Finnish agriculture in European integration:
A firm level approach

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European integration and the possible application of the Common Agricultural Policy, CAP, will substantially affect Finnish agriculture. Although the major principles and means of the CAP and the Finnish agricultural policy are quite similar, Finnish agriculture would face fundamental adjustment needs primarily due to the high level of domestic prices and costs. The key factor in the adaptation process would be the overall structural adjustment in terms of production costs, development of farm size, internal and external comparative advantage, and regional reallocation of resources. The length of run analysis, especially w.r.t. to capital requirements, is decisive. Major disadvantages of the Finnish agriculture are unfavourable climate and farm structure. The study indicates that cereal production in particular suffers from the disadvantages through high unit costs of production. Milk production has better capabilities to adjust in European integration, but not without problems, either.

Introduction

The earlier trade policy arrangements, e.g. within the GATT, EFTA and the possible EEA, have not altered the competitive position or border protection of Finnish agriculture to any significant extent. Concrete requirements for change in agricultural policy will be brought about by the current GATT Uruguay round, if ever completed. Nevertheless, the most important factor fundamentally influencing Finnish agriculture would be the possible EC-membership and the application of the Common Agricultural Policy, CAP, in Finland.

The major principles and means of the CAP and the Finnish agricultural policy are quite similar. However, the application of the CAP would be difficult due to the high level of producer prices and production costs in Finland.

This study concentrates on identifying and comparing the essential factors shaping the farm level profitability in Finland and the EC. The theoretical framework relies on traditional neo-classical microeconomic theory of the firm (Chapter 2). In addition, the concept of comparative advantage is employed to assess the resource allocation considerations between the EC and Finland and within Finland.

In detail analyses of profitability in cereal, pig and milk sectors are presented in Chapters 3 to 5. Cost-price squeeze plays the key role in the analysis. The importance of time interval as the adjustment factor is underlined. Possibilities and problems of the overall structural adjustment of the Finnish agriculture in terms of production costs, development of farm size, comparative advantage between production lines, and regional reallocation

of production resources is briefly examined in Chapter 6. Finally, conclusions and future research needs are presented.

Theoretical framework

Integration aims at securing economic growth and increasing society's welfare. Enhanced specializations according to comparative advantage, more efficient utilization of economies of scale, direct cost savings and increased competition represent some of the expected economic benefits.

According to the theories based on **comparative advantage**, regional differences in **relative** production costs are induced by regional differences in **scarcity** of production factors. A country specializes to products which it can produce by effectively utilizing its relatively abundant and inexpensive production factor. Hence, trade structure depends on differences in production possibilities by country and production branch. In order to mitigate the theoretical problems in explaining why countries also trade products of the same branch, contemporary trade models often include components from imperfect competition, scale benefits, differentiation in products and differences in consumer preferences .

Because comparative, or competitive, advantage is not easily measured, analysts have often resorted to a static indicators such as production costs to quantify competitiveness. However, there remain considerable difficulties also in international comparisons of production costs (see e.g. STANTON 1986).

The neoclassical firm theory assumes that a firm operates in a pursuit to optimize goals w.r.t. production possibilities. In particular, it assumes that a firm aims at profit maximization. In reverse, this can be presented as a long run cost minimization problem:

$$\min_{z_1 \dots z_n} \sum_i p_i z_i$$

s.t. (a) $y = f(z_1,...,z_n) \geq y^\circ$
        (b) $z_i \geq 0$ (i=1,...,n)

where p_i is a price for a production factor i, z_i quantity and y° preferred production volume in a certain time period (BEATTIE and TAYLOR 1985). The assumptions concerning production technology include, inter alia, differentiable production functions and true quasiconcavity (see BEATTIE and TAYLOR 1985; CHAMBERS 1989). Now, the Lagrangian can be written:

$$L = \sum_i p_i z_i + \lambda \, [y^\circ - f(z_1,...,z_n)]$$

The first order conditions to minimize the Lagrangian are:

$$\delta L/\delta z_i = p_i - \lambda f_i = 0 \ (i=1,...,n)$$

$$\delta L/\delta \lambda = y^\circ - f(z_1,...,z_n) = 0$$

The optimal value of the Lagrange multiplier illustrates a change in costs as production volume changes, i.e. long run marginal cost LMC. Because the optimal input combination z_i^* is a function of input prices and production volume, total costs C are:

$$C = \sum_i p_i z_i^* = \sum_i p_i z_i^*(p,y)$$
$$= C(p,y) = C(p_i,...,p_n,y)$$

How production volume affects demand for inputs (ceteris paribus) depends on a form of the production function. In the case of a function of linear homogeneity, a growth in production volume leads to increased input use with stable relative shares between inputs (GRAVELLE and REES 1990). On the other hand, when relative prices of inputs change, use of the input becoming cheaper increases, provided that the production volume remains stable. Lower p_i reduces total costs in relation to cost elasticity E^c_{pi}:

$$E_{p_i}^{\ c} = \delta C/\delta p_i \cdot p_i/C = z_i^* p_i/C$$

Decrease in average costs can also take place through increasing returns to scale as production

expands. This is realized, if the following equation equals less than one:

$$\delta LTC/\delta y \cdot y/LTC = LMC/LAC$$

The same can be seen in Figure 1. The long run average cost curve LAC is at a minimum when the output is y_2. The cost curve is said to illustrate diseconomies of scale at the output $y>y_2$ and economies of scale at the output $y<y_2$.
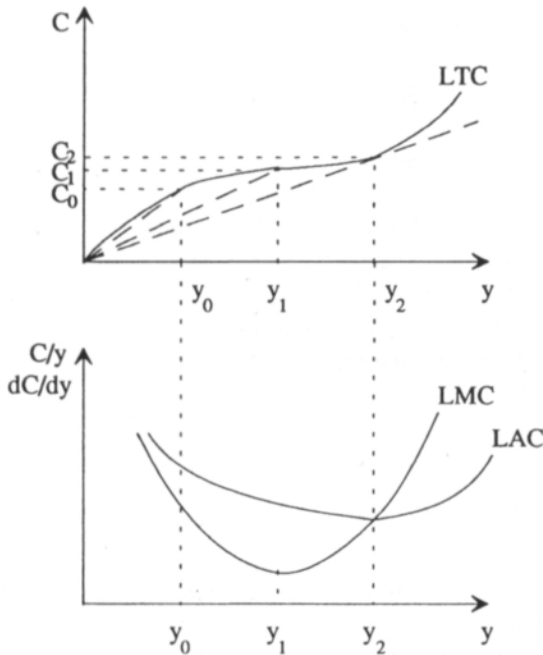

Fig. 1. The relationship between long run cost functions and the level of output.

In Finnish agriculture, returns to scale are evidently positive. However, the continuity assumption of the cost function conflicts with the divisibility problems of many major production factors. The result can be a kinky functional form due to increasing average costs by acquisition of an additional input unit. However, as production expands, average costs start to decrease.

In the short run, some production inputs are fixed. The more fixed an input is, the larger the difference is between the acquisition cost and the resale value. In agriculture, the share of fixed inputs is so big that reallocation of capital, land, and labour is extremely slow, even when production environment fundamentally changes (empirical studies by e.g. JOHNSON and PASOUR 1981; VASAVADA and CHAMBERS 1986). This could be the key problem for Finnish agriculture in the EC.

This article, in the next three chapters, analyzes production costs and identify means to adjust them on the farm firm level. Differences in cost structure between production lines (Fig. 2) and their implications to potential adjustment strategies are examined.
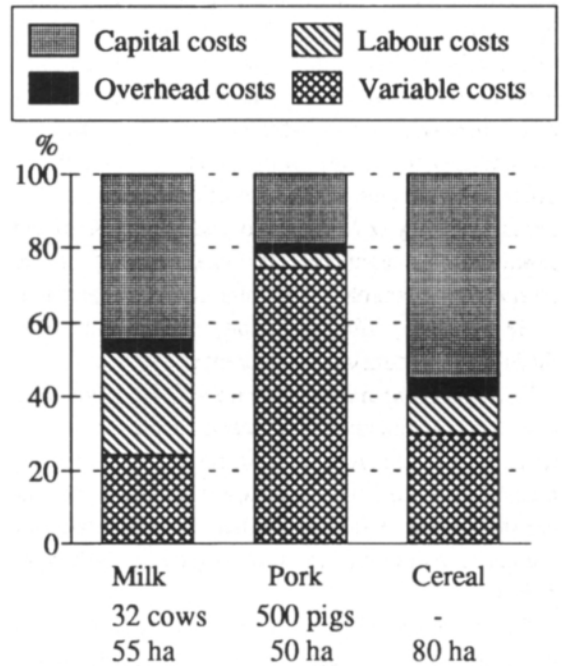

Fig. 2. Cost structure in milk, pork and cereal production.

The data sources are the farm accountancy results (MTTL 1991 a), and the farm model calculations (MTTL 1991 b) of the Agricultural Economics Research Institute.

Cereal production

The low level of yields is the basic problem of Finnish crop production. In the major cereal regions of the EC, average yields have increased more than 50 % during the last decades. Improved professional skills, mechanization of farming, strongly increased chemical input use, and shift to high-yielding fall grain varieties have contributed to this development (ABARE 1985). In Finland, the growth and level in average yields has been much smaller, mainly due to unfavourable climate and soil (Fig. 3).
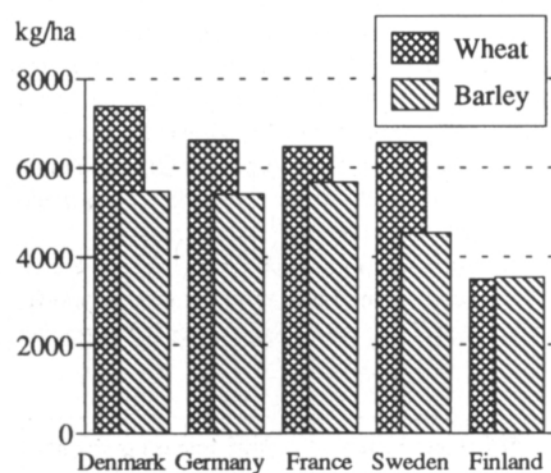

Fig. 3. Average yields of wheat and barley in 1990.

Because of low yields, a Finnish grain producer has to reduce production costs per hectare considerably lower than farmers in more efficient EC-countries. According to the farm accountancy results, production cost of cereal rises as high as to FIM 1.74/kg on the farms with more than 50 hectares in southern Finland (Table 1). In Denmark, costs per hectare (median 50 ha) are markedly lower primarily due to less expensive farm land, and costs per kilogram of grain is only FIM 0.92 due to significantly higher average yields (Statens ... 1990). In Finland, high producer prices have guaranteed good profitability, which has, in turn, raised land values and thereby production costs.

Table 1. Production cost of grain in Denmark and southern Finland in 1989, FIM/ha.

	Denmark islands	Finland 30-50 ha	>50 ha
Cost item:			
Variable	1 784	1 917	1 926
Labour [1]	728	1 279	882
Equipment	1 518	1 585	1 334
Building	517	386	300
Land interest	609	1 153	1 153
Other	507	670	762
Total	5 663	6 990	6 357
Yield, kg/ha	6 180 [2]	3 832 [3]	3 659 [4]
Cost, FIM/kg	0.92	1.82	1.74

[1] FIM 44.10/h
[2] barley 57 %, wheat 38 %, rye 5 %
[3] barley 37 %, oats 12 %, wheat 35 %, rye 16 %
[4] barley 34 %, oats 14 %, wheat 34 %, rye 18 %

Were the producer prices lowered by 50 %, profitability of Finnish farms would be ruined. Return would cover only labour and variable costs. If the average yield rises to 4 500 kg, production cost falls to FIM 1.41/kg on the largest farms. However, this improvement would not be sufficient, either, for Finnish producers to adapt to the lower price level of the EC.

A scale effect seems to be very significant in cereal production in e.g. machinery and labour costs (Fig. 4). Machinery and equipment cost are above FIM 2 000/ha on a 21 hectare grain farm, but only half of that on a triple-size farm. The indivisibility problem of key production factors, e.g. machinery, is evident as the farm size grows from 14 to 21 hectares.

Small farms and low yields would result in a very weak competitive position of Finnish cereal production in the EC markets. The required structural development to the direction of farms with clearly more than 100 hectares is hindered by high priced farm land. Lower cereal prices would cut land price, but, at the same time, they would deteriorate loan repayment ability and collaterals on many farms.
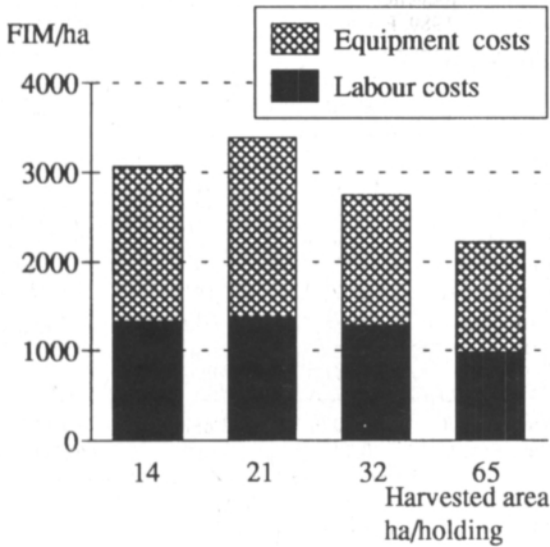
FIM/ha

Fig. 4. Equipment and labour cost on cereal farms in southern Finland in 1989, FIM/ha.

The opportunities of Finnish cereal production lie on feed grain production in most suitable cultivation regions. The extent of animal husbandry would primarily also determine the possibilities of cereal production. It would be very difficult to maintain the income goal for full-time grain farms. Even on the largest farms, other sources of income would evidently be required to finance investments and secure the income level.

Pork production

In the case of pork, the producer price in Finland has been 50 to 60 % higher than the average producer price in the EC-countries. Therefore, the EC-membership would cause a drastic drop in the price received by pork producers. In addition, potential suppliers of pork from the EC-countries, e.g. Denmark and the Netherlands would be able to penetrate into the Finnish market.

The price for feed plays an important role in the survival of Finnish pork producers. Feed cost amounts to 65 % of total production cost. Feed cost in the EC is only half of that in Finland. The

Finnish pork producers would enjoy lower feed cost as an EC-member. Eventually, this would lead to lower production costs.

If the producer price of pork would be at the same level with the EC-countries, the income of pork producers would be severely affected even though input prices are also assumed at the EC-level (MARTTILA and NIEMI 1991). In the EC, the Finnish feeder **pig finishing** farms with more than 500 pig places would get farm income of FIM 93 000; farms with 250 to 499 places FIM 87 000; and the farms with less than 250 pig places FIM 48 000 (Fig. 5).

Due to the heavy debt burden, the income received by an average farm can barely pay the interest payments to service the debts. Even the largest pig farms would have only FIM 20 000 after interest payments (Fig. 5). However, there is considerable variation in profit among the farms, and the uppermost quarter of the farms can retain FIM 80 000/farm after interest payments.

The **combined** production farms with more than 250 pig places would fare about as well, or poorly, as the largest feeder pig finishing farms, but smaller
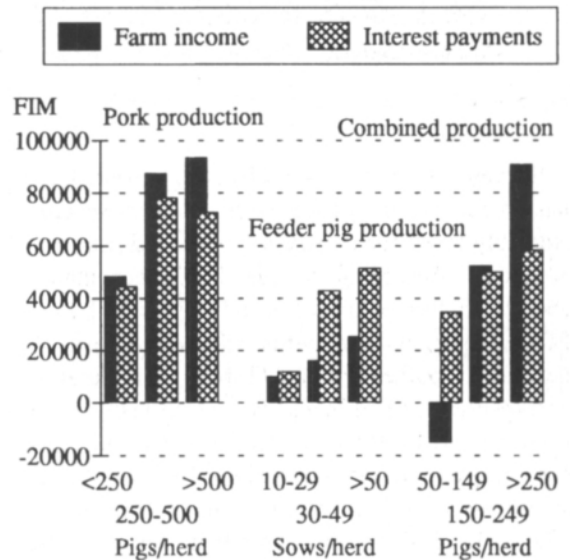

Fig. 5. Farm income and interest payments in different pig farms in the EC-alternative.

units would face serious income problems. In the feeder **pig production**, all size groups (less than 30, 30 to 49 sows, and more than 49 sows) would have a loss after interest payments. Even the most profitable farms would retain only about FIM 20 000 per farm after interest payments. Due to high fixed costs, these farms cannot afford a big drop in the price of pig, which, however, would be vital for feeder pig finishing farms.

Using farm models, MARTTILA and NIEMI (1991) studied production costs when feed price is reduced by 50 %. Fertility of 22 pigs per sow and year and feed conversion rate of 2.7 f.u./meat-kg were used for the calculation of optimal production cost. The most efficient Finnish farms actually operate in these conditions. The calculation were based on the feeder pig production farms with 30, 50 and 100 sows, and feeder pig finishing farms with 150, 500 and 1 000 pig places. The price of pig would drop from FIM 380 to about 280. If the feeder pig finishing farm buys pigs from the pig production farm with 100 sows at the production cost of FIM 260, the production cost of pork will be as follows: 150 pigs 10.55 FIM/kg; 500 pigs 9.66 FIM/kg; 1 000 pigs 9.48 FIM/kg.

In addition to feed cost, production cost of pork also correlates with the size of piggery and production technology. Larger piggeries and better technology will result in lower production cost due to labour savings and improved feed conversion rate (KÖGL and PLESSER 1988). Denmark and the Netherlands have increased efficiency through larger piggeries, which have thousands of pigs, i.e. economies of scale. Relatively small piggeries in Finland lead to high production cost of pork.

Finnish piggeries have a competitive edge in the biological and technological efficiency. The genetic quality of pigs, production environment and feeding regime are up to the Danish or Dutch standards. Furthermore, the quality of pig meat (low in fat and residues) in Finland is high. Thus, it is possible to differentiate the pork produced in Finland from the imported one, but it is hard to gauge whether consumers are willing to pay a higher price for quality.

Milk production

Both in Finland and in the EC, milk production is the most important line of production both in terms of economic and rural policy aspects. Milk production in Finland suffers from the unfavourable structure. The average herd size of 11 cows is only half of that in Sweden or one third of that in Denmark (KOLA et al. 1991). Disadvantageous climate has indirect effects on milk production through high feed and building costs. Nevertheless, yield per cow, 5 713 kg, is exceeded only by Sweden, Denmark and the Netherlands.

Fat surplus has been the persistent problem both in Finland and in the EC. Slight alterations in and slow effects of pricing and breeding have not cut fat surplus, which is likely to remain when consumers increasingly favor low fat products. Producers suffer from fat penalties beyond their (cows') ability to adapt.

Milk production is labour intensive in Finland and therefore chances for additional income are rather slim. Hence, milk production alone has to provide sufficient income for the family farm to a larger extent than any other production line. On the other hand, structural improvements would facilitate marked cost savings through **economies of scale and changes in input mix**. The evident need for larger farms in Finland is emphasized by a recent Swedish study stating that 60 to 80 cows are required for profitable production (BELOTTI et al. 1991).

In order to avoid emerging capital constraints in the structural development and adjustment process, the prevailing dairy farm structure of competitive capability should be fully utilized. Consequently, regional resource reallocation within the milk sector should remain quite limited in the future.

According to the farm accountancy results, production **costs** decrease from FIM 3.50/l to 2.40/l as the herd size increases from the current average of 11 to 32 cows (Fig. 6; producer price FIM 3/l). In the EC, producer **prices** of Denmark and Germany are close to FIM 2/l (OECD 1991). However, transport costs will alleviate price differences markedly for

fluid milk, but less so for dairy products. The farm models (MTTL 1991 b) indicate that production costs per liter of milk diminish on the index scale 100-83-73-65 as the herd size is 8-16-32-60 cows, respectively. A significant drop occurs in labour cost, share of which falls from 33 % in the smallest herd to 26 % in the largest.
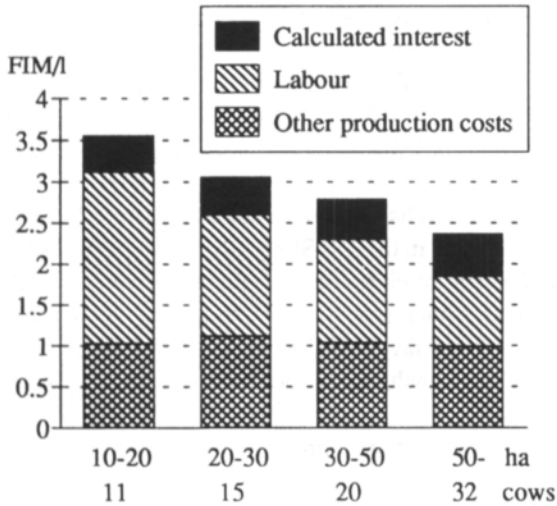

Fig. 6. Production costs on dairy farms of different sizes in southern Finland in 1989.

Although milk production is less dependent on feed costs and less flexible to adjust than pork production, its feeding practices are to be changed, too, if the price ratio of feed grain and concentrates to on-farm produced roughage considerably changes, as is expected in the EC-alternative. The need for change is underpinned by the quite unaltered production costs of roughage. In 1987-90, from crop failures to record harvests, the production costs of feed varied steeply: barley FIM 2.80/feed unit to 1.67; hay 2.97 to 2.70; silage 2.38 to FIM 1.95/f.u. (HELANDER 1991).

In the membership alternative, milk price would on the average drop by 40 % and feed prices, roughage excluded, by 50 %. Hence, feed unit requirement would be fullfilled to a larger extent by feed grain and concentarates instead of silage, use of which is based on high nitrogen input trans-ferred to protein in grass. However, silage feeding

would maintain its profitability to hay-compound feeding (Table 2). Yet, the advantage slightly narrows.

Table 2. Cost comparison in heavy silage and hay-compound feeding; currently and at the EC prive level: decline of 40% in returns and animal assets and 50% in cereal and compound.

	Currently		EC-prices	
Total returns				
FIM/cow	21118		12732	
Milk price FIM/l	3.02		1.81	
Yield, l/cow	5980		5980	
Variable costs	silage	compound	silage	compound
FIM/cow	13437	15370	9887	10356
FIM/l	2.24	2.57	1.65	1.73
Returns after variable costs				
FIM/cow	7681	5748	2845	2376

Source: base calculation by MKL 1991; own calculations.

The likely changes in feeding practices can also alter land use. Field area will, however, be used for more extensive roughage production and more effective manure utilization to meet the ever increasing environmental concerns. This will also reduce costs for roughage and improve profitability on dairy farms.

Structural adjustment process

In the EC, producer prices for major agricultural products are on the average 50 % of Finnish prices (KOLA et al. 1991). Hence, to reach the common European price level would cause enormous problems in Finnish agriculture, its joint sectors and in numerous rural communes. In the short run, farm income would drop rapidly because cost adjustment will follow only after a certain time lag and obviously to a smaller extent. As a whole, the high level of prices, costs and taxes in Finland has to be lowered.

In the adjustment process, the variation between production lines is considerable. It determines the

internal comparative advantage and indicates where the support efforts should be directed to further enhance the strongest farm activities w.r.t. the CAP. E.g. animal husbandry will benefit from lower feed prices, but crop production will not face any significant reductions in fertilizer or other costs (for an input cost comparison, see SUMELIUS 1991).

The extent to which Finnish agriculture can be practised at a markedly lower price level depends largely on the comprehensive structural adjustment capabilities on farms. When strictly considering the profitability of agricultural production (not other sources of income), small inefficient farms are forced to quit as prices drop. Evidently, smaller margins require larger volumes in order to provide sufficient income per farmer.

The assumed price drop, even though gradual over a long transition period, would obviously punish most severely young farmers, whose farms in fact are the most capable to manage even with the CAP. These farms have high debt-to-asset ratios due to expensive change of generation arrangements and aggressive investments. However, the investments have been based on the expectations according to the favourable domestic price development.

Financial crisis will arise when prices drop. Consequently, collaterals, especially land, lose value, but liabilities stay. Hence, security ratios (LEE et al. 1982) have to be followed closely. Stabilization support will be needed to avoid short-sighted foreclosures on farms able to succeed in the long run.

The capital formation and financial situation of farms depends heavily on the time interval for the adjustment. Financing problems can be mitigated by increased profitability through improvements in technology (WALTER-JÖRGENSEN 1985).

Both output increasing and cost reducing investments are needed on Finnish farms during the adjustment period. However, there should be fewer but larger farms to divide the shrinking total farm income. Cost efficiency could be considerably improved by economies of scale (BEATTIE and TAYLOR 1985). Falling prices and increasing supply of land, due to decreasing product prices, contributes to improvement of farm structure. There are significant economic benefits to be gained through horizontal and vertical integration. These means are the fastest and most concrete to improve cost efficiency in the overall agribusiness sector.

Furthermore, strict supply control measures, e.g. quotas in milk production, should be gradually relaxed or made more flexible to prevent the evident inefficiences and distortions emerged over time in Finnish (KOLA 1991) and European agriculture in general (OECD 1990). In jargon, instead of quantitative supply controls, price should be the means for more efficient resource allocation.

Concluding remarks

Finland would be the first country entering the EC required to adjust to much lower prices of farm products. The major adjustment need would be a substantial reduction of costs. Among the Nordic countries, Norway would experience a similar process.

This article has shown that barely variable costs are covered by the EC producer prices, but, at the same time, that the structural development can enable cost efficiency of a considerably higher degree. However, due to anticipated problems of indebtness and capital shortage during transition, adjustment process should be based on the prevailing farm structure of efficiency and competitive capability. The internal comparative advantage aspects are partially offset by capital constraints.

Structural change has been rapid, and continues (e.g. WALTER-JÖRGENSEN 1985), even in the countries which joined the EC with minor needs to adjust. In Denmark, the number of dairy farms declined from 79 000 to 33 000, and the average herd size doubled to 25 cows during the decade after the 1973 membership (COHEN 1986). There were alternatives for Danish dairy farmers in crop cultivation, but in Finland corresponding alternatives would be strictly limited.

Cereal production especially suffers from the Finnish drawbacks of climate and small farm size which translate into high unit costs. Milk production would be more able to adjust, but difficult problems

would arise to cover capital costs and maintain an adequate income level. In Sweden the situation is the opposite: cereal production is considered the most apt and milk the least to succeed in the EC membership (RABINOWICZ 1991). This is expected according to comparative advantage.

This study has analyzed the farm level constraints and possibilities of the adjustment process required in the EC-option. For a comprehensive analysis, further assessment of e.g. support means and resource reallocation and their costs should be made.

Several uncertainties, changes in the CAP and the entire Community included, require continuous updating. Various models can be employed to improve our understanding of the many intertwined factors, but problems persist also with models, indeed. E.g. aggregate econometric models (e.g. in Norway RICKERTSEN 1991), are handicapped because no empirical evidence of supply responses to price changes of this magnitude exists. Therefore, the firm level analysis as applied in this article, for instance, are on a sound basis.

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SELOSTUS
Suomen maatalous Euroopan integraatiossa: tilatason tarkastelu

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Maatalouden taloudellinen tutkimuskeskus

Mahdollisen EY-jäsenyyden ja yhteisön yhteisen maatalouspolitiikan (CAP) soveltamisen vaikutus Suomen maatalouden toimintaedellytyksiin olisi huomattava. Näin olisi siitä huolimatta, että EY:n maatalouspolitiikan keskeiset tavoitteet ja keinot ovat melko samankaltaisia kuin Suomen maatalouspolitiikassa.

Maataloustuotannon edellytykset ovat Suomessa paljon huonommat kuin EY:n tärkeimmissä tuottajamaissa. Keskeinen haittatekijä on maamme maantieteellisen sijainnin aiheuttama heikko tuottavuus, mikä ilmenee ensisijaisesti käytettyjen tuotantopanosten määrään nähden alhaisina hehtaarisatoina. Tällöin viljan yksikkökustannukset ovat korkeammat kuin EY:ssä, mikä kertautuu kotieläintuotantoon korkeina rehun hintoina.

EY-jäsenyyden keskeisin vaikutus maatilatasolla olisi tuottajahintojen muutos. Se merkitsisi huomattavaa pudotusta vallitsevasta suomalaisesta hintatasosta. EY-jäsenyys vaikuttaisi välittömästi myös eräiden maatalouden tuotantopanosten hintoihin ja sitä kautta maatalouden kustannuksiin. Alhaisemmat tuote- ja panoshinnat merkitsisivät muutosta panosten käytön optimiin. Tuotehintojen aleneminen aiheuttaisi ongelmia erityisesti velkaantuneille usein tilaa voimakkaasti kehittäneille tuottajille. Vaikka tuotot ja kustannukset alenisivat tasasuhteisestikin, maatilan oma rahoitustulo pienenisi.

Maatilojen sopeutuminen tuotehintojen alentumiseen ja sen kautta määräytyvä Suomen maatalouden laajuus riippuisi paljolti tuotantokustannusten ja maatalouden rakenteen muutoksista. Eri tuotantosuuntien sopeutumiskyky on hyvin erilainen. Rehun hinnan lasku alentaa kotieläintuotannon kustannuksia, kun taas kasvintuotannossa kustannussäästöt jäävät vähäisemmiksi. Tuotantoyksikköjen koon kasvattamisella voidaan saavuttaa mittakaavaetuja alenevien yksikkökustannusten muodossa.