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EC's Common Agricultural Policy and Denmark: An applied general equilibrium analysis

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SUMMARY: *The purpose of this paper is twofold: (1) to examine the microeconomic consequences for Denmark of an abolition of EC's Common Agricultural Policy, and (2) to illustrate the use of computable general equilibrium models and thereby encourage further use of this methodology to analyze long-term policy problems in Denmark. The results in this study show that Denmark is a net beneficiary of the EC's agricultural price supports and would suffer a welfare loss of between 2 and 4% if the CAP were abolished.*

1. Introduction

Denmark's decision to join the European Community (EC) in 1972 was to a large degree motivated by the prospective benefits of EC's Common Agricultural Policy (CAP): mainly the opportunity to export agricultural products to European markets at high, guaranteed prices and to the rest of the world with export subsidies from Brussels. There is little doubt that Danish agriculture has gained considerably from the CAP, as have other large agricultural export sectors in Holland, France and Ireland. Some attempts at quantifying these gains have been made. One can start with the European Agriculture Guidance and Guarantee Fund (EAGGF) amounts paid to Denmark; in 1984, the total was 7205.6 million DKR, composed of 4929.7 million in export subsidies, 1640.8 million in home market subsidies, and 635.1 million in intervention expenses (i.e., losses on products sold from EC stocks, storage expenses etc.)[1]. Of course, as Ølgaard (1987) points out, the main source of gains to Danish agriculture is the ability to sell products at high prices to other EC countries, which is not reflected in the EAGGF budget. Ardy (1988) estimates the total gain to Danish agriculture from

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1. Introduction

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the CAP to be in order of 2.5% of GDP, or around 15 billion DKR[2]. Only Ireland's gain is relatively higher, mostly due to that country's much greater dependence on agriculture and its low GDP.

Ardy's results point to potential problems for the CAP as seen from a Danish point of view, It has not gone unnoticed among Denmark's partners in the Community that the incidence of the CAP is such that one of the three wealthiest member countries reaps some of the greatest gains. Today, there are considerable internal and external pressures on the EC to reform the CAP. The demands by agricultural exporters outside the EC for reduced CAP export subsidies coupled with the ever-increasing budgetary burden of the scheme will effectively put a ceiling on total CAP expenditures in coming years. At the same time, low-income countries on the Community's periphery are demanding increased intra-EC transfers, both explicity through the regional funds and implicitly through reorientation of the CAP toward their products (this is especially true of Spain, Portugal, and Greece, whose products – mainly fruits and vegetables – have until now enjoyed much weaker protection under the CAP than meat, dairy and grain).

Various proposals to reform the CAP have surfaced in recent years. One such proposal was put forth in 1989 by the Socialist Group in the European Parliament, summarized in de Veer (1989). This proposal would essentially abolish the CAP by scrapping its price-support mechanisms. EC prices would be allowed to fall to world levels, and any aid to farmers would take the form of direct income support, financed in part nationally and in part by the Community, depending on the country's »ability to pay«, i.e. GDP per capita. Based on partial equilibrium analysis, and assuming a 20% decline in EC agricultural prices following CAP liberalization[3], de Veer estimates that Danish farmers would suffer a loss in income equal to 22% of value added, while the impact on the economy would be a loss of 0.19% of GDP[4]. According to de Veer's calculations, Ireland and Holland would also lose under the Socialist proposal. A similar partial equilibrium analysis was carried out by Thomson (1989), using a very disaggregated model. The impact of complete CAP liberalization on Denmark was also negative in this study, namely -0.79% of GDP. Again, there is a net loss because the producers' loss more than offsets the consumers' and taxpayers' gains.

2. It must be stressed, however, that Ardy does not assess the impact of the CAP on the economy as a whole. His estimates of agricultural gain are calculated as the sum of EAGGF transfers and the difference between EC and world prices multiplied by net exports. They ignore the negative impact of high food prices on consumer welfare and the distorting effect on other sectors via higher factor prices.

3. Since de Veer assumes that current world prices are 40% below EC prices, this implies that CAP liberalization would cause world prices to increase by 33%, a somewhat larger impact than in most other studies.

4. The loss to agriculture is 0.95% of GDP; the gains to consumers and taxpayers are 0,39% and 0.37%, respectively, for a net loss of 0.19%.

Danish politicians and economists as well as the general public have historically tended to focus on the advantage accruing to the agricultural sector from EC policies rather than on the total effect of those policies. In particular, as Ølgaard (1987) notes, the costs borne by consumers through high food prices have seldom been mentioned. This probably is a reflection of the strength of the agriculture lobby and the importance of the rural tradition in Danish culture. However, it appears that now there is a recognition in Denmark that the Common Agricultural Policy is likely to be reformed in the coming years, and in this context »reform« means lower prices for Danish agricultural products. In fact, Larsen (1988) concludes that Denmark ought to concentrate not on trying to maintain high prices for its products but on preserving access to its export markets.

Given the important role played by the prospect of higher agricultural exports in Denmark's decision to join the EC in 1972, it is somewhat surprising that few formal Danish analysis of the CAP's effects on the economy have been published to date. Danish Economic Council (1971) is still the most comprehensive study in this area, but it suffers from a lack of even partial equilibrium analysis; the advantages for Danish agriculture were estimated using 1970-71 quantities and the then new, higher EC prices. The purpose of this paper is to begin remedying that deficiency by analyzing the impact on Denmark's economy of a complete abolition of EC's agricultural price supports using a simple computable general equilibrium (CGE) model.[5]

2. The model

The model used for the analysis is a small CGE model of the Shoven-Whalley type. The specification of the model follows to a large degree the model described in Dervis, de Melo and Robinson (1982, Chapter 7).

The economy is divided into three producing sectors: agriculture and food processing, manufacturing, and services. Four institutional sectors are distinguished: households, corporations, the government, and the foreign sector. There are nine consumer goods and four investment goods in the model; these goods are fixed-coefficients aggregates of the produced goods (i.e., each consumer and investment good is a linear combination of the three produced goods). Table 1 summarizes the produced goods and the consumption and investment categories and their acronyms, which will be used in the remainder of the paper. In what follows, the produced goods are referenced by the index i $(i=1,2,3)$; the index j $(j=1,2,3,4)$ refers to investment categories, and the index c $(c=1,...,9)$ refers to consumption categories.

5. For a brief introduction to CGE models and their evolution during the past 20 years, see Wajsman (1991), Shoven and Whalley (1984) provide a comprehensive survey of CGE model applications.

Table 1. Sectors and goods in CGE model.

I.	Produced Goods:		
		1. Agriculture and Food Processing	AG
		2. Manufacturing	IN
		3. Services	SE
II.	Consumption Categories:		
		1. Food	FOOD
		2. Beverages and Tobacco	BT
		3. Clothing and Footwear	CL
		4. Gross Rent, Fuel and Power	RFP
		5. Household Equipment and Operations	FURN
		6. Medical Care, Personal Services	MED
		7. Transport and Communication	TC
		8. Recreation, Education and Entertainment	LEIS
		9. Miscellaneous Goods and Services	MISC
III.	Investment Gategories:		
		1. Machinery	MACH
		2. Transportation Equipment	TRANS
		3. Buildings and Other Construction	CONST
		4. Other Investment	OTHER

Each sector produces value added using a Cobb-Douglas production function with constant returns to scale for the two primary factors, labor and capital, while intermediate demand is modeled with a Leontief fixed-coefficients specification. Capital is sector-specific and immobile so that rates of return are not equalized across sectors. Labor, on the other hand, is fully mobile. The labor market is thus neoclassical, with full employment and wage rate equalization across sectors.

Households receive all labor income as well as a share of capital income, in addition to government transfer payments and some factor income from abroad. They maximize a Stone-Geary utility function, yielding a Linear Expenditure System (LES)[6] as the consumption demand system, and they save a fixed proportion of their after-tax income. Corporations receive a share of capital income and save a fixed proportion, corresponding to retained earnings. Government income is the sum of tax receipts from personal income and corporate taxes, VAT and other indirect taxes, any profits from state-

6. The LES is described in all standard works on consumption demand; see, for example, Deaton and Muellbauer (1980).

owned enterprises, and import tariffs less export subsidies. Finally, the foreign sector's income consists of its share of capital income (corresponding to foreign ownership of Danish firms), net government transfers, and payments for Danish imports.

The portions of the model outlined so far conform closely to the traditional Walrasian paradigm, with the exception of sector-specific capital stocks. However, when modeling international transactions, it is almost always necessary to depart somewhat from the standard Hecksher-Ohlin-Samuelson (henceforth H-O-S) theory.

The problems is applying H-O-S in empirical models stem from the use of constant returns to scale in production coupled with the small country assumption on the export and import side. The small country assumption says that the country cannot influence world prices of the commodities it imports or exports by its actions – clearly, a reasonable assumption for a country like Denmark, especially considering the level of aggregation in the model. However, as shown in Dervis, de Melo and Robinson (1982, Ch. 6), the small country assumption in its pure form in a model with more traded goods than factors of production and constant returns to scale results in complete specialization in M goods, where M is the number of factors. The assumption of sector-specific capital stocks prevents complete specilization from happening – in effect, it increases the number of factors. However, the model will still show excessive responsiveness to changes in terms of trade, such as exogenous changes in world prices[7]. In addition, the assumption of homogenous products in H-O-S theory is empicically problematic because it does not allow for two-way trade.[8]

The way to overcome these difficulties is to abandon the assumption of perfect substitutability between domestic and imported goods. Once product differentiation is introduced, the small country assumption may no longer be appropriate on the export side. With differentiated products, even a small country may face downward-sloping demand curves for its products. Accordingly, the export demands are assumed to have the following form:

$$E_i = E_o * \left(\frac{\overline{PW_i}}{PWE_i} \right)^{\varepsilon_i} \qquad i = 1,2,3 \qquad (1)$$

where E_i is the export demand for sector i's output, PW_i is the exogenous world price of good i, measured in foreign exchange, PWE_i is the supply price of good i, also in terms of foreign currency, E_o is a constant showing the level of exports at the point where

7. For an example of this phenomenon, see Clarete and Roumasset (1987) who employ a model with homogeneous products and sector-specific factors to analyze effects of tariff changes in the Philippines.

8. Two-way trade (sometimes called cross-hauling) refers to the simultaneous import and export of the same good. It has been observed in commodities at extremely disaggregated levels; to account for it without resorting to product differentiation would require a model with thousands of commodities.

$PWE_i = PW_i$, and ε_i is the elasticity of export demand. Thus, the small country assumption has been retained in the sense that Denmark still cannot influence the world price PW_i; however, Denmark's market share in its export markets depends on how competitive Danish exporters are, measured by the ratio of their supply price to the world price. The supply price of exports depends on Danish domestic prices and trade policy:

$$PWE_i = \frac{PD_i}{(1 + te_i) * \overline{ER}} \quad i = 1,2,3 \tag{2}$$

where PD_i is the domestic price of good i, te_i is the rate of export subsidy, and ER is the exchange rate (measured as the domestic price of foreign currency, e.g. DKR/\$). It is assumed that Danish producers are indifferent between exporting and selling in the domestic market, so export supply is defined implicitly and residually as the difference between production and domestic sales.

On the import side, following the suggestion af Armington (1969), these is imperfect substitution between imported and domestic goods. In the model, I thus assume that in each sector, foreign and Danish goods are combined to form a composite commodity, using a CES aggregation function:

$$Q_i = B_i * [\delta_i * M_I^{\rho_i} + (1 - \delta_i) * D_i^{-\rho_i}]^{-\frac{1}{\rho_i}} \qquad i = 1,2,3 \tag{3}$$

where M_i and D_i are imported and domestically produced commodities, respectively, while B_i, and δ_i are parameters. Demand for imports of good i is then given by:

$$M_i = \left(\frac{\delta_i}{1 - \delta_i}\right)^{\sigma_i} * \left(\frac{PD_i}{PM_i}\right)^{\sigma_i} * D_i \qquad i = 1,2,3 \tag{4}$$

where $\sigma_i = (1/1 + \rho_i)$ is the elasticity of substitution between imported and domestic goods. This specification has three interesting special cases: for $\sigma_i = o$, there is no substitution between imports and domestic goods – this is the case of »non-competitive imports« sometimes used in models of developing countries to describe imports of, say, essential investment goods not manufactured domestically; for $\sigma_i = 1$, (4) reduces to a Cobb-Douglas specification, and the value share of imports remains constant; and

$\sigma_i \rightarrow \infty$ represents the case of perfect substitutability between imports and domestic goods.

The import price measured in DKR, PM_i, is a reflection of exogenous world prices and trade policy:

$$PM_i = \overline{PW}_i * (1 + tm_i) * \overline{ER} \qquad i = 1,2,3 \qquad (5)$$

where tm_i is the tariff rate on imports of good i. Given the import demand function, the price of the composite good will be:

$$P_i = [\delta_i^{\sigma_i} * PM_i^{1-\sigma_i} + (1 - \delta_i)^{\sigma_i} * PD_i^{1-\sigma_i}]^{\frac{1}{1-\sigma_i}} \qquad i = 1,2,3 \qquad (6)$$

It should be noted that I have implicitly assumed that the elasticity of substitution between imported and domestic goods of a given category is the same for all uses. Purchasers of intermediate products, consumer goods, and investment goods are confronted with this composite price, and the concepts of net price and consumption and investment goods prices can now be defined. The net price in producing sector i is defined as:

$$PN_i = PD_i * (1 - tp_i) - \sum_{k=1}^{3} P_k * a_{ki} \qquad i = 1,2,3 \qquad (7)$$

where tp_i is the indirect tax rate on production and the ak_i are the input-output coefficients. The consumer price PC_c is defined in (8), and the price of the j'th investment good in (9).

$$PC_c = \left(\sum_{i=1}^{3} c_{ic} * P_i\right) * (1 + tc_c) * (1 + vc_c) \qquad c = 1...9 \qquad (8)$$

$$PI_j = \left(\sum_{i=1}^{3} i_{ij} * P_i\right) * (1 + ti_j) \qquad j = 1...4 \qquad (8)$$

where tc_c and vc_c are the excise tax and VAT rates on the c'th consumption good, ti_j is the excice tax rate on the j'th investment good, and the c_{ic} and i_{ij} are the coefficients of the consumption and the investment composition matrices.

Every CGE model must include a mechanism to determine the overall level of economic activity; this is referred to as the macroeconomic closure. In the present model, total investment and government comsumption are endogenous, while foreign savings (i.e., the current account balance) and government savings (i.e., the budget surplus or deficit) are exogenous. Such a model is said to be »savings-driven«. While other macroeconomic closures are possible[9], the specification chosen here closely mirrors the situation of Danish policymakers who often operate under constraints on the politically acceptable sizes of the current account and government budget deficits. The exchange rate, defined as the domestic price of foreign currency, is fixed and serves as the numeraire.

3. Model implementation

The implementation of the model is based on a Social Accounting Matrix (SAM) for 1984.[10] A SAM is a concise way to describe the structure of an economy and is particularly well suited for CGE models. The key concept in the SAM is the »institution«. An institution can be a producing or consuming sector, a group of commodities, or the rest of the world. The SAM is essentially an augmented input-output table, with one row and one column corresponding to each institution. Per convention, the columns in the SAM make payments to the rows, and each account balances, i.e., the sum of payments made by each institution is equal to the sum of payments received by it.

The HERCULES software package described in Drud and Kendrick (1988) was used to calibrate and solve the model. From the modeler's standpoint, HERCULES is extremely easy to use, because there is no need to write down any equations. The base SAM is used to define the model and calibrate most of the model parameters. The numbers in the SAM are values, i.e., they are mostly payments of the form price∗quantity[11]. Calibration in the SAM is made possible by assuming that in the base case, all prices are unity. This method was pioneered by Harberger (1962). The payments in the base SAM can now be interpreted as quantities, where appropriate, and the model can be calibrated.

The SAM is transformed into a model once functional forms for the payments in the table are specified (using standard acronyms such as CD or CES) and parameter values

9. For example, government consumption could be exogenous in real terms, implying that the government has an activity plan which will be carried out regardless of cost. Investment could also be fixed; such a closure yields an »investment-driven« model in which savings from abroad and the government adjust to ensure macroeconomic balance.

10. For an introduction to Social Accounting Matrices, see King (1981). The use of SAMs in CGE models is discussed in Dervis, de Melo and Robinson (1982), Pyatt (1988) and Kendrick (1990), among others.

11. Of course, certain payments, such as government transfers or the current account deficit, do not have associated prices or quantities.

Table 2. Cobb-Douglas production function parameters.

	A_i	a_i
AG	1.897	0.662
IN	1.876	0.323
SE	1.886	0.330

Table 3. Input-output coefficients.

	AG	IN	SE
AG	0.464	0.017	0.012
IN	0.109	0.461	0.118
SE	0.102	0.134	0.245
Value added	0.337	0.386	0.598

which cannot be calibrated from the data are furnished by the modeler (in this case, the LES parameters and the trade elasticities). Once this is done, HERCULES generates the equations of the model, performs error checking, calibrates the model parameters, and performs the experiments requested.

The majority of the parameters of the model can be inferred directly from the base SAM[12]. For example, the Cobb-Douglas share parameters are simply the factor shares of base value added. Table 2 shows the production parameters for the 3 producing sectors, where the A_i are the Cobb-Douglas efficiency parameters and the α_i are the capital share parameters.

Thus, the agricultural sector is relatively capital-intensive, while the industrial and service sectors are labor-intensive.

The input-output coefficients a_{ik}, showing the intermediate input requirements per unit of output in sector i, are also computed directly from the base SAM. They are shown, along with the share of value added in gross output, in Table 3.

As one might expect, the services sector has the highest value added ratio, while agriculture has the lowest. The relatively small difference between agriculture and industry lies in the definition of agriculture to include food processing; thus the value added to farm products during food processing is here assigned to agriculture.

Three groups of parameters cannot be calibrated from the SAM: the LES parameters, the trade substitution elasticities, and the export demand elasticities. The LES pa-

12. The basic data sources used for the construction of the SAM were Danmarks Statistik (1988, 1989). Space limitations preclude the presentation of the base SAM in this article. However, all the data used in this study as well as computational details are available from the author on request.

Table 4. LES parameters and elasticities.

	Y_c	B_c	e_y	e_p
FOOD	43478	0.036	0.21	-0.20
BT	10645	0.053	0.70	-0.57
CL	3208	0.061	1.05	-0.83
RFP	26260	0.218	0.85	-0.74
FURN	-3081	0.099	1.47	-1.13
MED	-2037	0.032	1.77	-1.37
TC	-9819	0.256	1.52	-1.14
LEIS	-349	0.124	1.29	-1.01
MISC	-1006	0.122	1.33	-1.03

Table 5. CAP experiment results – prices (% change from base).

	EXP.1	EXP.2	EXP.3	EXP.4
Household consumption	-17.1	-14.9	-12.3	-4.4
FOOD	-28.1	-23.9	-19.0	-4.8
BT	-26.2	-22.4	-17.9	-4.8
CL	-8.4	-7.5	-6.3	-2.6
RFP	-15.5	-13.8	-11.6	-4.9
FURN	-9.8	-8.7	-7.3	-3.1
MED	-13.6	-12.1	-10.2	-4.3
TC	-13.2	-11.7	-9.9	-4.2
LEIS	-13.7	-12.1	-10.1	-4.0
MISC	-15.3	-13.6	-11.5	-4.9
Domestic AG	-32.6	-27.8	-22.1	-5.8
Domestic IN	-9.1	-8.1	-6.8	-2.8
Domestic SE	-16.9	-15.0	-12.7	-5.4
Import-AG	-33.0	-27.0	-20.0	0.0
Import-IN	0.0	0.0	0.0	0.0
Import-SE	0.0	0.0	0.0	0.0
Composite AG	-32.7	-27.6	-21.7	-4.6
Composite IN	-3.7	-3.3	-2.7	-1.1
Composite SE	-16.3	-14.5	-12.3	-5.2
Export-AG	-26.6	-21.4	-15.2	2.5
Export-IN	-9.1	-8.1	-6.8	-2.8
Export-SE	-16.9	-15.0	-12.7	-5.4
Labor	-18.7	-16.7	-14.1	-6.1
Capital-AG	-59.8	-52.3	-43.1	-15.4
Capital-IN	4.0	3.4	2.7	0.8
Capital-SE	-20.9	-18.6	-15.8	-7.0

rameters γ_c and β_c (corresponding to committed expenditure and the marginal consumption shares) were chosen so as to yield reasonable own-price and income elasticities of demand, based on literature estimates, particularly Danish Economic Council (1980). In practice, this was done by choosing appropriate γ_c's; given those, the β_c's could be calculated by HERCULES.[13] Table 4 shows the LES parameters and the income and own-price elasticities for the 9 consumption categories.

For the two parameters related to foreign trade, ε_i in Equation (1) and σ_i in Equation (4), values deemed reasonable were chosen in a somewhat *ad hoc* manner. There have been virtually no Danish studies upon which the estimation of these elasticities could be based. Knudsen (1989) estimated the export demand elasticity for Danish manufacturing to be 2.5. Since agricultural products may be presumed to be more homogenous, and services less homogenous than industrial products, I have chosen ε to be 5.0 for agriculture and 1.0 for services. Based on similar homogeneity considerations, the trade substitution elasticity σ was set at 3.0 for agriculture, 1.0 for industry, and 0.5 for services.[14] This procedure for selecting the trade parameters is obviously less than satisfactory, but in view of the shortage of reliable econometric estimates it remains the only feasible method for most CGE applications.

4. Simulations of abolition of the CAP

Abolition of the Common Agricultural Policy would have several direct effects on the Danish economy. As discussed above, the CAP has kept agricultural prices within the EC considerably above world prices. In addition, the EAGGF subsidizes agricultural exports to countries outside the EC, thereby exerting a depressing influence on world prices. Hence, from Denmark's point of view, abolition of the CAP would have three main effects: (1) export and import prices of agricultral products would decline to the world level; (2) mitigating this somewhat, world prices would rise due to the decline in EC net exports; and (3) Denmark would no longer receive the EAGGF subsidies. Accordingly, I conduct four experiments. In all four experiments, the EAGGF subsidies, equal to 6.802 billion DKR in the base SAM,[15] are set to 0, thus increasing the government's net transfers abroad by that amount. The experiments differ in their assumptions about the movement in world prices following CAP liberalization. In Experiment 1, world prices are unchanged; in Experiment 2, they rise by 10% fol-

13. The income elasticity in the LES is given by $e_y = \beta_c / w_c$, where w_c is the budget share of the c'th consumption good. Thus, given the desired income elasticities, preliminary β_c's can be computed as $\beta_c = e_y * w_c$. The γ_c's can then be calculated by solving the 9-equation system $\gamma_c = Y*[w_c - \beta_c * (Y - \Sigma\gamma_c) / Y]$ (c=1,...,9). Note that this formulation assumes P_c=1 for all c, as is the case in the base SAM. For further details, see Deaton and Muellbauer (1980, Ch. 3).

14. Equation (4) also contains the parameter δ_i. Once the substitution elasticity is specified, δ_i is easily calculated in the base SAM (remembering that $PD_i = PM_i = 1$ as $1/[(M_i/D_i)^{-1/\sigma} + 1]$.

15. Specifically, 5.034 billion DKR in export subsidies and 1.768 billion DKR in production subsidies.

lowing CAP abolition, and in Experiment 3 the increase is 20%. Finally, in Experiment 4, world prices rise to a level sufficiently high so that Denmark's export and import prices are unaffected by the liberalization. This last scenario is obviously not very realistic, but it was included as an extreme case.[16] I also assume that the EC subsidies lost would not be replaced by any additional agricultural support scheme. The aggregate welfare measure used in evaluating the results of the policy changes is total domestic absorption – i.e., the sum of household consumption, investment, and government consumption.

In concrete terms, I have assumed that current EC prices are 50% above world prices, a reasonable guess given the results cited in Rosenblatt et al. (1988) and elsewhere. Experiment 1 then translates into a 33% drop in the prices confronting Danish agriculture after CAP liberalization; Experiments 2 and 3 imply a 27% drop and a 20% drop, respectively, while Experiment 4 implies unchanged external prices[17]. Table 5 shows the resulting price changes.

Obviously, prices of agricultural commodities – domestic, exports, and imports-decline; the decline diminishes when world prices increase. In fact, in Experiment 4, with the world price rising to the original EC level, PWE_{AG} increases slightly. To understand this seemingly paradoxical result, one must keep in mind that the domestic and export prices are jointly determined by the interaction of the domestic supply curve and the domestic and foreign demand curves. The reduction in export subsidies has an effect equivalent to a downward shift of the foreign demand curve and puts downward pressure on price. The reduction in production subsidies is equivalent to an increase in production costs and thus shifts the supply curve upwards, which tends to increase price (however, since the production subsidies in the base care are relatively small, this effect is minor). Finally, the increase in the exogenous world price is equivalent to an upward shift in the foreign demand curve. In Experiment 4, due to a large increase in the world price, this last effect dominates and PWE_{AG} rises.

Domestic and export prices for industry and services also decline, partly due to the lower cost of intermediate inputs from agriculture, and partly due to lower labor costs, which benefit both industry and services. As one might expect, with fixed sectoral capital stocks, the price of agricultural capital declines sharply.

Prices of consumer goods consequently decline. The overall price index (i.e., the price shown on the »Household consumption« line in Table 5) declines for all four experiments. The CPI decline is smaller than the decline in the wage rate in all cases,

16. In fact, some authors, such as Sørensen and Pultz (1986), speculate that world prices would indeed rise enough to maintain constant export prices for Denmark.

17. The calculations are as follows: if Danish agriculture currently sells its products at 1.5 times world prices, and world prices are unchanged following abolition of the CAP, then the decline in price as seen from Denmark will be (1.5-1.0)/1.5, or 33%. Similarly for the other cases.

Table 6. CAP experiment results – quanties (% change from base)

	EXP.1	EXP.2	EXP.3	EXP.4
Household Consumption	2.0	1.4	0.8	-0.5
FOOD	3.6	2.7	1.9	-0.0
BT	10.1	7.7	5.4	-0.0
CL	-3.7	-3.5	-3.1	-1.9
RFP	2.3	1.9	1.3	0.0
FURN	-3.5	-3.4	-3.1	-2.1
MED	1.6	1.1	0.5	-0.8
TC	0.9	0.5	0.0	-0.8
LEIS	1.3	0.8	0.3	-0.9
MISC	3.4	2.7	1.9	0.0
Gov't consumption	-15.3	-13.3	-10.8	-4.0
Investment	-6.6	-5.8	-4.8	-2.0
Total domestic absorption	-4.1	-3.8	-3.3	-1.7
Real GDP	0.1	0.1	0.1	-0.0
Production-AG	-21.2	-17.2	-13.0	-3.5
Production-IN	18.2	15.7	12.9	4.9
Production-SE	-1.8	-1.6	-1.3	-0.6
Exports-AG	-36.4	-30.9	-25.1	-11.5
Export-IN	27.0	23.4	19.2	7.4
Export-SE	20.4	17.7	14.6	5.7
Imports-AG	-9.4	-11.0	-12.4	-14.9
Imports-IN	-0.9	-0.8	-0.8	-0.5
Imports-SE	-12.2	-10.8	-9.1	-3.9

indicating a falling real wage. Naturally, the consumer categories with the highest percentage of agricultural inputs – food, beverages and tobacco, and, to a lesser degree, leisure and entertainment – experience the greatest price reductions.

Table 6 shows the impact of the experiments on various quantities in the economy. Turning to the aggregate impacts first, one sees that total absorption declines between 4.1% and 1.7%, depending on the experiment, while real GDP is virtually unchanged.

Household consumption increases for most commodities and in the aggregate (except in Experiment 4). The increase in food consumption is relatively small despite the fall in its relative price, due to low own-price and income elasticities of demand for food. The increase is greatest for beverages and tobacco; although the demand for those goods is also inelastic, it is much less so than for food, and the relative price of BT falls almost as much as that of food.

Consumption of commodities which have high industry input coefficients – clothing and household equipment – actually declines. Table 5 reveals the underlying reason: although all consumer prices decline, the prices for those commodities decline by smaller percentages, so that their relative prices increase. Consumers respond to this by reallocating their consumption away from those goods. The small decline in the price of industry-dependent consumer goods is in turn a consequence in the relatively small decline in industrial commodity prices, which increases their relative price compared to agricultural and service goods[18].

The services sector declines somewhat, due to the large cut in government consumption and the smaller fall in private investment needed to maintain macroeconomic balance[19]. Because of the decline in services, a labor-intensive sector, the price of labor declines considerably. This, along with the lower agricultural prices, benefits industry, and the industrial sector expands production and exports. This is largely because the export demand for its products is elastic, and hence the decline in *PWE* leads to strong export expansion. Since import prices do not change (this is the small country assumption), the price movements imply a reduction in the relative price of domestic versus foreign industrial goods – in other words, Danish industry becomes more competitive, both on world markets and at home. Therefore, imports decline while exports increase. Agricultural exports, imports, and production decline sharply, especially exports. This holds true even when world prices of agricultural products are assumed to rise to the internal EC level, because even in that case there is still the effect of the abolition of production subsidies to agriculture.

In summary, CAP liberalization has a large negative impact on the agriculture sector, even if world prices were to increase to the previous EC support level, an extremely unlikely occurence, while the industrial sector gains.

5. Conclusions

The preceding section shows that if the reductions in government spending needed to maintain the current account and government deficits at constant levels are taken into account, CAP liberalization is unambiguously welfare-reducing for Denmark, at least in this static model. Total domestic absorption declines between 2 and 4%, depending on the behavior of world prices following the abolition of agricultural support[20]. In the most realistic scenarios (Experiments 2 and 3, in which world prices in-

18. If the transition from produced goods to consumer goods had been modeled in a way which allows substitution (rather than the fixed-coefficients approach used here), the impact of relatively higher industrial prices om consumer goods prices would have been smaller.

19. Investment is actually services-intensive because a large portion of it is construction.

20. The model was run with varying macroeconomic closures and exchange rate specifications, including one with a flexible exchange rate. The results from that model were broadly similar to those presented here. Only when the model was investment-driven (i.e., investment and government consumption were exogenous), did abolition of the CAP yield a small welfare improvement, but at a cost of considerable deterioration in the external and internal balances. The relative distribution of gains and losses across sectors did not vary from the results of the savings-driven model.

crease by 10 and 20%, respectively), the small increase in private consumption is more than offset by falling government consumption and investment.

Given the level of aggregation of the model used in this study and the inherent limitations of static CGE models, the precise size of the numerical estimates of the effects of the CAP policy changes should be taken with a grain of salt. Nevertheless, the results are sufficiently convincing that further investigation of the effects of the CAP in the Danish economy is warranted. Although outright abolition of the CAP must be said to be in the realm of speculation at this time, some form of CAP reform will probably occur due to the internal and external pressure on the EC. Indeed, as mentioned above, during the second half of the 1980s, tentative steps toward reform have already been taken. Whether reform takes the form of increased quantity management of agricultural output (as in the dairy sector), through lower guaranteed prices, or through some other scheme such as direct payments to farmers, there is no doubt that the changes made will not be favorable to Denmark[21]. The results presented here are in broad agreement with the general perception, which points to Denmark (along with Holland and Ireland) as one of the big beneficiares of the CAP in its current form. Given the country's high GDP per capita, Denmark is unlikely to encounter much sympathy from its EC partners in future negotiations over CAP reform.

21. One concrete and very recent example is the proposal by the EC Agriculture Commissioner, Ray MacSharry (see »Europe's Latest Farming Muddle«, *The Economist*, 23 February 1991), to move away from price support toward direct income supplements for small farmers. Since Danish farms tend to be large compared to the EC average, this change would undoubtedly hurt Danish agriculture.

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