ANALYSIS OF THE COMPETITIVENESS OF CEREAL PRODUCTION IN SELECTED EU COUNTRIES

F. S. Thorne

Rural Economy Research Centre, Teagasc, Dublin, Ireland
E-mail: fthorne@rerc.teaagsc.ie

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Abstract

This paper examines the competitiveness of cereal production in selected EU member states, during the period 1996 – 2000. Profitability was selected as a measure of competitive performance and costs of production, value of output and partial productivity indicators were examined as possible sources (potential) of competitive performance. Using data from the Farm Accountancy Data Network (FADN) the analysis showed that productivity levels in the UK, Ireland and France were consistently higher then competing countries Denmark, Germany and Italy. In terms of profitability, the opportunity cost of owned resources had a major impact on the competitiveness of cereal production within the EU. Cash costs as a percentage of total output were lowest in Italy but in terms of total economic costs, including an opportunity cost for all owned resources, Italy had the highest cost structure amongst the countries examined. These findings have implications for EU cereal producers in the medium term as direct payments are decoupled from production and producers must make production decisions based on full economic costs of production, including adequate remuneration for owned resources.

Key Words: Competitiveness, Cereal production, Profitability, Competitive Performance, Competitive Potential. (JEL: Q12)

Introduction

The competitiveness of the European cereals market has been at the forefront of much debate in recent times in the context of impending reforms to the Common Agricultural Policy (CAP), increasing trade liberalisation brought about as a result of World Trade Organisation (WTO) negotiations, and EU enlargement (Newman and Matthews, 2004). In particular, the most recent reforms of the CAP, detailed in the Luxembourg Agreement (2003), have increased awareness within the EU of competitive agriculture in the context of decoupled direct payments. Consequently, the objective of this research was to examine the competitiveness of selected EU cereal producing countries for a baseline period, 1996 to 2000, to provide an insight into the ability of these producers to react to the afore mentioned influences. The EU countries chosen for comparison were the UK, Denmark, France, Germany and Italy. Together these countries accounted for over 78 per cent of the total cereal production within the EU-15 during the period 1996 – 2000 (Eurostat, 2003).

Alternative indicators for measuring the competitiveness of EU cereal production were examined, to determine appropriate indicators of competitiveness which meet the requirements of the theory of competitiveness and for which relevant data could be collected. The main findings from this literature review are outlined below which identifies why the specific indictors of competitiveness used in the study were considered appropriate. The data sources used and methodology involved in the computation of the indices are outlined in the following section. The results of the various indicators of competitiveness are then outlined and the conclusions from the research identified.

Literature Review

Competitiveness is much debated by both economists and policymakers. However, nearly every study on the topic of competitiveness adopts a different definition of the term and this was noted by Reich (1992) who had the following to say about the term: "*Rarely has a term in public discourse gone so*

directly from obscurity to meaninglessness without an intervening period of coherence" (p.1). Accordingly, it was considered imperative for the purpose of the study that the main developments in the theory of competitiveness were outlined to assist in the identification of an appropriate definition of competitiveness.

The Theory of Competitiveness

The theory of competitiveness has been analysed using three approaches (Thorne, 2002): traditional trade theory, industrial organisation theory and strategic management theory. Traditional economic trade theory provides useful insights into the development of the concept of competitiveness. However, McCalla (1994) identified the focus of traditional trade-based theories of competitiveness as being inherently structured on supply side economics. Relative price differentials have remained the primary indicators of competitiveness definitions based on trade theory. Therefore, it must be concluded that these theories do not account very well for demand side economics. There is an inherent failure amongst these theories to address qualitative differences in products, marketing and service abilities of firms and the strategies by which industries attain competitiveness (van Durren *et al.,* 1991). Following from the failure of trade models to address such issues additional schools of thought were investigated to develop a definition which defines the concept of competitiveness from a supply and demand perspective.

In contrast to traditional trade theory, the main focus of Industrial Organisation (IO) theory is the identification of variables that influence economic performance (van Durren *et al.,* 1991). McCalla (1994) provided a framework which summarised the attributes of IO based theories of competitiveness in which a number of characteristics of the theory were identified: (i) a limited use of theory, research is inductive in its nature and as a consequence the frameworks developed are complex and conceptual; (ii) the belief that competitiveness is demand driven; (iii) policy is not considered as an important construct variable; (iv) non-price elements are much more important than price variables.

Based on this summary the transition between traditional trade theory and IO is evident. The difference between the two is based on the relative emphasis placed on supply side economics and demand side economics respectively. Furthermore, the Strategic Management school of thought can be viewed as a theory of competitiveness which brings together the concepts of both trade theory and IO. Kennedy *et al*., (1997) defined competitiveness as outlined by strategic management theorists as "*the ability to profitably create and deliver value through cost leadership and or product differentiation*" (p.386). This definition implies that competitiveness is directly related to factors that influence both the cost and demand structure of a firm.

Based on the approaches discussed above, the Strategic Management concept of competitiveness is often argued to be the strongest model. This conclusion derives from (i) its explanatory power (van Durren *et al.,* 1991) and (ii) the critical importance assigned to sources of competitiveness rather than indicators of competitiveness. However, Harrison and Kennedy (1997) argue despite of the importance of identifying sources of competitiveness it is also vitally important that there is an inherent link between the sources and measures of competitiveness, which the Strategic Management school, including Porter (1990), has failed to do. An additional critique of the Strategic Management concept of competitiveness is that it has not yet been advanced to the point where it provides generalised statistically hypotheses (van Durren *et al*., 1991; Grant, 1991).

Defining Competitiveness

Based on the critique of the main theories of competitiveness outlined above, it is appropriate at this stage to define a definition of competitiveness that is considered appropriate for this analysis. Earlier work by Pitts and Lagnevik (1998) accepted that "*a competitive industry is one that possesses the sustained ability to profitably gain and maintain market share in domestic and/or foreign markets*"

(Martin *et al*, 1991). For the purpose of this study profitability is considered as a leading indicator of competitiveness and market share will be considered in subsequent research. From the above critique of competitiveness theory which highlights the importance of (i) considering both supply and demand and (ii) identifying appropriate measurable indicators, measures of profitability are appropriate given that both cost and return variables are considered.

Levels of Competitiveness

Further to defining competitiveness it is necessary to accurately measure the term. Buckley *et al.,* (1988) identified a useful distinction between three different measures of competitiveness, namely: *Competitive Performance, Competitive Potential* and *the Competitive Process*. *Competitive Performance* is the measurement of indicators of competitiveness of specific firms, sectors or countries. Profitability is considered for this study as a leading indicator of performance. Based on the theory of competitiveness, Brinkman (1987) identified profitability as a superior indicator of longer term competitiveness, relative to market share. However, the opposite case has also been proposed i.e. short term profit can be forfeited in the pursuit of long term market share gains. Based on this analysis it can be concluded that *"…one 'best' measure of competitiveness may not exist…(but) market share and profitability provide useful insights into overall competitiveness*"(Kennedy *et al*, 1997, p.24). Therefore, ongoing research is currently examining market share based indicators of competitiveness and will be reported separately.

Competitive Potential is the measurement of sources of *Competitive Performance*. Boyle (2002) highlighted the importance of measuring costs of production in addition to product returns. Furthermore, Boyle (2002) also identified specific partial productivity indicators as important measures of *Competitive Potential*. *Competitive Process* is the mechanism whereby *Competitive Potential* is translated into *Competitive Performance*. The majority of measures of the *Competitive Processes* are qualitative in nature and consequently are not considered for the purpose of this research whereby appropriate quantitative indicators of competitiveness are to be identified.

Methods

This section of the paper outlines (i) the data sources and (ii) the measures of competitiveness used in the analysis.

Source of Data

The Farm Accountancy Data Network (FADN) was the primary source of data used in this analysis. The aim of the network is to gather accountancy data from farms for the determination of incomes and business analysis of agricultural holdings. The concept of the FADN was launched in 1965, when Council Regulation 79/65 established the legal basis for the organisation of the network. The network consists of an annual survey carried out by the Member States of the European Union. Derived from national surveys, the FADN is the only source of micro-economic data that is harmonised, i.e. the bookkeeping principles are the same in all the countries. Currently, the FADN annual sample includes approximately 80,000 holdings. They represent a population of about 5 million farms in the 25 Member States, which cover approximately 90 per cent of the total utilised agricultural area (UAA) and account for more than 90 per cent of the total agricultural production of the Union.

The FADN farm classification type used in this analysis was Farm Type 4310 – specialist cereal, oilseed and protein (COP) producers. The FADN classification for COP farms is not as homogeneous as other enterprise systems defined by the Commission, such as specialist dairy (Type 411). Consequently, there is an inherent unavoidable bias introduced as a result of the different cost intensities and output prices commanded by the different products. However, this approach to comparative analysis was defended by Boyle (2002) because '*a crop by crop analysis is impossible to obtain owing to the paucity of*

the sample at that level of disaggregation. Moreover, since several different varieties of cereals are produced jointly, such a dissaggregated analysis, even if it were feasible, might not be very meaningful'. Nevertheless, efforts were made to redefine farm type 4310, whereby the economics of cereal enterprises were analysed in isolation from oilseed and protein producers. Oilseed and protein production is more common in other European countries than in Ireland. In France, for example, oilseed and protein production accounted for 25 per cent of cereal, oilseed and protein output combined, from specialist farms, during the period 1996 to 2000. This figure compares to a value of 3 per cent in Ireland over the same period. Consequently, efforts were made to examine the relative competitiveness of cereal production on these farms as distinct from the competitiveness of the whole farm, which by definition specialises in cereals, oilseed and protein production.

FADN data itemises costs on a whole farm basis only, and some method of allocating these costs to the specific enterprises analysed in this research had to be attempted. For the majority of cost items, whole farm costs were allocated to the specific enterprise activity according to the share of specific enterprise output in total farm output. A number of exceptions to this general rule were adopted for individual cost items at the enterprise level. These are outlined in Table 1.

Table 1. Allocation Keys used to define costs associated with the cereal enterprise on Specialist COP farms, using FADN data.

COSTS ITEMS	**ALLOCATION KEYS**
Specific costs, fixed costs and imputed charges for owned capital and labour	% of cereals production output plus allocated direct payments in the total output & direct payments of the farm.
Owned land	% of cereal acres in total UAA of the whole farm

Table 1 shows that all cost items, apart from owned land, were allocated based on the per cent of cereals production output and allocatable direct payments in the total production output and direct payments of the whole farm. The direct payments allocated to the cereals enterprise was calculated as the cereals area multiplied by the area aid rate per tonne multiplied by the reference yield for each country. In addition to this direct payment, the additional supplement per hectare for durum wheat was calculated for Italy. Over the period 1996-2000, 42 per cent of total cereal area was devoted to durum wheat production in Italy (Eurostat, 2003). Consequently, it was assumed that 42 per cent of the cereal area in Italy over the period was allocated a supplementary durum wheat direct payment (€297 per hectare), which was in turn reflected in the analysis. No other country in the analysis was allocated a durum wheat supplement based on estimates from Eurostat (2003), which indicated that average durum wheat levels (as a per cent of total cereal production) were relatively low.

Direct payments were taken into consideration in the allocation key for cost items because it was considered that cereal producers based production decisions, and the ensuing allocation of inputs, on the full knowledge that production was coupled to the direct payments. The only exception to this allocation basis was made for owned land. This resource was allocated to the cereal enterprise based on the per cent of cereals in the total UAA of the whole farm.

The specific FADN countries used in the analysis for the purpose of comparing EU competitiveness of cereal production was based on production capacity, export volume and import volume of specific countries. The comparative countries used in the analysis were: Ireland, UK, France,

Denmark, Germany and Italy. Together these countries accounted for just under 80 per cent of total EU cereal production over the period 1996 to 2000 (Eurostat, 2003).

Measurement

All the measures of *Competitive Performance* used in this report are based on profitability as the leading indicator. Boyle (2002) in his analysis of the competitiveness of Irish agriculture said that '*returns and costs matter to competitiveness'* (p.153). Using profitability as an indicator of competitiveness means that both costs and returns are taken into consideration.

Three separate measures of cost and return comparisons were used for comparing the competitiveness of cereal production in the selected member states: (i) total costs as a percentage of the total value of output, (ii) total costs per 100kg of production volume[i], and (ii) total costs per hectare of cereal production. Measuring costs of production, in terms of output is consistent with traditional production theory, which aims to minimise costs or maximise net revenue per unit output. Since the introduction of direct payments paid on an area basis, it is arguably more relevant to examine costs of production on an area basis, as land was the most limiting production factor during the period of analysis. This is especially relevant where there are national quota limits on the land classified as 'eligible' for tillage production.

Competitiveness in the market place for commodities, such as cereals, is largely determined by costs of production (Boyle, 2002). However, this is not entirely the case as quality differences, transport costs to the point of purchase and access to direct payments are also important. Therefore, it was considered important to examine the competitiveness of cereal production in terms of total costs of production as a percentage of the total value of output. The total value of output in this analysis included both production output and direct payments in the form of Area Aid payments per hectare of production.

An important issue in measuring competitiveness is the distinction between the different *levels* of competitiveness. All too often research on the topic of competitiveness tends to focus on indicators of *Competitive Performance* and indicators of *Competitive Potential* are ignored (Harrison and Kennedy, 1997). Consequently, the indicators presented in this research go some way towards identifying the sources of competitiveness in addition to presenting results of *Competitive Performance*. The individual measures (i) costs as a percentage of output; (ii) margin over costs per product volume; and (iii) margin per hectare; provide an insight into the *Competitive Performance* of the countries examined, over the time period 1996 to 2000. However, they do not provide an insight into the sources of competitive advantage or disadvantage. Therefore, the individual cost variables and associated returns were examined. This data provides an insight into the sources of *Competitive Potential* associated with the *Competitive Performance* of the individual countries.

Furthermore, as *Competitive Potential 'is concerned with the availability, quantity and quality of inputs and how they are formulated to produce superior performance'* (Pitts and Lagnevik, 1998), the partial productivity indicators presented for each of the commodities are also considered indicators of *Competitive Potential*. The indicators of partial productivity used in the determination of productivity of selected resources for cereal production were (i) wheat yield – 100kgs per hectare of wheat area[ii]; (ii) land productivity – output from cereal production plus allocated direct payments per hectare of land devoted to cereals; and (iii) labour productivity – output from cereal production plus allocated direct payments divided by the total annual work units (AWU) devoted to cereal production.

[i] The production volume of cereals was calculated based on yield of wheat multiplied by the area of total cereals. Data on the yield of individual cereal crops was not available and the yield of wheat was used as the next best alternative.

[ii] Due to data limitations this was the only indicator of cereal yield available.

Costs were defined in the following way:

(i) **Cash costs**, which include all specific costs, directly incurred in the production of a given commodity, for example fertiliser, feedstuffs, seeds etc. plus external costs such as wages, rent and interest paid, plus depreciation charges.

(ii) **Economic costs**, which includes all of the cash costs identified above, except interest charges, plus imputed resource costs for family labour, equity capital and owned land.

The calculation of total economic costs for the competing countries was one of the most problematic exercises in this analysis. If long-term competitiveness is to be examined the assumptions regarding the measurement of opportunity costs for family labour, owned land and other non-land capital must be as realistic as possible. Family labour was assigned an opportunity cost equal to the cost of hired[iii]. The hired labour charge was determined from the FADN data. Owned land was assigned an opportunity cost equal to the cost of rented land, which was also determined from the FADN data. This approach follows the methodology adopted by Boyle *et al.,* (1992), Boyle (2002), and Fingleton (1995). However, this approach does not distinguish between the marginal and average cost of land rental. Based on Clark's (1973) argument '*that land has an average product and a marginal product which may differ, and that its rent should depend on its marginal product…..[therefore] we have to fall back on estimating economic rent as a residual, from the gross product after all other necessary inputs have been remunerated*' (p.14). Consequently, total economic costs were calculated with and without an imputed value for land.

Non-land assets also proved to be a problematic resource for valuation purposes. Boyle *et al.,* (1992) and Boyle (2002) recommended using a (i) real interest rate which takes into account taxes, subsidies and inflation adjustments and (ii) a depreciation rate. However, Fingleton (1995) recommended using a long-term interest rate, rather than a real inertest (derived from the FADN data) as proposed by Boyle, derived by subtracting the price deflator for private consumption from the nominal long-term interest rates for each country for each relevant year. Both of these approaches were considered but were not adopted for the research. Application of a derived real interest rate substantially increased the spread of rates charged on non-land assets between the countries examined. In addition the application of a long-term interest rate was not considered appropriate given the record of real interest rates over the time period 1996-2000 for Ireland. Due to high inflation in Ireland in this time period, the computed long-term interest rate was negative in some time periods. For this study a nominal interest rate was applied for each of the countries for each relevant year. This approach was considered to provide more realistic opportunity costs for the purpose of valuing non-land assets in this analysis, than the two methods identified above.

Results

This section of the paper examines the costs and returns associated with the production of cereals in selected EU member states. The results are presented in two sections: (i) partial productivity indicators and (ii) comparative costs of production.

Comparison of partial productivity indicators on EU cereal farms

Figure 1 below shows the partial productivity indicators for the EU cereal farms identified above. The results presented here for each of the countries is the average for the years 1996 to 2000 and indexed

[iii] The determination of an appropriate opportunity cost for own family labour is always an issue in studies which examine costs of production on family farms. The use of the average agricultural wage to value owned family labour may in some instances over value (due to under employment) or under value (due to managerial or entrepreneurial ability) this resource. However, without any further evidence to suggest in which cases such situations arise the average agricultural wage is used in the absence of this additional information.

relative to the weighted average of all countries.[iv]. Figure 1 indicates that Ireland's wheat yield[v] was the highest over the period, among the countries examined. Yields in the UK were also relatively high compared to the other countries, with yields in Italy substantially lower than all countries. However, it is important to highlight that substantial volumes of durum wheat is produced in Italy, which attracts higher levels of direct payments relative to other cereal types, which in terms of profitability partially compensates for reduced yields.

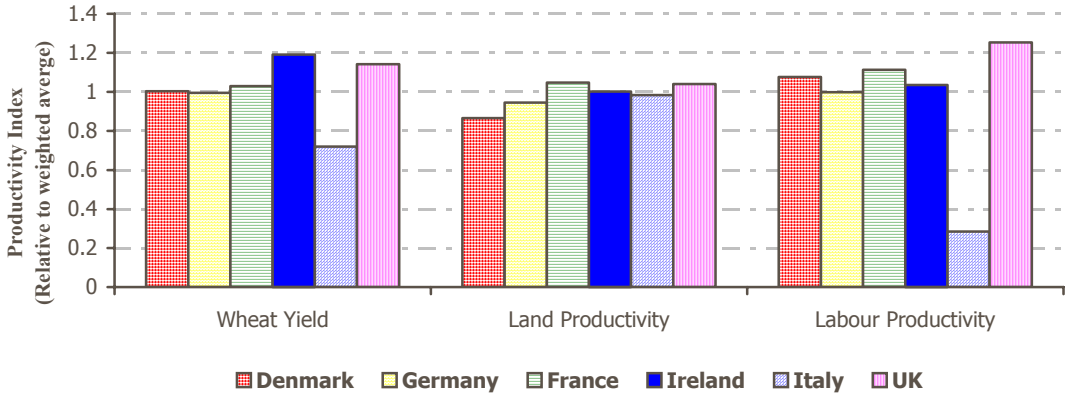

Figure 1. Partial Productivity Measures for EU Cereal Farms.

Relative differences in land productivity were not as variable as yield. Output per hectare of cereal production was highest in France, closely followed by the UK, with Ireland in third position, followed by Italy, Germany and Denmark. Labour productivity levels, like yield, were also quite variable between the countries examined. The UK had the highest level of output per AWU allocated to the cereal enterprise, with 25 per cent higher output per unit than the weighted average of all countries examined over the same period. All the other countries in the analysis, apart from Italy, were within 11 percentage points above or below the average, but Italy had substantially lower output per unit labour input with levels over 70 per cent lower than the average.

These productivity measures indicate that productivity levels on Irish, French and UK cereal farms were on average more positive than the results shown for the other countries examined. These results are consistent with findings from Boyle (2002) where partial productivity indicators for Ireland, the UK and France were higher than other countries examined.

Comparison of costs and returns on EU cereal farms

The first measure of comparative costs of production and returns for cereal farms was costs as a percentage of total cereal production output and allocated direct payments. Figure 2 shows the five-year average cost:output results for the cereals enterprise for each of the selected countries. The individual cost components for each of the countries is outlined in Appendix I. Figures 2 shows that cereal producers in Italy had the lowest cash costs as a per cent of output and Ireland had the second lowest cash costs, over the period 1996 to 2000. Cash costs in France, Germany and the UK were also quite similar to the Irish position over the period, with cash costs in Denmark considerably higher than the other countries examined.

[iv] Based on a trend regression analysis there was no apparent significant trend over time in relation to the partial productivity indicators for the EU cereal farms examined.
[v] It was not possible to standardise wheat yield for moisture content.

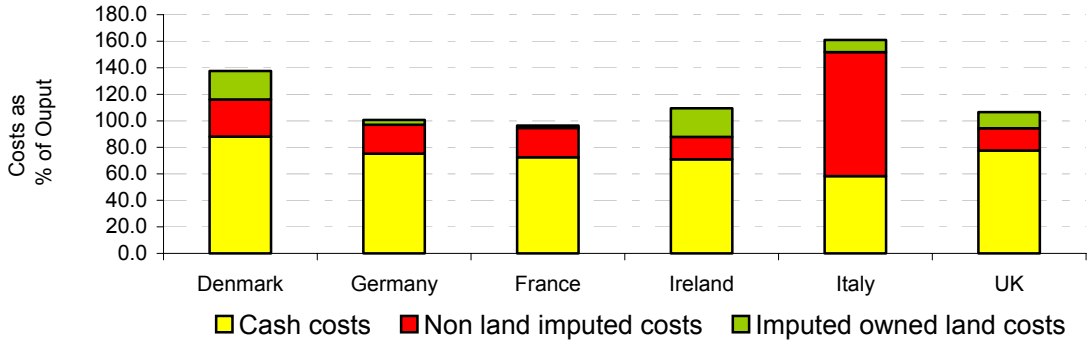

Figure 2. Costs as a % of Output on selected EU Cereal Farms.

When imputed charges for owned resources were taken into account to compare total economic costs, the ranking between countries changed considerably. Imputed charges were substantially higher in Italy than all other countries, which resulted in Italy having the highest total economic costs as a per cent of output compared to the other countries examined. On the other hand, imputed charges for owned resources were considerably less in France than all other countries, which contributed to French producers having the lowest total economic costs as a per cent of output for all countries examined. The specific imputed charges for owned labour and land were significantly variable between countries, which had the effect of altering the longer term competitive outlook for these countries. In particular, the opportunity cost associated with family labour was particularly high in Italy, and the opportunity cost of owned land was particularly high in Ireland and Denmark over the period.

These results are consistent with the findings obtained in Boyle (2002). As the findings obtained by Boyle were based on costs as a percentage of market based output for the year 1999, it was considered important to replicate this analysis for the years 1996 to 2000. This market based assessment is particularly important for Irish cereal producers given that Irish producers had the highest reference yields (Commission Regulation, No. 2316, 1999) and consequently the highest direct payments per hectare during the years analysed. Consequently, to determine the effect of the introduction of decoupled direct payments in January 2005, costs[vi] as a percentage of market based output were examined. This analysis did not show any substantial deviation form the results presented in Figure 2 above. However, the relative position of Irish producers did deteriorate slightly relative to the average, and France replaced Ireland as the second lowest cash cost producer.

The second measure of cost competitiveness employed in the analysis was margin over costs per 100kg of product volume. Figure 3 shows the average of these results for the period for all countries examined. Appendix II outlines the cost items and revenue per 100kg of product volume for each of the countries.

[vi] In this analysis costs were allocated to the cereal enterprise based on the allocation key: cereals output divided by total production output. This differs from previous measures of cost competitiveness in that direct payments are not taken into account.

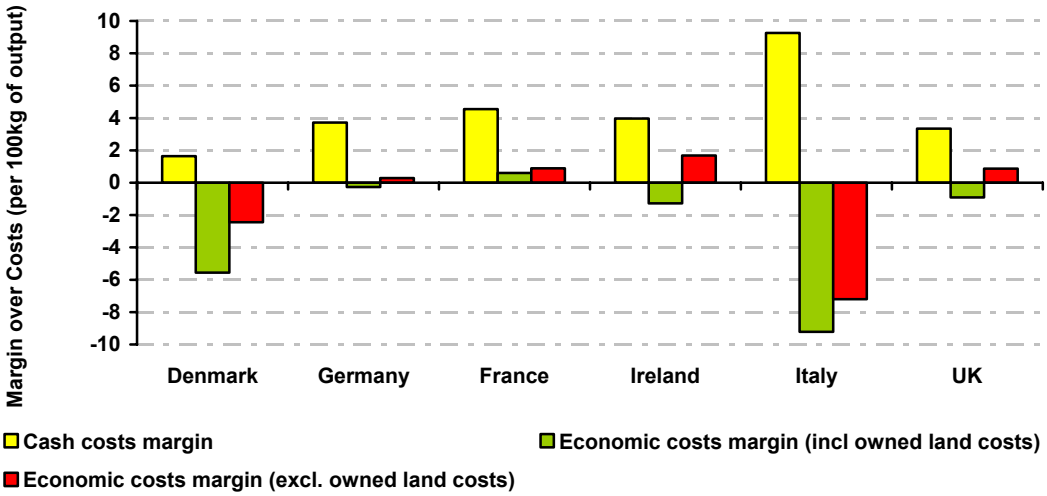

Figure 3. Cash and Imputed Charges for Selected EU Cereal Producers (1996-2000).

Similar results are evident in Figure 3 as were seen in Figure 2. The ranking between countries changes when margin over cash costs for the different countries is compared to the margin over total economic costs. The 'best' ranking position for margin over cash costs per 100kgs of cereal output over the period was witnessed in Italy, and the lowest ranking was in Denmark, with the margins in France, Ireland, Germany and the UK quite similar. However, when imputed charges were considered, to measure the margin over total economic costs, Italy moved into the lowest ranking position with France in the highest ranked position.

The third measure of cost competitiveness for cereals used in the analysis was cash and economic costs per hectare of cereal production. Figure 4 shows the average of these results for the period for all countries examined. Appendix III outlines the cost, revenue and margin per hectare for each of the countries. Figure 4 shows results similar to those in Figures 2 and 3. The margin over cash costs per hectare was highest in Italy, followed by Ireland, France, Germany the UK and Denmark. However, Italy again had the lowest margin over total economic costs, followed by Denmark and Ireland had the third lowest margin, with France and Germany the only countries that managed to retain a positive margin over total economic costs. Furthermore, the results presented here show that imputed charges for owned land have a large influence on relative competitiveness. When these imputed land charges are excluded from the analysis, Irish cereal producers again appear to have the highest margin per hectare during the period.

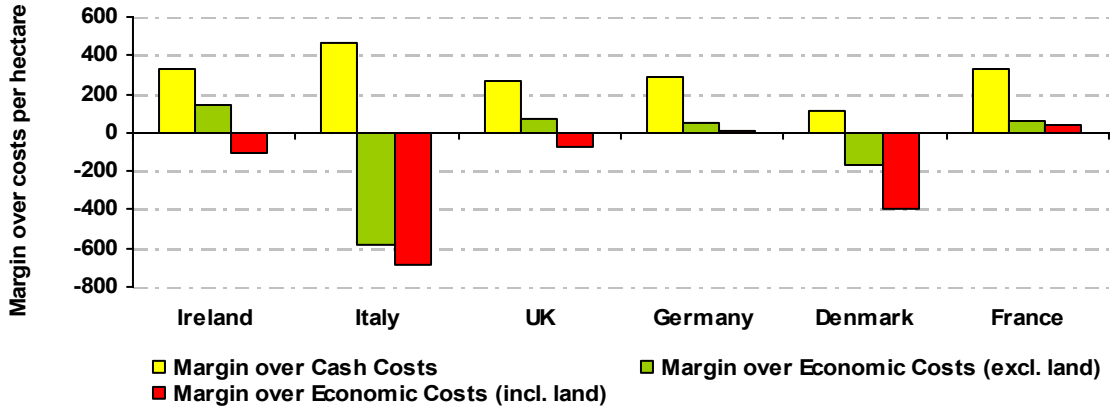

Figure 4. Cash and Imputed Charges for Selected Cereal Producers in the EU (1996-2000).

In addition to the specific imputed charges which had a significant influence on the relative competitiveness of cereal production, Appendices I, II and III show the individual cost items and returns associated with the three measures of competitiveness. Analysis of these variables show the prominent *sources* of competitive advantage and disadvantage associated with cereal production in the selected EU countries. This data shows that despite the relatively low cash cost structure as a per cent of total output, and relatively high margin over cash costs evident in Italy over the period, the magnitude of specific direct costs and fixed costs per product volume was considerably higher than competing countries. For example, the cost of seeds and plants, depreciation, buildings, machinery and family labour were all significantly higher in Italy than the other countries examined. However, total revenue per product volume was significantly higher than competing countries, probably associated with high levels of durum wheat production, which compensated for the relatively high cash costs. This finding highlights the importance of including cost and return variables in the analysis of competitiveness.

Other variables of particular interest in this specific and overhead costs analysis were evident for Ireland, France and Denmark. In Ireland, relatively low machinery costs, other direct inputs, depreciation and paid wages were evident. Low depreciation and machinery charges in Ireland were probably a reflection of the extensive use of contractors' services in Irish cereal production. Kelly and Shanahan (2001) noted that '*this reduces depreciation and allows the capture of the economies of scale associated with the use of high capacity machinery when this is used for long periods'* (p.5). In France, the opportunity cost of owned land was substantially lower than other countries. This finding is probably associated with the relatively high level of leased land on cereal farms in France (Boyle, 2002).

In contrast to these specific cost items, which were relatively low in Ireland and France, there were also a number of items that were higher than other countries, namely, fertilisers and crop protection materials. In Ireland in particular, this could be associated with high usage levels or the relatively high costs of these items in Ireland. Disease pressure on Irish cereal farms does tend to be higher than in the UK or mainland Europe, thus this could contribute to the high cost associated with crop protection materials. The high cost of fertiliser was also evident in other enterprises in Ireland (Thorne, 2004).

In Denmark, comparatively high interest charges were evident. These charges can probably be attributed to the Danish method of farm transfer, '*which is by sales and purchase using a mortgage rather than by gift between relatives'* (Kelly and Shanahan, 2001, p.3). Relatively high depreciation charges were evident in Italy, which were about 40 per cent higher than the average for all countries in the analysis, was also noticed by Kelly and Shanahan (2001), who said that in comparison to other countries examined, these producers tend to be less specialised and much smaller in size. Therefore, it could be said that the depreciation charges associated with cereal production in Italy were associated with a relatively small production area, thus the depreciation charges per hectare tend to be higher.

The afore mentioned individual cost and return variables assist in identifying the relative strengths and weakness of cereal production across the EU countries examined.

Discussion and Conclusions

In summary, it appears that for the period 1996 to 2000, the opportunity cost of owned resources had a large influence on the competitive position of the selected countries. Italy appeared to have the lowest cash cost structure but the highest cost structure when total economic costs were considered. France replaced Italy as the lowest cost producer when total economic costs were considered, due mainly to the relatively large opportunity cost associated with family labour in Italy. Furthermore, the high opportunity cost of owned land had a significant influence on the relative competitiveness of Irish producers. The relative importance of the opportunity cost of owned resources will become particularly important in the medium term as EU producers are faced with decoupled direct payments. Full and partial decoupling of direct payments will force producers to make production decisions based on full economic costs of production, including adequate remuneration of owned resources. In the longer term adjustment

within the sectors will be a reality which will be dependent on relative resource use and in this situation relative resource costs are needed to understand and analyse the adjustment process. As relative economic costs are considered as a relative guide to the longer-term competitive position of competing countries, these findings could be considered as warning signals for the future *competitive performance* of Irish and Italian producers in particular.

In terms of understanding the sources of competitiveness outlined in this research, the deterioration of specific countries relative position as the unit of measurement changed from cash costs to total economic costs has been demonstrated. A number of factors are important in explaining this deterioration. Boyle (2002) concluded that part of this explanation relates to '*the relatively low scale of primary agricultural activity*' (p.177). In this particular study the examination of scale economics was not possible due to data availability. The extent of the problem for smaller scale farms will become particularly evident when direct payments are decoupled from production and individual farms will need to base decisions on full economic costs of production including adequate remuneration of owned resources. Consequently, the impact of scale of operation on the future competitiveness of EU cereal production is considered important in the context of future work in this area.

Furthermore, in terms of competitive *potential*, the indicators of productivity included in this research are partial indicators of productivity. Further work in this work should investigate the feasibility of computing indicators of total factor productivity for EU cereal production.

In summary, the results of this study provide a baseline position against which the change in competitiveness of EU cereal production can be measured. This is an important development in the process of monitoring the position of EU agriculture. EU enlargement, trade liberalisation in the context of WTO negotiations and impending reform of the CAP will all have major influences on the competitive position of EU agriculture, which can be monitored against the baseline position outlined by this research. In addition, possible areas of future work have been identified.

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Appendix I - Costs as a % of Output for Selected EU Cereal Farms

	Ireland	Italy	UK	Germany	Denmark	France
Total Inputs						
Intermediate Consumption						
Specific Costs						
Seeds and Plants	4.8	5.5	4.3	3.5	3.7	5.3
Fertilizers	9.9	6.6	7.8	6.7	6.8	9.6
Crop Protection	10.4	3.0	9.0	6.8	4.3	9.3
Other Crop Specific	1.2	0.7	1.8	0.7	1.1	0.2
Farming Overheads	0.0	0.0	0.0	0.0	0.0	0.0
Machinery and Building current costs	6.1	3.4	7.8	7.4	12.3	5.3
Energy	2.6	5.4	3.8	5.3	2.6	3.5
Contract Work	10.3	4.8	4.1	3.5	4.6	3.9
Other direct inputs	2.5	3.4	6.6	7.5	5.3	7.0
Depreciation	5.4	19.5	14.2	14.7	13.5	15.2
External Factors	0.0	0.0	0.0	0.0	0.0	0.0
Wages Paid	2.6	1.9	8.8	6.5	4.6	2.4
Rent Paid	12.3	3.5	5.6	8.7	4.8	7.3
Interest paid (less subsidies)	2.9	0.6	3.9	2.3	20.7	3.3
IMPUTED COSTS	0.0	0.0	0.0	0.0	0.0	0.0
Fixed Assets	0.0	0.0	0.0	0.0	0.0	0.0
Buildings	0.7	6.2	0.5	2.0	16.1	0.7
Machinery	1.9	6.2	3.5	2.7	3.1	2.6
Working Capital	0.0	0.0	0.0	0.0	0.0	0.0
Agri. Product Stocks	0.1	0.6	1.0	0.1	0.9	0.9
Other Circulating capital	1.8	8.4	2.8	1.9	2.5	2.4
Family Labour	15.3	72.8	12.9	17.6	26.0	18.9
Owned Land	21.6	9.2	12.2	3.6	21.4	1.7
Total Economic Cost (incl. imputed owned land cost)	109.5	161.0	106.5	99.0	133.5	96.2
Total Economic Cost (excl. imputed owned land cost)	87.9	151.8	94.3	95.4	112.1	94.5
Total Cash Costs	71.0	58.2	77.6	73.6	84.2	72.4

Appendix II – Costs (€) per 100kg of Product Volume for Selected EU Cereals Farms

	Ireland	Italy	UK	Germany	Denmark	France
Total Revenue	**13.59**	**22.12**	**14.72**	**10.96**	**13.95**	**16.50**
Total Inputs						
Specific Costs						
Seeds and Plants	0.65	1.21	0.63	0.55	0.54	0.87
Fertilizers	1.35	1.46	1.15	1.05	0.99	1.60
Crop Protection	1.41	0.66	1.32	1.07	0.63	1.53
Other Crop Specific	0.17	0.15	0.27	0.11	0.16	0.04
Farming Overheads						
Machinery and Building current costs	0.83	0.76	1.14	1.16	1.80	0.88
Energy	0.36	1.19	0.55	0.82	0.37	0.58
Contract Work	1.39	1.06	0.61	0.55	0.67	0.64
Other direct inputs	0.34	0.75	0.96	1.17	0.78	1.15
Depreciation	0.73	4.30	2.08	2.30	1.96	2.52
External Factors						
Wages Paid	0.35	0.42	1.28	1.02	0.67	0.39
Rent Paid	1.66	0.77	0.81	1.36	0.71	1.21
Interest paid (less subsidies)	0.39	0.13	0.57	0.36	3.02	0.55
IMPUTED COSTS						
Fixed Assets						
Buildings	0.10	1.39	0.08	0.31	2.36	0.12
Machinery	0.26	1.38	0.52	0.43	0.46	0.43
Working Capital						
Agri. Product Stocks	0.01	0.13	0.14	0.01	0.13	0.16
Other Circulating capital	0.24	1.83	0.41	0.29	0.36	0.39
Family Labour	2.07	16.03	1.89	2.76	3.80	3.12
Owned Land	2.96	2.02	1.78	0.56	3.12	0.29
Total Economic Cost (incl. imputed owned land cost)	14.87	31.34	15.63	15.52	19.52	15.90
Total Economic Cost (excl. imputed owned land cost)	11.91	29.32	13.85	14.96	16.4	15.61
Total Cash Costs	9.62	12.86	11.38	11.53	12.31	11.95

Appendix III – Costs, Revenue and Margin (€) per Hectare for Selected EU Cereal Farms

	Ireland	Italy	UK	Germany	Denmark	France
Total Revenue	1143	1122	1187	1078	987	1195
Specific Costs						
Seeds and Plants	55	62	51	37	38	63
Fertilizers	113	74	92	72	70	115
Crop Protection	118	33	107	73	45	111
Other Crop Specific	14	8	22	8	11	3
Farming Overheads						
Machinery and Building current costs	69	39	92	80	127	63
Energy	31	61	45	56	26	42
Contract Work	116	54	49	37	47	46
Other direct inputs	28	38	78	80	55	84
Depreciation	62	218	167	158	139	182
External Factors						
Wages Paid	30	21	103	70	47	28
Rent Paid	139	39	66	93	50	88
Interest paid (less subsidies)	33	6	46	25	214	40
IMPUTED COSTS						
Fixed Assets						
Buildings	8	70	6	21	167	9
Machinery	22	70	41	30	32	31
Working Capital						
Agri. Product Stocks	1	6	11	1	10	11
Other Circulating capital	20	95	33	20	26	28
Family Labour	175	815	153	192	269	226
Owned Land	248	103	143	39	221	21
Total Economic Cost (incl. imputed owned land cost)	1249	1806	1259	1068	1380	1153
Total Economic Cost (excl. imputed owned land cost)	1001	1703	1116	1029	1159	1132
Total Cash Costs	808	653	917	789	870	866
Margin over Economic Costs (incl. land cost)	-106	-684	-72	10	-393	42
Margin over Economic Costs (excl. land cost)	142	-581	71	49	-172	63
Margin over Cash Costs	335	469	270	288	117	329