measures as follows:

\[
DRC = \frac{X - Y}{1 - Y}
\]

where,

\(X = \text{Index 1 ("Economic" costs), and} \)
\(Y = \text{Index 1 ("Cash" costs)}\)

Suppose \(X\) were say 0.92 and \(Y\) were say 0.66 then the DRC value would be 0.76 which would indicate that the sector was competitive. We can also show the necessary relationship that must hold between the \(X\) and \(Y\) values if the sector is to be just about competitive. This is a useful relationship given the difficulties that will be encountered in estimating \(X\) in particular. Thus suppose \(Y\) were say 0.66 and we set the target DRC as say 0.98 would imply borderline competitiveness then \(X\) could be no more than 0.99 for the sector to retain its competitiveness.
Processing sector competitiveness' indices

Primary agricultural commodities are major inputs into the production of a variety of products. Some of these products are homogeneous across countries and producers, while others are differentiated and command monopoly power within certain limits. The latter products might be the niche products while the former are often described as bulk or commodity products. Bulk prices will be pretty much equalised internationally, barring trade distortions, while niche product prices will be determined in local markets. The processor's output price in say country A will thus be a weighted average of bulk and niche product prices:

\[ P_{jA} = W_1 P_1 + W_2 P_2 \]  

(4)

where, \( P_{jA} \) is the price of processor j's output in country A; \( W_1, W_2 \) are the weights of bulk and niche sales in country A and \( P_1 \) and \( P_2 \) are the corresponding prices.

In the simplest case the competitiveness of the processing sector in Country A versus Country B could be ascertained by compiling the ratio of processed output prices, that is, \( P_j/P_k \). The higher is this ratio, the less competitive is A relative to B. A problem with this simple measure is that it doesn't explicitly account for the extent to which a country specialises in niche or high-value-added production. This is also a problem for all macro-level indices of competitiveness. We are not aware of macro-level indices, for instance, that can take account of switches in the value-added composition of products across countries. However, it is somewhat easier to do this at a sectoral level. Take the example of milk again.

The milk processor will be concerned to ensure a guaranteed milk supply. In addition he will be concerned about the quality of the milk he receives in terms of its protein and fat levels. The level that the processor can pay the farmer for milk will depend on the price for which he can sell his own product. The price paid will thus closely reflect the bulk/niche mix of his processing system. For example, if a processor is involved in a high-value-added activity that requires his raw material to be of a high protein level then we would expect him to pay a premium for milk with this characteristic. A flat rate pricing formula would simply not deliver the appropriate protein levels. Thus a niche processor with a high output price is able to pay for the quantity and quality of the milk that he requires.

Another way of thinking about this issue is to recognise that the high price obtained for niche products is that it is a reflection of consumer preferences for these products. Strong and stable demand for such products will reinforce the processor's willingness to pay high prices to his suppliers for milk of the desired quality (characteristics). Processors will also want to achieve high prices for their suppliers (and this is obviously true of co-operatives) to ensure long stability in milk supplies. The greater comfort zone that producers have, the greater flexibility that is afforded to processors in the event of adverse developments in markets.

These arguments suggest that we can modify the basic index of processor competitiveness by adjusting the measure for the impact of producer milk prices as follows:

\[ Index \ 3 = \left( \frac{P_{\alpha}}{P_{\beta}} \right) \left( \frac{PR_k}{PR_\alpha} \right) \left( \frac{1}{E} \right) \]  

(5)
where, PR is the price paid to primary producers (adjusted as appropriate for product characteristics such as fat and protein content of milk) and E is the nominal exchange rate between the currencies of countries A and B.

If Index 3 is less than 1 then Country A is more competitive than Country B. As with our suggested indices for primary production this index can easily be adapted to assess the dynamic performance of the processing sector’s competitiveness.

We can combine Index 2 and 3 to yield an aggregate measure of competitiveness for the primary and processing sectors as follows:

\[
\text{Index 4 = } \left\{ \frac{P}{\bar{P}} \right\} \left( \frac{PR}{\bar{PR}} \right) \left( \frac{IP}{\bar{IP}} \right) \left( \frac{Q}{\bar{Q}} \right) \left( \frac{1}{E} \right).
\]

(6)

Again Country A is more competitive than Country B if this index’s value is less than 1. The intuition underlying this more comprehensive measure can be seen by again taking the example of the dairy sector. Competitiveness can now be seen to depend on the processor’s ability to maximise the production of niche products that can command high-market prices and thus maintain a sustainable gap between the prices he receives and what he is required to pay for his raw material supplies. In turn the processor whose suppliers are relatively more cost efficient will also enjoy more room for manoeuvre in responses to market fluctuations and thus will be more likely to stay profitably trading in the marketplace.
Part II

Issues in the derivation and measurement of competitiveness in the EU dairy-production sector

Introduction

In the previous sections I have set out some of the theoretical and conceptual issues that I believe should inform any discussion about competitiveness. In this section I apply some of these concepts to the measurement of the competitiveness of selected dairy-producing countries in the EU15.

As stressed in the previous sections, the implications of competitiveness depend on the lens you’re looking through. If looked at from the viewpoint of a particular country the concern might be the enhancement of market share or indeed its maintenance under adverse policy circumstances. While such a strategy might be perfectly sensible for the country as a whole it might not be particularly attractive to an individual farmer whose scale may not be sufficient to ensure long-run competitiveness. By extension a strategy that might make sense for the whole Union may not be especially attractive to an individual country whose competitiveness might be vulnerable.

All this is to emphasise that being competitive, whether it be for an individual farmer or processor or for an entire country, does not imply location in any particular comfort zone; it simply means for the entity in question that it stays trading with profit in the market place. In other words, being competitive does not necessary imply having to be as good as the best but simply not being as bad as the worst! Chart 1 attempts to convey this message in graphic terms!

“Cash Costs”

The “Cash costs” of production are important in establishing competitiveness in the short-run but in the long-run resource or “Economic costs” (family labour, owned land and owned capital) are of crucial importance. Economies of scale may also be of significance.

In Chart 2 I present some data for “Cash costs” expressed per 100 kgs of product for selected EU and non-EU milk producers. The EU data are based on the Farm Accounts Data Network (FADN) maintained by the EU Commission whereas the non-EU are drawn from individual country sources. All international data comparisons are plagued with the problem of “comparing like with like”. The EU data are drawn from a harmonised database so comparability is probably more assured with these data than in the case of the non-EU data. However, it seems reasonable to assume that “Cash costs” would have a more consistent international meaning than “Economic costs”.

On this index Ireland emerges as the most competitive producer in the EU with Australia leading the table on an international scale. In Chart 3 we now present “Cash costs” expressed as a percentage of output value. This index, it will be recalled, views competitiveness from the perspective of each individual country and the focus is the flexibility of a country to withstand a reduction in prices. This index also implicitly accounts for variations in product prices which reflect different product characteristics (such as the differences in the fat and protein content of milk across countries). What’s interesting about this comparison is that if we exclude Denmark, the UK and the US, the index is remarkably close for all other countries. Thus notwithstanding the diversity of policies that impact on the milk-producing sectors in EU and non-EU countries most countries have more or less the same degree of
flexibility to withstand downward price movements. The outcome for the three exceptional countries suggests that these countries can only ensure their competitiveness if the scale economies are being experienced at both the primary and processing sectors.

**Resource costs and scale economies**

The importance of taking into account resource costs, at least in the long run, is apparent once we look at the diversity of the main milk-producing sectors in the EU in terms of their structural characteristics (Chart 4). Countries differ widely in terms of the area farmed, herd size and labour employed. However, the widest disparities are apparent in respect of the use of hired labour and rented land and especially the relative indebtedness of the different country sectors. These factors are also important in underpinning the long-run competitiveness of the milk-producing sectors in the EU. Failure to take account of these structural disparities in any consideration of the long-run competitiveness of the EU sectors will more than likely lead to misleading impressions of the true competitive strength of the countries concerned. When we estimate competitiveness based on the “Economic costs” of production per 100 kgs of product we find that a country like Ireland which seems impressive on a “cash cost” basis is much less so when we factor in the resource costs that are employed to produce the product.

Whether scale economies apply in the production of milk, and if they do, at what level of production, is an important factor that drives the long-run competitiveness of the sector. In Chart 5 I present a rough estimate of the extent of economies of scale which is based on an analysis of the relationship between the estimated “Economic” costs of producing milk at different levels of activity as measured by herd size.

Based on the structure of herd sizes within FADN the evidence suggests that total production costs begin to “flatten out” at a relatively modest herd size (50-60 cows). The “optimal” scale in the sense of the level at which average total production costs are minimised appears to be around the 100 cow level. We cannot rule out the possibility of course that theoretical scale economies above these levels could exist or that individual dairy farms could achieve economies at higher herd levels.

The importance of this result relates to the herd-size structure of EU dairy farms (Chart 6). With the obvious exception of the Netherlands, Denmark and the UK, the majority of herds in most countries are under 50 dairy cows. It would appear therefore that in most countries the scale economies are not being fully exploited.

**Concluding comments**

In this paper I have attempted to sketch both the meaning of competitiveness at the primary and processing sectors and the factors that drive competitiveness in the short and the long run. In the short run, both the cash costs of production and the prices received for output determine the ability of a sector, or an individual farmer, to stay trading profitably in the market place. In the long run the drivers of competitiveness are more complex because attention must be paid to the costs attached to resources such as owned land, capital and family labour. Also economies of scale may be of consequence.

While the measurement of competitiveness will always be open to debate there can be little doubt that the goal of enhancing a sector’s competitiveness is worth striving for. I would emphasise three areas as being important in achieving such a goal for any sector.
First, producers must pay attention to their production costs. This starts by an awareness of what their costs are. How many producers are in fact so aware?

Second, support agencies in the research and technical advice and support fields need to refocus attention on the fundamentals of productivity improvement. In the long run being competitive hinges on using all available resources productively.

Third, strategies to enable sectors to re-structure as painlessly as possible so as to exploit scale economies need to be put in place. In this context EU policy makers cannot ignore the deleterious effect that the continued existence of the EU quota regime has on the competitiveness of the entire EU dairy-production and processing sectors.

Fourth, any distortions by way of hidden subsidies or taxes that distort the true competitive position of a sector need to be eliminated.
COMPETITIVENESS IS ABOUT SURVIVAL IN THE MARKETPLACE
CHART 2

Dairy Production EU vs. Non-EU
"Cash Costs" EURO per 100 kgs product volume, 1998/99
CHART 3

Dairy Production EU vs. Non-EU 1998/99
"Cash Costs" as a % of product value

<table>
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<th>GER</th>
<th>FRA</th>
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<th>NL</th>
<th>DK</th>
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<td>37</td>
<td>36</td>
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<td>34</td>
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<td>1.6</td>
<td>1.7</td>
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<td>5</td>
<td>1</td>
<td>4</td>
<td>28</td>
<td>9</td>
<td>29</td>
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<tr>
<td>Debts % of assets</td>
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<td>31</td>
<td>1</td>
<td>35</td>
<td>29</td>
<td>55</td>
<td>5</td>
<td>16</td>
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</table>
Economies of Scale in EU Dairy Production, 1998/99

$y = 81.022x^{-0.2118}$

$R^2 = 0.552$
CHART 6

Percentage of EU Dairy Farms with herds 50+

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