Long-Run Effects of the Common Agricultural Policy for Switzerland: A Simulation Analysis

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1. INTRODUCTION

It is well-known that agriculture has been, and continues to be, a stumbling block in the multilateral trade negotiations. For OECD countries, in 1998, agricultural policies raised producers' income by some 37 % above the value of farm income when valued at world prices (OECD, 2000). A number of reasons have been put forth for this resistance to liberalization, some relating to standard second-best arguments (income distribution motives, the need to protect the agricultural landscape), others relating to political economy motives (for example, ANDERSON (1995) argues that farm support is not strongly opposed since it has few negative effects on the rest of the economy). Opposition to reduction in farm support has also been at the fore of the discussions on Switzerland's accession to the European Union (EU).[1] Indeed, a particular concern for Swiss authorities is the agricultural sector which is, by almost any standard, one of the most heavily protected in the world since total transfers received by farmers in 1998, which stood at 70 % of the value of production, was almost twice the OECD average.

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1. Since its refusal to join the European Economic Area in 1992, Switzerland has engaged in a long process of bilateral negotiations with the EU. Seven agreements were signed in June 1999 but have not yet been ratified by all EU countries. These agreements will only have a limited impact on Swiss agriculture. Although the long run objective of the Swiss government remains full membership in the EU, it is still unclear when the freezing of the official entry demand will be ended (a proposal to do so immediately was sternly rejected by referendum in March 2001).

While value-added generated in the agricultural sector and related industries (food, beverages and tobacco) is only slightly above 4 % of GDP, any changes in policies towards agriculture, such as those that would occur as a result of EU accession for Switzerland, are likely to have important economy-wide ramifications (due to budgetary implications, reallocation of labor and capital, and changes in the relative cost of food in living expenses). Surprisingly, even though several studies have sought to analyze the impact of European integration on Swiss agriculture, they have so far been limited to partial equilibrium analysis.[2] In this paper, we carry out a general equilibrium analysis, in which we are also careful to capture the sectoral detail found in partial equilibrium analysis, since our simulation model disaggregates agricultural activities into 18 sectors.

In case of accession to the EU, Switzerland would have to adopt the Common Agricultural Policy (CAP). This paper analyzes the overall economic impact of such a policy measure, using a three-region simulation model which includes Switzerland and its two trading partners, the EU and the Rest of the World (RW). The model shares common features with other general equilibrium studies of the CAP (see HARRISON et al (1995), WEYERBROCK (1998) and HEROK and LOTZE (2000)). Particular care has been given to capturing the full impact of farm support policies by using, wherever possible, data on producer support estimates (PSE) instead of tariffs.

From a modeling perspective, the interaction between agriculture and the rest of the economy is captured by contrasting the decreasing returns to labor and capital in the agricultural sectors (due to the use of land which is in fixed supply) with increasing returns and imperfect competition in some key industrial sectors. In addition, the model takes into account the long-run impact of policy reforms on the accumulation of physical capital and household wealth in a context of international capital mobility (allowing thus to capture an important structural feature of the Swiss economy: the persistent current account surplus). Finally, we explore the implications of different modeling assumptions for international trade by carrying out extensive sensitivity analysis.

From a policy perspective, the general equilibrium approach adopted here helps to have a better informed discussion on the efficiency/distribution trade-off arising from a reduction in support to agriculture in Switzerland. On a more general level, our results might allow to draw lessons for reform in other small OECD countries with a highly protected agricultural sector.

Two previous studies by the same authors already dealt with the general equilibrium impact of EU accession for Switzerland, using a less disaggregated model.[3] This paper extends the analysis by modeling in more detail the agricultural and food processing sectors and by taking into account compensation mechanisms and adjustment costs, which are crucial elements in shaping the political feasibility of agricultural reforms. In particular, the model includes (i) land as a specific input in agricultural sectors; (ii) more realis-

2. See BERNEGGER et al. (1995) and RIEDER (1998).
3. MÜLLER and GRETHER (1999) present a non-technical in-depth report of simulations and results, whereas GRETHER and MÜLLER (2001) provide a detailed presentation of the model and the calibration procedure, with a focus on manufacturing sectors.

tic price elasticities of final demand for food products; and (iii) a wider coverage of policy instruments (including export subsidy equivalents). Moreover, sensitivity analysis of some crucial parameters and model assumptions is carried out. As the present paper focuses on agricultural policy, it does not deal with the other dimensions of EU accession (fiscal consequences, product standardization, free movement of people, etc).

The adoption of the CAP is simulated by a removal of bilateral protection on Swiss-European trade and by the adoption of the common external tariff on Swiss imports from the RW. To anticipate the main results, the simulations suggest that adoption of the CAP would lead to a welfare gain of about 1 % of GDP, via a reduction of more than 20 % of the agricultural labor force. Estimates of adjustment costs are also provided by subtracting from the overall benefits the costs of compensation to the unemployed during their estimated time of unemployment. Depending on the selection of model closure, our conservative estimates of the benefit-cost ratio varies between 2 (substantial deterioration in agricultural terms-of-trade) and 5 (small deterioration in the terms of trade).

The remainder of the paper is organized as follows. General features of the Swiss trade and agricultural policies are described in section 2, along with a discussion of the likely effects of EU membership in this area. Section 3 summarizes the main features of the simulation model and outlines how the main effects to be expected from CAP adoption are captured in the simulations. Model details (structure, data and calibration of key elasticities) are described in a separate appendix available from the authors. Macro and sectoral results are discussed in section 4 while distributional and adjustment costs are presented in section 5. Results from sensitivity analysis under different model closures are given in section 6. Section 7 concludes.

2. SWISS AGRICULTURAL POLICY IN THE CONTEXT OF INTEGRATION WITH THE EU

Adopting the CAP will likely involve substantial reorientation of Swiss imports of farm and food products from the Rest of the World (RW) to the EU because of differences in tariffs and farm support policies embodied in the CAP and those in Switzerland. Table 1 gives Swiss agricultural imports and tariffs by region of origin. The sectoral disaggregation highlights the fact that agricultural and food products are considerably more protected by tariffs than the other traded goods which are conveniently aggregated into one category. Note that these figures do not take into account other border measures that may affect internal prices (see table 2 below).

In 1996, farm and food products, which together accounted for 6 % of total imports (and less than 4 % of total value-added), had ad valorem tariff rates substantially above those for other sectors (and tariff protection was higher for food than for farm products, reflecting the escalation of protection with the degree of processing observed in most countries). More than 80 % of Swiss industrial imports originate from the EU, and pay, on average, a lower tariff than corresponding imports from the RW. This is so because of the free trade agreement signed between EFTA partners and the EU in 1972. Farm and food products were not covered by the 1972 agreement, and differences in average tariff rates reflect compositional effects captured in the weighting scheme applied in table 1.

Table 1: Import and tariff structure of Switzerland (1996, percentages)

Category	share in total imports	share of imports from the EU	average tariff on EU imports[a)]	average tariff on RW imports[a)]	share in total value-added
farm products	2.9	60.8	6.0	8.7	1.9
food products	3.4	75.9	15.2	11.3	1.4
beverages & tobacco	1.2	88.7	12.7	18.2	1.0
other products[b)]	89.6	80.1	0.5	1.5	95.8

Notes: a) weighted by imports, b) excluding oil.
Source: own calculations based on data from Swiss customs and national accounts authorities.

Guaranteed prices to farmers and other support policies are an integral part of agricultural policies in most OECD countries. This necessitates the use of other indicators to get a better idea of the net incentives and of transfers from the rest of the economy. The OECD reports values for Producer Support Estimates (PSE) that allow for comparisons of transfers to the agricultural sector across countries. This measure captures most instruments used in farm support policies (including direct payments).

During the past fifteen years, Switzerland has followed the general downward trend in global support to farm activities and the progressive shift towards direct payments observed among most OECD members. However, Swiss global PSE remains the highest relative to the value of production among OECD members (around 73 % in 1999, against 40 % on average for the OECD zone). Moreover, Swiss direct payments, which represented 39 % of direct support in 1999 (32 % on average for the OECD), are less linked to production and more often subject to environmental standards than in other countries. Recent EU policy, however, is also heading in the same direction.

Border measures, which reflect the wedge between domestic and international price, are reported for the EU and Switzerland in table 2 (agricultural product categories correspond quite closely to the sectoral disaggregation in the simulations reported below). Perusal of table 2 leaves little doubt that under present conditions, adoption of the CAP will have a major impact on Swiss agriculture.

The adoption of the CAP would reflect a substantial trade liberalization for Switzerland, not only because of the removal of protection on bilateral trade flows but also because, as suggested by table 2, it would imply less protection on most imports from the RW. The adoption of the CAP can also be expected to lead to a reduction in direct payments. Although such a measure will reduce farmer income, it is likely to change economic incentives only to a small extent, since direct payments tend to rely increasingly on environmental conditions rather than on the level of production.[4] Moreover, the CAP leaves EU member countries some leeway to define their own policy with respect to direct payments. This is why our simulations focus on the efficiency impact of trade policy reform, leaving direct payments unchanged.

Table 2: Border measures for agricultural products (average over the 1995–1997 period, percentages)

Category	border measures[a)] in the EU	border measures[a)] in Switzerland
Wheat	84	196
Other cereals	16	125
Sugar	94	257
Bovine cattle meat products	88	167
Other meat products	9	244
Dairy products	94	252

Note: a) wedge between domestic and international price as a percentage of the international price.
Source: own calculations based on data from OECD (1998).

The data in tables 1 and 2 refer to 1996 which is the benchmark year selected for the simulations below. It should be noted that since 1996 global support of agriculture, as measured by the PSE, has not fallen significantly both in the EU and Switzerland. More recently, the composition of support is shifting away from market price support towards enhanced direct payments. As the developments in the EU and in Switzerland seem to proceed in parallel (even in their reform programs "Politique Agricole 2002" in Switzerland and "Agenda 2000" in the EU), the 1996 data can be considered as being approximately representative of the current situation with respect to the *relative* position of Swiss and European agricultural policies. However, Swiss federal authorities argue that in the near future Swiss policy is heading towards further liberalization even in the absence of EU accession. In this case, our simulations would tend to exaggerate the liberalization impact of the CAP on Switzerland.

It should be noted that the adoption of the CAP would also imply direct financial transfers between Switzerland and the EU, which are, however, difficult to disentangle from the transfers implied more generally by Swiss membership in the EU. Consider the two changes most closely linked to the implementation of the CAP. On the one hand, tariff revenues on imports from the RW will accrue to the EU and not to Switzerland. In our simulations, these tariff revenues on agricultural and food products amount to 500 million francs after CAP adoption (of which 187 m francs on agricultural products). On the other hand, Switzerland can be expected to receive 900 m francs from the "Guarantee section" of the European Agricultural Guidance and Guarantee Fund

4. There is some controversy on the question whether (or to what extent) existing direct payments in the EU are decoupled from individual farm production levels (see e.g., Gohin and Guyomard, 2000).

(EAGGF).[5] This would leave a net transfer to Switzerland of 400 m francs (0.1 % of GNP), which should be contrasted with a contribution by Switzerland of approximately 0.9 % of GNP in case of EU membership (VAT and GNP resources). As it is not clear which proportion of the latter can be attributed to agricultural policies, we do not include financial transfers in the simulations.

EU membership could also affect agriculture more indirectly, through its overall impact on the rest of the economy. The net contribution of Switzerland to the EU budget would be associated with an increase in the value added tax (VAT). The former would have a contractionary effect, while the latter would deter investment in the sectors which are excluded from the VAT domain, agriculture being one of them. Capital formation would certainly be also affected by labor mobility (expected immigration due to high Swiss wages) and by a possible adoption of the euro (and the subsequent rise in Swiss interest rates). Finally, tariff and non-tariff barriers would be eliminated in all the other tradable sectors of the economy, which will enforce efficient allocation and promote competition. These effects have been dealt with elsewhere (MÜLLER and GRETHER, 1999) and as their interaction with the adoption of the CAP turns out to be rather limited, they will not be considered further in this paper.

3. SIMULATING THE EFFECTS OF THE CAP

The simulation model has been designed such as to capture the main issues involved in Switzerland's accession to the EU. It is useful to give an overview of the model's main characteristics before discussing the way the adoption of the CAP is implemented.[6]

3.1. Overview of the model

As tables 1 and 2 make clear, there is a wide dispersion of protection measures across sectors and countries. To give the most accurate description of the likely effects of adopting the CAP, the simulation model should therefore be disaggregated accordingly. Moreover, a careful analysis of the distributional impact of the CAP can only be carried out if production factors are disaggregated to a sufficient degree.

For trading partners, we assume a three-region world economy with Switzerland, the EU and the RW, each region modeled symmetrically. Thus the level of sectoral disaggregation and the structure of technology and of preferences are identical in all three regions, although their different size is taken into account in the calibration of crucial parameters.

5. See section 251.03 in CONFÉDÉRATION SUISSE (1999).
6. The appendix provides more information on data sources and calibration. The modeling of imperfect competition sectors and of the savings decision in an overlapping generations framework is described in more detail in GRETHER and MÜLLER (2001).

To capture the level of heterogeneity across agricultural activities as well as the difference in incentives from one activity to another, the model includes 41 sectors: 11 agricultural, 7 food, and 23 non-food.

On the supply side, all agriculture and 6 out of 7 food sectors are modeled under perfect competition. In these sectors, output is differentiated according to destination (Switzerland, EU, RW) using a constant elasticity of transformation (CET) function. As Switzerland is a small country, the supply of ist imports from the EU and the RW is assumed to be infinitely elastic. This is a crucial assumption for the determination of welfare effects, but as it is not common in multi-region models we have performed sensitivity analysis regarding this issue (see section 6). Most industrial goods, and the "other food products" sector (representing 47 % of total food production) are modeled under imperfect competition, using a monopolistic competition framework with no barriers to entry.

Technology is assumed to combine value added and intermediate inputs under fixed proportions. Only agriculture uses land (which can be reallocated across agricultural activities), along with five (weakly) substitutable primary inputs: capital and four skill categories of labor. In other sectors (including food products), a more nested CES value-added function allows to capture the widely documented complementarity between capital and skilled labor (see GRETHER and MÜLLER, 2001).

On the demand side, utility maximization of the representative consumer is achieved in two stages. First, the optimal savings rate is determined in an overlapping generations model. Aggregate savings and capital stock are the (endogenous) result of intertemporal optimization and the general equilibrium can be interpreted as the steady state of the economy in a dynamic perspective.

In the second stage, optimal consumption quantities are chosen using a nested three-level CES utility function (see figure A1). The two upper levels of the utility function and ist main parameters have been chosen such as to capture the econometric estimates by CARLEVARO et al. (1994) of price elasticities of demand for food products in Switzerland (see table A1). The lower level of the utility function reflects the Armington assumption which treats the goods from the three regions as imperfect substitutes. By analogy with the supply side, demand for Swiss products in the EU and RW is assumed to be almost perfectly elastic.

3.2. *Main effects of the CAP*

Adoption of the CAP by Switzerland involves two main changes:

a) elimination of trade barriers between Switzerland and the EU;
b) adoption by Switzerland of the common European policy regarding trade with the RW.

If protection consisted only of tariffs, simulating the effects of adopting the CAP would be straightforward. Starting from the tariff data at the 6-digit level, EU tariffs can be reaggregated, using as weights Switzerland's import structure. However, as shown in table 2, estimates of border measures (BM) are available from the OECD for 6 sectors.[7] These measures reflect more accurately the net incentives to production resulting from the wide spectrum of protective instruments in use. Table 3 shows how BM and tariff data are used to determine ad-valorem tariff equivalents and export subsidy equivalents which characterize the current situation.[8] If the CAP is adopted, there is free trade in agricultural products between Switzerland and the EU, and Switzerland adopts the common external tariff (and the corresponding export subsidy rate) on trade with the RW.

Table 3: Changes in trade barriers for agricultural products[a) b)]

	Base case	CAP
Equivalent import tariff rate		
– from EU to CH	$(BM_{CH} - BM_{EU}) / (1 + BM_{EU})$	0
– from RW to CH	BM_{CH}	BM_{EU}
– from CH to EU	t_{EU}	0
– from RW to EU	BM_{EU}	BM_{EU}
Equivalent export subsidy rate		
– from CH to EU	$[t_{EU} + (BM_{CH} - BM_{EU}) / (1 + BM_{CH})] / (1 + t_{EU})$	0
– from CH to RW	$BM_{CH} / (1 + BM_{CH})$	$BM_{EU} / (1 + BM_{EU})$
– from EU to CH	0	0
– from EU to RW	$BM_{EU} / (1 + BM_{EU})$	$BM_{EU} / (1 + BM_{EU})$

Notes: a) applies to agricultural products for which border measures are available. b) BM_{CH} and BM_{EU} denote border measures in Switzerland and EU; t_{EU} is the EU import tariff rate.

The expressions given in table 3 are based on the observation that BM are consistently higher in Switzerland than in the EU. Thus we assume that the EU exports its agricultural goods towards Switzerland without subsidizing them. The equivalent Swiss import tariff on these goods is then given by the difference between border measures; this difference includes actual Swiss tariffs. By contrast, Swiss agricultural exports towards the EU are subsidized at a rate which compensates not only for the differences in prices (or, equivalently, in border measures) but also for actual EU import tariffs.[9]

7. Swiss BM are also reported in column 1 of table 5, along with the tariffs for those sectors that do not have BM estimates.
8. Export subsidies are set to zero in sectors for which no BM are available.
9. To see how this subsidy rate is determined, consider the price of an agricultural product in Switzerland: $p_{CH} = (1 + BM_{CH})p^*$, where p^* is the world price. The producer price of the same product in the EU is $p_{EU} = (1 + BM_{EU})p^*$. If t_{EU} is the EU tariff rate on imports from Switzerland, then the subsidy rate on Swiss exports to the EU, s_{CH}, is defined in such a way that the price of the Swiss good on the EU market is equal to the EU price. Indeed, using the expression for s_{CH} given in table 3 yields: $p_{CH}(1 - s_{CH})(1 + t_{EU}) = p_{CH}(1 + BM_{EU})/(1 + BM_{CH}) = p_{EU}$.

4. EFFICIENCY AND RESOURCE ALLOCATION EFFECTS OF THE CAP

This section presents the aggregate and sectoral effects of moving to the CAP; distributional and compensation estimates are discussed in section 5. The benchmark year for the simulations is 1995 (although 1996 data were used for tariffs to take into account the implementation of the Uruguay Round agreement). Unless otherwise specified, results are expressed in percentage change with respect to the base year.

4.1. Macro results

In our base simulation, the adoption of the CAP yields a welfare gain of 1.0 percent of GDP, representing an increase in real disposable household income of 1.8 percent (see table 4). From tables 4 and 5 it is obvious that these gains are obtained through substantial changes in the production structure of the economy which lead to a dramatic decrease in land rent. These welfare gains are quite important, considering the small size of the agricultural sector in Switzerland. As a point of comparison, HUBBARD (1995) estimated that the abolition of the CAP would increase welfare in the EU by 0.8%. This slightly larger effect in Switzerland might reflect the fact that it is more profitable to

Table 4: Aggregate effects of the CAP (Percentage change relative to base case)

	CAP	CAP + FAL[a]
GDP	1.1	1.1
Welfare of residents (% of GDP)	1.0	1.0
Investment	0.1	0.1
Private consumption	2.1	2.0
Household disposable income	1.8	1.8
Net foreign assets	2.1	2.5
Real exchange rate [b]	1.8	1.7
Terms of trade	−0.2	−0.2
Total exports	3.0	3.2
Exports to EU	2.7	3.0
Exports to RW	3.4	3.7
Total imports	3.7	4.0
Imports from EU	4.0	4.3
Imports from RW	2.7	3.0
Capital stock	0.1	0.1
User cost of capital	1.6	1.4
Average wage rate	1.8	1.6
Return to land	−75.3	−0.5

Notes: a) CAP with 34% of agricultural land left fallow. b) real depreciation if positive.

reduce the very high Swiss protection to European levels, than to abolish the CAP altogether, since the marginal welfare cost of protection increases with the level of protection. Also, note that Swiss trade expands with both partners, in spite of the discriminatory nature of the CAP. Finally, it is striking that the adoption of the CAP does not induce any additional capital formation at the aggregate level (the capital stock remains quasi constant), which suggests that the welfare gain results mostly from static reallocation effects. Indeed, the sensitivity analysis carried out in Section 6 (assuming no international capital mobility) confirms that induced growth effects do not play a significant role.

4.2. Resource shifts

At the macro level, the deepest impact falls by far on the return to land, which decreases dramatically. This is due to the fact that land cannot adjust by moving away from the agricultural sector. By contrast, CAP adoption leads to a substantial reallocation of other factors previously used in the farm and food sectors. This is confirmed by table 5, which presents output and employment changes by sector.

Table 5: Output and employment effects (Percentages)

	Border measure		**Employment**	**Output**
	Base Case [a]	**CAP** [b]		
Wheat	196.0	89.3	−43.6	−42.0
Cereal grains n.e.c.	125.0	47.6	−55.9	−54.3
Vegetable fruit nuts	5.3	39.3	11.6	14.3
Oil seeds	30.9	0.0	−30.5	−28.6
Sugar beet	n.t.	n.t.	−22.7	−20.4
Crops n.e.c.	4.2	5.8	42.6	46.6
Bovine cattle [c]	167.0	88.0	−9.3	−6.6
Animal products n.e.c.	244.0	7.4	−62.5	−61.6
Raw milk	n.t.	n.t.	−30.9	−28.7
Forestry	0.0	0.0	2.6	2.5
Meat products of bovine cattle [c]	167.0	88.0	3.9	3.6
Meat products n.e.c.	244.0	31.8	−32.8	−33.0
Vegetable oils and fats	93.3	7.6	−26.6	−26.8
Dairy products	252.0	103.2	−30.3	−30.4
Sugar	257.0	94.0	−52.1	−52.2
Food products n.e.c. (IRS)	8.5	16.7	5.3	5.3
Beverages and tobacco			2.7	2.5
Other sectors with CRS			0.5	0.4
Other sectors with IRS			2.3	2.3

Notes: a) Initial Swiss border measure towards RW imports. b) CAP-adjusted Swiss border measure towards RW imports. c) Includes sheep, goats, horses. n.t.: non-traded between Switzerland and RW.

Output contraction is larger than 30 % in those sectors where CAP adoption leads to the largest fall in protection (see the first two columns of table 5). For animal products n.e.c. and sugar, the fall in production is even larger than 50 %. By contrast, the only two agricultural sectors where BM are raised (vegetables & fruits and other crops n.e.c.) register a strong increase in production. These are the sectors where land is reallocated, as it cannot be employed outside agriculture. The fall in land rent leads to substitution between production factors, explaining why employment decreases (increases) by a larger (lesser) extent than output in agricultural sectors. In all other sectors, output and employment vary roughly in the same proportion.

5. DISTRIBUTIVE EFFECTS AND ADJUSTMENT COSTS

On the whole, the net gains from the adoption of the CAP seem rather important given the limited size of the agricultural sector in Switzerland. However, the political feasibility of such a policy reform might necessitate important compensatory payments towards farmers. How important would such transfers be? Farmers will suffer from two types of losses. First, as owners of agricultural land (which cannot be used for other purposes, due to political reasons) they will experience an important income loss. Second, agricultural employment falls by 30 % with the adoption of the CAP. Agricultural workers will have to bear the costs that are caused by the adjustment to the new situation. These two issues will now be considered in turn.

5.1. Distributive impact

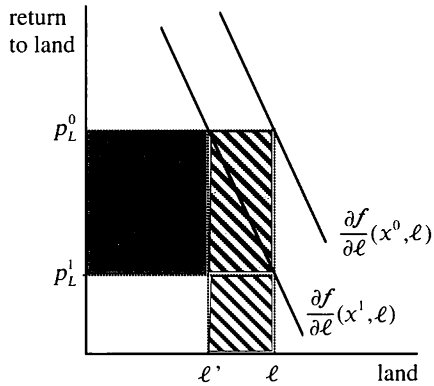
From the perspective of political feasibility, our estimates of net welfare increase must be put in balance with the gross losses suffered by agricultural households. These losses might be important in the Swiss case, because Switzerland presents an economic structure which is close to the "rich country" archetype analyzed by ANDERSON (1995), where agricultural protection has been shown to produce greater gains for farmers and smaller losses for other sectors than in poor economies.

As an estimate of the transfers implied by CAP adoption in Switzerland, the variation in the return to land provides a good approximation. As already noted in table 4, the return to land decreases by 75 %. Under reasonable assumptions,[10] this drop might imply a relative decrease in agricultural income by 15 %. At the aggregate level, the loss of land rent represents 0.18 % of GDP. If distortion-free direct payments[11] can be implemented,

10. The share of labor payments in agricultural value-added is roughly 70 %, the remaining share being equally distributed between capital and land. If the entire capital stock and 20 % of farm labor are hired, the decline in land returns hits approximately 20 % of the income of a hypothetical agricultural household (abstracting from other income sources and from the slight increase in wages).
11. In the context of the assumptions used in our model, direct payments based on acreage would be distortion-free (i.e. they would not have any impact on economic incentives), since the supply of agricultural land is fixed.

this is the amount that would be necessary to compensate those farmers who remain in business after the adoption of the CAP. This amount is represented by the grey area in figure 1, where the marginal product of land in the agricultural sector is depicted before and after adoption of the CAP.[12]

Figure 1: CAP, Land Rent and Transfers



Is there a cheaper alternative to such a policy of compensatory transfers? Assume that the government pays farmers to leave some of their land fallow and that the proportion of land left fallow is chosen such that the return to land is stabilized at the pre-CAP level (p_L^0 in Figure 1). Then farmers cultivate only a surface equal to ℓ' and the government compensates farmers by an amount equal to the hatched area in Figure 1. Interestingly, it turns out that this compensation amounts to only 0.08 % of GDP (although 34 % of total land is left fallow), which is less than half the amount needed for compensation through acreage payments (the grey area). Obviously, this result hinges on the low price-elasticity of demand for land, implied by the calibration of our model (see table A 1).

It should be emphasized that such a policy of fallow land should not be taken too literally. Alternatively, farmers might be paid conditionally on performing ecological services on parts of their land. The important point is that a large proportion of agricultural land is not cultivated, keeping therefore the return to cultivated land at pre-CAP levels (see last column of table 4). It should however be acknowledged that, although this policy is less costly than acreage payments, it reduces agricultural employment even further. Indeed, the marginal cost of agricultural products is higher than in the "pure" CAP scenario because of the higher cost of land. As a result, agricultural output and employment fall even more (by 34 % relative to the base case). However, the total welfare gain is unchanged and other aggregate indicators are hardly affected (see table 4).

12. In this figure, superscripts 0 and 1 denote the situation before and after the adoption of the CAP, ℓ is the use of land in the agricultural sector, p_L denotes the return to land and x designates production factors other than land used in the agricultural sector.

5.2. *Adjustment costs*

Labor reallocation across sectors implies costs that the simulation model does not account for. Thus they should be subtracted from the long run estimated benefits. Adoption of the CAP leads indeed to a substantial reallocation of labor out of the farm and food sectors, as the third column of table 5 illustrates in detail. These adjustments take time and often involve activities including job search, relocation and training. Good information on these costs is lacking. However, following DE MELO and TARR (1992), we can rely on a proxy for adjustment costs given by the discounted value of displaced workers' earning losses. Denote by $AC_{i,t}$ the earning losses of workers in sector i, year t. The discounted adjustment costs in sector i, DAC_i, is calculated as:

$$\text{DAC}_i = \sum_{t=0}^{n} \frac{AC_{i,t}}{(1+r)^t} = \sum_{t=0}^{n} \frac{\alpha_{i,t} Y_i}{(1+r)^t} L_i^d \tag{1}$$

where Y_i is the per capita income of non displaced workers, L_i^d the number of displaced workers, $\alpha_{i,t}$ the income loss (in percentage) of displaced workers, n the time horizon and r the discount rate.

To estimate (1), the values of Y_i and L_i^d are derived from the simulations and the discount rate is set to 5 %. We assume that displaced workers loose 50 % of their income during the first two years, 15 % in the subsequent four years and 0 % afterwards, with a corresponding time horizon set to six years.[13] It turns out that overall adjustment costs ($DAC \equiv \sum DAC_i$) represent 1.03 % of GDP (0.6 % for farm products and 0.4 % for food products).

These figures are not directly comparable to the net efficiency gains as they are discounted over six years. Thus, the annual adjustment costs (aggregated over sectors, $AC_t \equiv \sum AC_{it}$) are subtracted from efficiency benefits, EB (e.g. 1.0 % of GDP in table 4), and discounted over six years to provide an estimate of the discounted net benefits, DNB:

$$\text{DNB} = \sum_{t=1}^{n} \frac{EB - AC_t}{(1+r)^t} \tag{2}$$

Note that this is a conservative estimate of the net benefits as after six years earning losses are zero while efficiency benefits do not decay.

13. Unfortunately, data on earning losses of displaced agricultural workers do not exist for Switzerland. The values of α_{it} we use in our calculations are derived from the estimates of JACOBSON (1978) for US steel workers. In a more recent study, JACOBSON et al. (1993) found that displaced non-manufacturing workers in Pennsylvania who obtained a new job in another sector suffered an earning loss of 26 % (33 %) three (six) years after their displacement. Applying these alternative values over the same time horizon does not significantly affect our results.

Following (2), it turns out that discounted net benefits represent 4.97 % of GDP. The benefit-to-cost ratio (DNB/DAC) is 4.8. Thus, for every franc of adjustment costs, the economy gains about 5 francs from CAP adoption.

6. SENSITIVITY ANALYSIS

It is useful to explore the sensitivity of results regarding terms-of-trade effects, returns to scale, product differentiation and international capital mobility. This leads to five versions of the model which are listed in table 6. The base simulation (BASE) includes increasing returns to scale in most industrial sectors. A first experiment is to run the same simulation but imposing constant returns to scale and perfect competition (PC) in all sectors.

Table 6: Sensitivity Analysis: Alternative Model Specifications

		BASE	PC	CES	CES-CET	CAP IMM
Returns to scale:						
Some sectors with IRS		X		X	X	X
All sectors with CRS			X			
Product differentiation in EU and RW:						
Elasticity of substitution between domestic and imported goods:	High	X	X			X
	Low[a)]			X	X	
Elasticity of transformation between domestic and exported goods:	High	X	X	X		X
	Low[a)]				X	
International capital mobility						
perfect mobility		X	X	X	X	
no mobility						X

Note: a) set at Swiss levels (see table A 1).

Second, as described above, the BASE simulation relies on an elasticity of substitution between domestic and imported goods (and an elasticity of transformation between domestic and exported goods) which is low in Switzerland and very large in the other two regions. This asymmetric treatment was designed to minimize terms-of-trade fluctuations, which tend to be exaggerated for small countries in models of trade liberalization incorporating the Armington assumption for foreign export demand (DE MELO and ROBINSON, 1989).[14] However, it is instructive to revert progressively to the "symmetric" case. We assume first that the elasticity of substitution in the EU's and RW's Armington function is reduced to the level adopted for Switzerland (CES simulation). This version is representative of the GTAP family of models (see e.g. HERTEL (1999) or HUBBARD

14. See also BROWN (1987) for an analytical treatment and SHIELLS and REINERT (1993) for an empirical discussion.

(1995)). Finally, in the CES-CET simulation, we assume furthermore that the elasticity of transformation in the production of EU and RW is set to Swiss levels.

In the BASE simulation, capital is assumed to be perfectly mobile internationally. As a result, the Swiss real interest rate is tied to the world interest rate, and adjustments on the capital market are realized through variations in net foreign assets. In the last experiment, we reverse this hypothesis: with capital internationally immobile (CAP-IMM), the Swiss interest rate varies freely and might therefore induce more important dynamic effects through capital formation.

Results for these alternative specifications of the model appear in table 7 (along with the replication of the results for the BASE simulation). When all sectors exhibit constant returns to scale and perfect competition (see column "PC"), welfare gains are slightly smaller. This could be expected, as the reallocation of agricultural labor to other sectors does not generate scale economies anymore. However, even at the sectoral level, results seem surprisingly close to the BASE simulation. A similar result is obtained when the elasticity of substitution in the EU's and RW's Armington function is reduced to the level adopted for Switzerland (column "CES"). There is a slight improvement in the terms of trade generated by the reduction of Swiss export subsidies. Again, results are not significantly different from the BASE case.

Then we assume that the elasticity of transformation in the production of EU and RW is set to Swiss levels. In this (less plausible but) perfectly symmetric case, Switzerland has monopsonic power on its imports (see column "CES-CET"). Here the reduction of import tariffs deteriorates the terms of trade, and welfare gains are substantially diminished.

In the CES-CET case, and following the same logic as in section 5.1, it turns out that the gross loss of agricultural households (around 0.57 % of GDP) is larger than the overall net gain of the economy (0.3 % of GDP). Thus, were adverse terms of trade to materialize, the transfers necessary to keep farmers' income constant would mean a substantial decrease of the gross gains of other actors by more than 50 %. However, as changes in sectoral employment are more limited than in the BASE case, this also means lower adjustment costs.

In the absence of international capital mobility, the increased savings generated by the adoption of the CAP cannot be accumulated as foreign assets. Instead, the Swiss real interest rate (which does not move in parallel with the world interest rate as in the case of perfect capital mobility) falls and increases the firms' demand for capital. Thus the main difference between this version of the model and the BASE simulation is the greater increase in the capital stock (which remains modest, at 0.5 % instead of 0.1 %) and the implied difference in factor price variations (wages rise more and the cost of capital less than in the BASE simulation). Aggregate welfare effects are, however, identical to the BASE case. At the sectoral level, only the output of sectors with increasing returns to scale increases significantly more than in the base case. As the output variations in the agro-food sectors are strikingly similar to the case with perfect capital mobility, adjustment cost estimates are quasi identical. Whatever the version of the model, the benefit-cost ratio of CAP adoption remains larger (or becomes only slightly smaller) than 2 (see last line of table 7).

Table 7: Sensitivity Analysis: Alternative Results

Model[a)]	BASE	P.C.	CES	CES-CET	CAP IMM
I. Aggregate results (percentage change)[b)]					
GDP	1.1	0.9	1.1	0.6	1.2
Welfare of residents	1.0	0.8	1.0	0.3	1.0
Investment	0.1	−0.1	0.1	0.0	0.5
Private consumption	2.1	1.7	2.0	0.6	2.0
Disposable income households	1.8	1.5	1.8	0.6	1.7
Net foreign assets	2.1	1.2	2.0	0.2	
Real exchange rate	1.8	2.0	1.9	1.0	1.9
Terms of trade	−0.2	−0.3	0.1	−0.4	−0.2
Total exports	3.0	3.0	2.8	2.2	3.4
Exports to EU	2.7	2.7	2.6	2.0	3.1
Exports to RW	3.4	3.5	3.2	2.6	3.9
Total imports	3.7	3.6	3.6	1.5	3.8
Imports from EU	4.0	3.8	3.9	1.5	4.1
Imports from RW	2.7	2.6	2.7	1.2	2.8
Capital stock	0.1	0.0	0.1	0.0	0.5
Return to land	−75.3	−71.5	−71.7	−57.3	−75.3
User cost of capital	1.6	1.6	1.6	0.7	1.1
Average wage rate	1.8	1.7	1.8	0.8	2.2
II. Output effects (percentage change)[c)]					
Wheat	−42.0	−42.0	−41.8	−29.9	−42.0
Cereal grains n.e.c.	−54.3	−54.3	−54.2	−41.2	−54.3
Vegetable fruit nuts	14.3	13.5	13.4	8.4	14.2
Oil seeds	−28.6	−29.1	−29.4	−25.5	−28.5
Sugar cane and beet	−20.4	−20.5	−20.0	−13.8	−20.5
Crops n.e.c.	46.6	44.8	15.8	11.2	46.9
Bovine cattle	−6.6	−5.7	−5.0	−5.4	−6.7
Animal products n.e.c.	−61.6	−60.7	−60.6	−36.0	−61.6
Raw milk	−28.7	−23.0	−21.9	−17.4	−28.8
Forestry	2.5	3.2	1.0	0.6	3.0
Meat products of bovine cattle	3.6	3.8	4.4	1.0	3.5
Meat products n.e.c.	−33.0	−32.4	−32.4	−17.4	−33.1
Vegetable oils and fats	−26.8	−26.7	−27.6	−20.7	−26.8
Dairy products	−30.4	−24.6	−23.5	−18.3	−30.5
Sugar	−52.2	−51.7	−51.3	−34.6	−52.2
Food products n.e.c. (IRS)	5.3	4.4	5.1	2.9	5.3
Beverages and tobacco	2.5	2.1	2.5	1.3	2.5
Other sectors with CRS	0.4	0.3	0.3	0.1	0.5
Other sectors with IRS	2.3	2.1	2.3	1.9	2.6
III. Adjustment costs (percentage of GDP except for DNB/DAC)[d)]					
farm products	0.6	0.5	0.6	0.4	0.6
food products	0.4	0.4	0.4	0.2	0.4
total (DAC)	1.0	0.9	0.9	0.6	1.0
discounted net benefits (DNB)	5.0	3.9	5.1	1.2	5.0
benefit-cost ratio (DNB/DAC)	4.8	4.2	5.4	1.8	4.8

Notes: a) see table 6 for description of models. b) see also table 4. c) see also table 5. d) see equations (1) and (2).

7. CONCLUSIONS

Although the CAP is not an example of free trade policy, it is less protectionist than Swiss agricultural policy. As a result, its application to Swiss agriculture could generate important welfare gains at the aggregate level. The simulations presented in this paper estimate a range of 0.3 %-1.0 % of GDP for this welfare gain, depending on the market power of Switzerland in international markets and the degree of unexploited scale economies in other sectors of the Swiss economy.

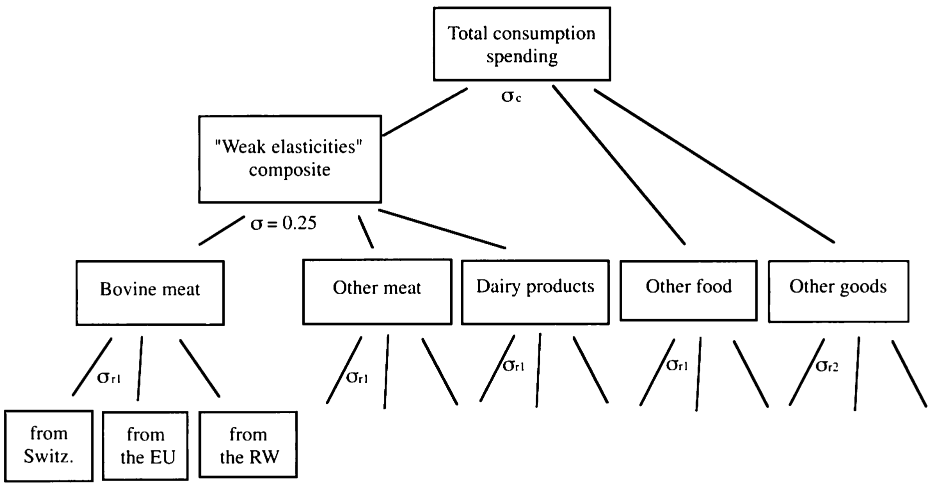
These results must be put in balance with the strong decrease in land returns, which depresses the income of agricultural households, and with the sharp reduction of employment in agricultural and food sectors, which might generate adjustment costs. Our estimates suggest that the costs of redistributive schemes to stabilize farmers' income do not exceed one fifth of net welfare gains, and may even be significantly smaller if appropriate mechanisms to prevent the fall in land return can be implemented. Moreover, adjustment costs amount to one fifth of efficiency gains in our preferred version of the model, although they might represent up to half of these gains in the most adverse (but least plausible) case.

Finally, it should be recognized that the calibration of the simulation model had to rely on a certain number of assumptions because of the shortage of data. Although we tested the sensitivity of results to some of these assumptions, there remain two issues which are more difficult to quantify. On the one hand, it could be argued that our estimates of welfare gains are biased upwards because they fail to take into account future agricultural policy liberalization which would take place even if Switzerland remains outside the EU. Both Switzerland and the EU are indeed committed to a process of reforms (whose actual consequences are difficult to anticipate), while this paper uses 1996 tariff equivalents in the base year and may thus overstate the future differences between the two agricultural regimes. On the other hand, our estimates are quite conservative in assuming the absence of unexploited scale economies in agriculture. Therefore, we neglect the additional welfare gains that may result from pro-competitive and rationalization effects, which could also be quite large and would attenuate the contraction of agricultural output. The net outcome of these two effects is difficult to estimate as there is not enough data to make realistic assumptions about these parameters of the model.

APPENDIX

This appendix summarizes the parameters of the model which are crucial for the simulation of agricultural policies. A more detailed description of a previous version of the model can be found in MÜLLER and GRETHER (1999), hereafter MG.

Figure A1: Structure of Preferences



Data sources: The 1995 social accounting matrices (SAM) for the EU and the RW were obtained from the GTAP data base (version 4).[15] For Switzerland, we updated the 1990 SAM elaborated by ANTILLE and GUILLET (1998). In the matching process (see table B3.2 in MG for a correspondence between the two classifications), Swiss data were maintained for trade with the other two regions, adjusting trade flows between the EU and the RW.

Swiss tariffs were calculated from a data base provided by the Swiss customs authorities, while EU tariffs come from the Integrated Data Base of the World Trade Organization. Both sources provided information at the 8 digit level, but while Swiss data covered all types of tariffs, the European ones were limited to MFN tariffs. To account for the free trade agreement between Switzerland and the EU, European tariffs on imported industrial goods from Switzerland were replaced by their Swiss ad valorem equivalent. As the first measures of the Uruguay Round agreements were implemented in mid-1995, tariffs for 1996 were used in this study.

15. See HERTEL (1997) and MCDOUGALL et al. (1998).

Table A1: Parameters of the Simulation Model

(i) Supply parameters

A) Elasticities of substitution between		
• Valued-added and intermediates		0
• Primary inputs in agriculture		0.25
B) Elasticity of transformation (perfect competition sectors) between		
• Domestic and exported goods in Switzerland		2.0
• Domestic and exported goods in the EU/RW		∞

(ii) Demand parameters

A) Substitution elasticities		
• Intertemporal	0.25	
• Consumer goods(σ_C)	1.0	
Between domestic and imported goods (perfect competition sectors)		
	Switzerland	EU/RW
• Agriculture and food (σ_{r1})	2.5	50
• industry and services (σ_{r2})	3.0	100
B) Food sectors price-elasticity of demand		
Sector:	Calibrated elasticity[(a)]	Estimated elasticity[(b)]
• Bovine meat products	−0.36	−0.33
• Meat products nec	−0.50	−0.33
• Dairy products	−0.50	−0.47
• Vegetables, fruits, nuts	−0.99	−1.14
• Vegetable oils and fats	−1.00	−1.35
• Food products nec	−0.97	−1.19
• Aggregate food	−0.91	−1.49

Notes: (a) Compensated price elasticity of demand. (b) From CARLEVARO et al. (1994).

The original Swiss SAM only included one sector for agriculture and one for food products. For the analysis of agricultural policies, the input/output matrix was inflated to include 11 farm products and 7 food products. This was done using Swiss data on production, consumption and external trade and by applying a RAS procedure on the basis of the Danish input/output matrix included in the GTAP data base and described by JACOBSEN (1998). The adjustment only affected inter-industry flows which included agricultural or food products. For more details on this procedure, see appendix B.2 in MG.

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SUMMARY

The long run impact of adopting the Common Agricultural Policy for Switzerland is analyzed on the basis of a three-region applied general equilibrium model. Estimates suggest that, because of the present high protection of agriculture, integration generates important net welfare gains (about 1 % of Swiss GDP) in spite of the small size of the agricultural sector. Taking into account adjustment costs due to temporary unemployment still produces sizeable welfare gains. Estimates of the distributive impacts are also provided along with an analysis of the robustness of results.

ZUSAMMENFASSUNG

Wir analysieren die langfristigen Auswirkungen einer Teilnahme der Schweiz an der Gemeinsamen Agrarpolitik der EU mit Hilfe eines angewandten allgemeinen Gleichgewichtsmodells, das drei Regionen umfasst. Unsere Simulationen ergeben, dass wegen des aktuellen hohen Protektionsgrades der Landwirtschaft substantielle Wohlfahrtsgewinne (von etwa 1 % des BSP) erwartet werden können, trotz des kleinen Anteils der

Landwirtschaft am BSP. Auch wenn Anpassungskosten, verursacht durch temporäre Arbeitslosigkeit, einbezogen werden, bleiben beträchtliche Wohlfahrtsgewinne. Der Artikel enthält ebenfalls eine Schätzung der Verteilungswirkungen und Sensitivitätsanalysen.

RÉSUMÉ

L'impact à long terme de l'adoption de la politique agricole commune par la Suisse est analysé au moyen d'un modèle d'équilibre général appliqué à trois régions. Les résultats suggèrent qu'en raison de la forte protection de l'agriculture, et en dépit de la taille réduite du secteur agricole, l'intégration génère d'importants gains de bien-être net (environ 1 % du PIB suisse). Les gains de bien-être restent positifs même après la prise en compte des coûts d'ajustement dûs au chômage temporaire. Le papier inclut également une simulation des effets distributifs et une analyse de la robustesse des résultats.