The Reform of the Swiss Agricultural Policy : A Multifunctionality Approach of the Agriculture in a CGE Framework

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Abstract

The main feature of the Swiss reform is to decouple direct payments from agricultural production. These payments are given for environmental farming and not as a function of the quantity produced. We study the impact of these measures within the framework of a single-country, 22-sector computable general equilibrium model, where farm policy instruments are explicitly represented and environmental farming modelled as a public good. For the parameters of our model, the reform decreases the welfare of the farmers due to the non-compensated diminution of the raw milk quota rent. However the reform increase the social welfare because of substantial gains from agricultural trade liberalization.

JEL classification: D58; F13; H41; Q18

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1 Introduction

Before the agricultural reform, Swiss agriculture policy has been marked by the principle of ensuring self-sufficiency and characterized by price and market guarantees. This has led to an over-production and high production costs within the agricultural sector during the 1970s and the 1980s. The aim of the reform is then to make the farm sector move away from an exclusive food producing role and become more clearly multifunctional. Public services are remunerated through direct payments. These are not tied to agricultural production, but linked to the degree of ecological farming. The central element in the reform package is the gradual shift from price supports to a system of decoupled direct payments conditional on an environmentally friendly farming. The purpose of the paper is to analyse how the welfare of consumers is affected by this new orientation of the agricultural policy. One intuitively expects they should be better off because of the non-distortionary characteristic of this new instrument[1].

This question is investigated within the framework of a single-country, 22-sector computable general equilibrium model, where farm policy instruments are explicitly represented and environmental farming modelled as a public good. Some existing CGE models of Europe have addressed EU agricultural protection and policy reform (Harrison, Rutherford, and Wooton, 1989; Burniaux et al., 1990; Folmer et al., 1995). Other CGE models have examined the economic implications of the Uruguay Round Agreement (Francois, McDonald, and Nordström, 1995; Goldin and van der Mensbrugghe, 1995; Harrison, Rutherford, and Tarr, 1995; Hertel et al., 1995). However all these models either approximate policies as exogenous price wedges or does not provide a detailed coverage of agricultural sectors. Work on explicitly modelling the Common Agricultural Policy in CGE models is scarce (Harrison, Rutherford, and Wooton, 1995; Weyerbrock, 1998) and relies on work by Kilkenny and Robinson (1988) and Kilkenny (1991) on modelling US agricultural policies.

In Switzerland however there is no research on this specific topic. Nevertheless, some existing CGE models have examined the issue of a EU membership (Grether and Mueller, 1999; van Nieuwkoop and Mueller, 1999) or the impact of the Common Agricultural Policy for the Swiss economy (Mueller and Grether, 2000). Introducing the milk quota in the GTAP model[2], Lips and Rieder (2001) analyse the consequences of the suppression of Swiss export subsidies. Our contribution is therefore threefold. First the Swiss agricultural policy reform have not been quantified yet. Second the model formulation integrates the explicit

[1]The theory of second best tells us that it is not always the case. Using a GE model with distortionary income taxation, Chambers (1995) analyses the incidence of different agricultural policies and found that, at the margin, supply control through acreage retirements may dominate lump-sum transfers if the tax system is highly inefficient and subsidies are very high.

[2]GTAP is the abbreviation for Global Trade Analysis Project based at Purdue university (Hertel, 1997).

modelling of agricultural policies, in particular the raw milk quota. Finally, this model represent a first essay on modelling the multifunctionality of agriculture.

The outline of the paper is as follows. A brief description of the Swiss agricultural reform is given in the next section. The model is described in section 3. Section 4 discusses the explicit modelling of agricultural policies. An overview of the data is given in section 5 and section 6 presents the different scenarios of the agricultural reform. Our results and concluding remarks follow in sections 7 and 8 respectively.

2 The Reform of the Swiss Agricultural Policy

Since the Second World War farm policy objectives are exclusively oriented towards economic ends through the maintenance of farm incomes, the assurance of reasonable prices to consumers and the need for food security. Market-managed price supports provide the principal thrust of policy mechanisms and are completed by structural policy measures to take into account the modernization of the farming industry. This leads to an increase in food production towards a greater degree of self-sufficiency and high production costs within the agricultural sector during the 1970s and 1980s. Consequences are significant shifts in the objectives of agricultural policy by the end of the 1980s. Whilst farm income maintenance and consumer protection remain, food security goals are displaced by specific objectives for the environment, ecology and the welfare of the rural community.

The reform embraced a full reappraisal of the functions and role of the farm sector, in particular the desire to conform to the Uruguay Round Agreement on Agriculture and to satisfy the new objectives. The farm sector has to move away from an exclusive food producing role to become more clearly multifunctional. The first phase of this new orientation focuses on splitting up price and income policy. Public services such as maintaining the landscape, biodiversity and wildlife habitats are remunerated through direct payments, which are not in function of the agricultural quantity produced. Moreover compensatory payments induce farmers to a more ecological farming or even organic farming. The second phase consists mainly of abolishing all price and market guarantees. At the same time, the more ecological farming regime becomes compulsory for all direct payments. In 1996 the Swiss nation approves this reform by accepting the article 104 of the federal Constitution assigning to agriculture the role

- to ensure the supply of food to the population;
- to protect natural resources;
- to maintain the landscape;
- to spread out the population throughout the territory.

In the pursuit of these new objectives, Swiss agricultural policy may be at present characterized by three elements. The central element is the gradual shift

from price supports to direct payments decoupled from production[3]. These are given only to farmers satisfying the environmentally friendly farming on the whole of their agricultural land and not just targeted areas. The second one is related to the consequences of the Uruguay Round Agreement on Agriculture, in particular the scaling down of domestic support prices by 20% and the conversion of all non-tariff border measures into tariff equivalents. Finally, social and structural policies provide the third element of policy, to ease the operation of the industry and to allow its adjustment towards the fulfilment of the new policy objectives.

According to the new objectives for agriculture only one of the four is related to food production whereas the three others are closely related to the notion of environmental public services. In practice public services are achieved through production and environmental constraints such as specific conditions for animal husbandry or a well balanced use of fertilizer. As this kind of public services verifies the characteristics required for the definition of a pure public good, the multifunctionality of agriculture[4] is represented by the joint production of an agricultural private good and a public good. The production is joint because the farmers have the choice between the ecological farming implying a decrease of agricultural production and a standard farming with a smaller public good output[5]. The modelling of these public services as an externality is not appropriate in this case because it does not allow to take into account the allocation of primary factors into the production process. It was true before the reform since it was more the result of a traditional way of farming than the application of given ecological standards whereas now farmers have to engage primary factors to satisfy the necessary conditions linked to the decoupled direct payments.

3 The CGE Model

The analysis of the Swiss agricultural policy reform is based on a static, single-country, 22-sector computable general equilibrium model. Because of the importance of international trade in Switzerland, the model takes into account the foreign trade but under the small-country assumption. The institutions are represented by a farm household, a nonfarm household and by the government. Capital expenditure for the three institutions are included in a capital account.

[3]These transfers are computed on an hectarage or headage base.

[4]Agriculture may be defined as multifunctional when it has one or several roles or functions in addition to its primary role of producing food and fibre.

[5]The reason is for example that in the latter case, a higher agricultural production is achieved only with a high contribution of natural resources which decreases the public good output.

3.1 Producer behaviour

The sub-model of producer behaviour encompasses ten agricultural sectors, four food sectors, four industrial sectors and four service sectors. All need two primary factors, labour and capital. In addition, agricultural sectors employ land and produce, through a constant elasticity of transformation (CET) function, the public good jointly to their sector specific output. Each sector produces a composite commodity that can be transformed into domestic supply and exports according to a CET function. Producers are assumed to maximize profits subject to their production technology represented by a two-stage production function. The upper level is a Leontief combination of value-added and intermediate inputs. On the lower level, all primary factors are combined using a constant elasticity of substitution (CES) function and, following Armington (1969), intermediate demand is represented as a composite of imported and domestic goods.

3.2 Consumer behaviour

In this economy the farm and the nonfarm representative consumers maximize a utility function subject to a budget constraint that equals the revenue of primary factors net of taxes as well as the rents from production and tariff quotas. This income is allocated to private expenditure, savings (domestic and foreign investment demand), transfers to government and the balancing of the net trade surplus. The model takes into account a leisure-labour choice so that an increase in labour subsidies incorporates the incentive to work associated with a higher net wage. The consumer's welfare is achieved through a four-stage procedure using at each nest a CES function. At the highest decision level, the household chooses between leisure and the composite consumption good. Then, he has the choice between public and private consumption. At the third and fourth levels of the optimization process, the agent determines the optimal quantity for each private good which can be, as intermediate inputs, a domestic or imported commodity.

In factor markets, the model include the following assumptions. Labour and capital are perfectly mobile between sectors, while land is imperfectly mobile among crops to reflect the strict crop rotation. The mobility of this sluggish endowment is described with a CET revenue function. The final equilibrium has thus sectorally differentiated rental rates. Perfect mobility of labour and capital means that farm labour and capital markets are fully linked to nonfarm markets so that farm-nonfarm migration may occur. The final equilibrium has in this case an unique factor return for the labour and capital markets.

Using the dual approach allows us to get rid of the constant returns to scale problem on the production side and, on the consumption side, gives us immediately a Hicksian money metric welfare index and a true cost-of-living index. Moreover, in order to take the consumer utility for the public good into account, this one has to be part of his expenditures. Following Rutherford (1998), the

trick is to endow the consumer with his own demand of the public good leaving thus the budget constraint unaffected. A quantity constraint assures that he does not consume more than the available production.

3.3 Public sector

The role of the government in this economy is twofold. The first is to regulate the public good market whereas the second is to ensure public sector output. This one is exogenous and is produced from the intermediate demand of public administration and social security. Government expenditure are supposed to be fixed.

Since there is no market for the public good, the intervention of the government is necessary. The production of the public good is then induced by the government through decoupled direct payments which are conditional on production and environmental constraints. The farmers satisfying these conditions obtain the direct payments. This transfer can be seen as the purchase of the public good by the government. Fixing the total amount of decoupled direct payments the government may thus determine the desired level of public good production.

Regarding the government income, it is obtained from collecting value-added taxes represented by a flat ad valorem tax on consumption goods, income taxes on labour and capital, tariffs and net production taxes. Balanced budget is achieved through the endogenous VAT rate on industrial goods and services.

3.4 Investment

Investment output is assumed to represent a Leontief aggregation of market commodities. Each of these investment sector demand is defined by an Armington (1969) aggregation of domestic and imported inputs. The composition of investment sector inputs responds to relative prices. This defines a price index for investment composed by prices of the invested goods.

The second closure rule is the balance between aggregate investment and savings. In this simple static model, private and government savings are assumed to be fixed so that aggregate investment is exogenous as well. Saving is modelled as a negative endowment for the representative household. In addition, as investment includes inventories, net negative investment corresponds to inventory reductions fixed exogenously at the base year.

3.5 International trade

Given the fact that Switzerland is an open and relatively small economy, world prices are treated as exogenous variables. Again we follow the Armington (1969) approach by assuming that imports are imperfect substitutes for similar domestic

commodities. Exports and supply for the domestic market of a commodity are a joint product of domestic production. Transfers from and to the rest of the world are mainly composed of factor revenue and are fixed. The last closure rule of the model is to impose trade balance with respect to the rest of the world accounting for those transfers and an exogenously specified net capital outflow. This is modelled as a negative endowment of the foreign exchange commodity for the representative consumer. The balance-of-payments equilibrium is then achieved by purchasing this asset. As the balance of transfers and the balance on capital account are set exogenously, the balance-of-payments equilibrium in the simulations is obtained by permitting the real exchange rate to float.

4 Modelling Policies

Our approach to policy modelling is based on Weyerbrock (1998) and Kilkenny (1991) since it allows a differentiation between exogenous and endogenous or coupled and decoupled policies. Explicit modelling of policies means that they are represented as closely as possible how they really work. The main instrument of the Swiss agricultural policy are direct payments not linked to agricultural production. Other internal market support measures are input subsidies on labour and capital, output subsidies and quotas on production. Trade policies include tariffs and tariff quotas as well as export subsidies.

4.1 Domestic policies

As said earlier, the reform of the agricultural policy is intended to remunerate the public good production through direct payments decoupled from agricultural production. These are modelled as the purchase by the government of the output produced by each agricultural sector,

$$\bar{dp} = \sum_{j \in A} p_{\text{pgd}} y_{\text{pgd},j} \tag{1}$$

where $\bar{dp}$ are the direct payments set exogenously by the government. The price, p_{pgd}, is the direct payment rate necessary to obtain the given direct payments and the resulting quantity, y_{pgd}, is the degree of ecological farming. The former may represent the incentive degree to produce the public good and the latter the share of the country's agricultural land farmed in an ecological way.

Social and structural policies are represented by an ad valorem input subsidy rate on labour,$-\tau^Z_{\text{lab},j}$, and on capital, $-\tau^Z_{\text{cap},j}$, respectively. The user cost is then

$$p^Z_{\text{lab},j} = p_{\text{lab}}(1 + \tau^Z_{\text{lab},j}) \tag{2}$$

for labour and

$$p^Z_{\text{cap},j} = p_{\text{cap}}(1 + \tau^Z_{\text{cap},j}) \tag{3}$$

for capital. Consequently, the subsidy decreases the producer cost of inputs. In both cases, the subsidy rate is endogenous to meet the target expenditure of the social and structural policies.

Subsidies on production are modelled as an ad valorem subsidy on output g, $-\tau_{gj}^{Y}$. The user cost is in this case

$$p_{gj}^{Y} = p_g(1 - \tau_{gj}^{Y}) \tag{4}$$

so the subsidy increases the producer value of output. The subsidy rate is endogenous as well in order to satisfy the total expenditure relative to market support.

The model includes also a quota on raw milk production. Defining $\bar{y}_{\text{rmk,rmk}}$ as the output quota level and $y_{\text{rmk,rmk}}$ as the unrestricted quantity of supplied production, the explicit modelling of this device takes the form of a quantity constraint

$$y_{\text{rmk,rmk}} \leq \bar{y}_{\text{rmk,rmk}} \qquad (\rho_{\text{rmk,rmk}}^{Y}) \tag{5}$$

whose Lagrange multiplier, $\rho_{\text{rmk,rmk}}^{Y}$, is the shadow price representing the quota rent attributed to the farmers since the rights to produce are not auctioned by the government.

4.2 Trade policies

Switzerland uses export subsidies to dispose its exports of agricultural or food commodity g on world markets. The ad valorem export refund rate, $-\bar{\tau}_g^E$, is exogenous whereas γ_g^E is an endogenous tax rate,

$$p_{g,\text{E}} = \bar{p}_g^E(1 - \bar{\tau}_g^E + \gamma_g^E)p_{FX} \tag{6}$$

where p_{FX} is the real exchange rate. Therefore, adding an inequality constraint which defines a ceiling, $-\bar{c}_g^E$, on export subsidy expenditure

$$\left(\bar{\tau}_g^E - \gamma_g^E\right)\bar{p}_g^E p_{FX} e_g \geq \bar{c}_g^E \qquad (\gamma_g^E) \tag{7}$$

ensures that export subsidies are not greater than the specified level but may be smaller.

All customs duty are considered as ad valorem tariffs and are represented by an exogenous price wedge between the world market price, $\bar{p}_g^M$, and the domestic price of imports, $p_{g,\text{M}}$,

$$p_{g,\text{M}} = \bar{p}_g^M(1 + \bar{\tau}_g^M)p_{FX} \tag{8}$$

where $\bar{\tau}_g^M$ is the tariff rate for a given commodity g.

Due to the Uruguay Round Agreement on Agriculture all non-tariff barriers on product g are converted in Switzerland into a two-part tariff quota. This is explicitly modelled, which means that a lower rate, $\underline{\tau}_g^M$, applies until a specified

Table 1: Domestic and trade policies in the base year (in mio. CHF)

Instruments	Agriculture	Food	Industry	Services	Totals
Direct taxes					51'311
Value-added taxes	229	421	6'666	5'112	12'428
Social measures	88				88
Structural measures	338				338
Net output subsidies	1'250	167	-2'782	1'661	296
Production quota rent	608				608
Direct payments	1'522				1'522
Export subsidies	33	481	249		763
Tariffs	184	461	4'647		5'292
Tariff quota rents	548	1'591			2'139

threshold level, $\bar{m}_g$, is attained and a higher tariff rate, $\overline{\tau}_g^M$, is used beyond this level. This two-part tariff rate schedule is thus monotone increasing,

$$\bar{\tau}_g^M = \begin{cases} \underline{\tau}_g^M & \text{for} \quad m_g \leq \bar{m}_g \qquad (\rho_g^M) \\ \overline{\tau}_g^M & \text{for} \quad m_g > \bar{m}_g \end{cases} \tag{9}$$

where ρ_g^M is the rent associated with a binding quota and attributed to the importers represented here by the nonfarm household.

5 The Data

The core of the 1995 social accounting matrix used to calibrate and initialize the model is based on Grether and Mueller (1999) and follows the GTAP classification. It is an update of the 1990 SAM taking into account two points. First as Switzerland introduced the VAT in 1995, the 1996 VAT data are used instead. Second, tariff data are provided by the customs authorities and refer to 1996 as well. The reason is that the first measures resulting from the Uruguay Round Agreement were implemented only in July 1995, which is the date of Switzerland WTO membership.

Additional data are provided by the Federal Office of Statistic. Expenditures regarding the agricultural policy are from the Federal Office of Agriculture. The value of the rent from the raw milk production quota is based on Lehmann et al. (2000). Using a Swiss production model with different cost structures of farms, they simulate a decrease of the milk price until aggregate production begins to decline, which gives an approximation of the milk rent. The total rents generated by tariff quotas are the difference between the tariff equivalents from the OCDE (1998) including non-tariff barriers and the effective customs duty. In the benchmark year, imports are assumed to be at quota and at the higher tariff rate level. Table 1 shows all the revenues and expenses of the policies implemented in the model.

Table 2: Aggregate sectors used in the model

Model	GTAP 5 composition	Description
Agricultural sectors		
wht	wht	Wheat
gro	gro	Cereal grains nec
v_f	v_f	Vegetables, fruit, nuts
osd	osd	Oilseeds
c_b	c_b	Sugar cane, sugar beet
ocr	ocr	Crops nec
ctl	ctl	Bovine cattle, sheep, goats, horses
oap	oap	Animal products nec
rmk	rmk	Raw milk
oag	pdr, pfb, wol, for	Other agricultural products
Food sectors		
cmt	cmt	Bovine cattle, sheep, goat, horse meat
omt	omt	Meat products nec
mil	mil	Dairy products
ofd	fsh, vol, pcr, sgr, ofd	Other food products
Industrial sectors		
nrg	oil, gas, p_c, ely, gdt, wtr	Energy
mnf	col, b_t, tex, wap, lea, lum, ppp, crp, nmn, i_s, nfm, fmp	Manufactured products
eqp	omn, mvh, otn, ele, ome, omf	Equipment
cns[a]	cns	Construction
Service sectors		
t_t	trd, otp, wtp, atp, cmn	Trade, transport
srv	ofi, isr, obs, ros	Private services
osg[a]	osg	Public services
dwe[a]	dwe	Dwellings

[a]Non-traded good.

Regarding the benchmark value of the public good, we assume that the production value equals the market value, that means the total direct payments received by the farmers. Household preferences for the public good are inferred by imputing *private expenditures* on public goods to individual households. The attribution rule employed in making these imputations in the calibration process involves public good expenditure by households proportional to net income. Since the quantity of public goods is common to all households, imputing expenditures in this way implicitly defines the personalized public good prices used in calibration.

The whole SAM is then balanced using the cross entropy method and assuming select macroeconomic aggregates to be known together with specified row and column totals. The aggregation of sectors from the GTAP classification are

Table 3: Aggregate SAM for the 1995 base year (in mio. CHF)

		SECTORS			COMMODITIES					FACTORS			INSTITUTIONS			TAXES	ROW			TOTALS
		s_agr	s_fdp	s_ind	pgd	agr	fdp	ind	vpg	lab	cap	lnd	ra	inv	gov		exp	subs	rent	
SECTORS	s_agr				1522	12354														13876
	s_fdp						24101													24101
	s_ind							609521												609521
COMMODITIES	pgd														1522					1522
	agr	2785	8089	1437									2380	43			343	33		15110
	fdp	380	2859	4949									17938				2293	481		28900
	ind	2861	7955	268850									190528	75112	54522		110776	249		710853
	vpg												1522							1522
FACTORS	lab	5115	3864	220317																229296
	cap	2066	1334	113968																117369
	lnd	1095																		1095
INSTITUTIONS	rural[a]								26	3765	600	606				608				5606
	urban[b]								1496	191576	99413	489					58817		2139	353931
	inv												69416		31888					101305
	gov												20387			63016		5292		88695
TAXES	inc_r									517	92									609
	inc_u									33438	17264									50702
	lab	-88																		-88
	cap	-338																		-338
	prod					-1250	-167	1121												-296
	rent					608														608
	agr												229							229
	fdp												421							421
	ind												11778							11778
ROW	imp					2667	3168	95564					44936	25895						172229
	tarifs					184	461	4647							763					6054
	rent					548	1591													2139
TOTALS		13876	24101	609521	1522	15110	29155	710853	1522	229296	117369	1095	359537	101050	88695	63624	172229	6054	2139	

[a] Farm household.

[b] Nonfarm household.

Table 4: Elasticity values used in the model

Description	Value
Elasticity of transformation between public good and agricultural goods	4.0
Elasticity of substitution between value-added and intermediate inputs	0
Elasticity of substitution between labour, capital and land	
- Agricultural sectors	0.25
- Food sectors	0.4
- Industrial and service sectors	0.5
Elasticity of substitution between public good and private consumption	0.5
Elasticity of substitution between private consumption goods	1.5
Elasticity of transformation between domestic goods and exports	2.0
Elasticity of substitution between domestic goods and imports	
- Agricultural and food sectors	2.5
- Industrial and service sectors	0.5
Elasticity of transformation for the sluggish factor land	0.25

given in table 2 and the 1995 aggregate SAM for Switzerland in table 3. Table 4 summarizes the elasticity values employed in the model. Regarding the allocation of time, it is assumed that each household may spend 16 hours between leisure and labour. The share of working time is then derived from the fact that Swiss people work on average 43 hours a week. This parameter is then used in the calibration process for the uncompensated supply of labour.

6 Experiment Design

All simulations study agricultural reform packages that require simultaneous changes in many policy instruments. They are 5 scenarios which are summarized in table 5. The first scenario is an evaluation of the 1999 agricultural policy (AP 99). The second scenario is the anticipated policy for the year 2002 (AP 02). The last three scenarios are reallocation policies with regard to the 2002 agricultural policy[6]. This means that part of the government agricultural budget is allocated to another policy instrument. In scenario 3 (scenario DP) direct payments are reduced by an amount of 482 mio. which are allocated to social and structural policies proportionally to their expenditure level. In the fourth scenario (scenario MS) 25% of the production subsidies are converted in labour and capital subsidies. The final scenario (scenario DP&MS) is concerned with both diminutions of direct payments and output subsidies.

Each of the five scenarios is performed with the implications of the Uruguay Round Agreement on Agriculture. Export competition target is the reduction of subsidy expenditure by 36% from 1986-90 levels for each product. Market access

[6]This is the choice the government faces now. Either the status quo (scenario AP 02) or one of the reallocation policy scenario (scenarios DP, MS and DP&MS).

Table 5: Summary of the experiment design (in mio. CHF)

Instruments	AP 99	AP 02	DP	MS	DP&MS
Subsidies on labour	90	90	434	228	572
	+2	*+2*	*+346*	*+140*	*+484*
Subsidies on capital	321	471	609	526	664
	-18	*+133*	*+271*	*+188*	*+326*
Output subsidies	1'144	682	682	489	489
	-272	*-734*	*-734*	*-926*	*-926*
Direct payments	2'286	2'482	2'000	2'482	2'000
	+763	*+960*	*+478*	*+960*	*+478*
Export subsidy ceiling	440	440	440	440	440
	-73	*-73*	*-73*	*-73*	*-73*
Tariffs - TRQs	*-15%*	*-15%*	*-15%*	*-15%*	*-15%*

target is a minimum reduction of 15% per tariff line from 1986-88 base. This is true for both tariffs and new tariffs resulting from the conversion of non-tariff border measures into tariff quotas.

7 The Results

The consequences of the agricultural reform in Switzerland are analysed under three different aspects. The first details the impact of the Uruguay Round Agreement on Agriculture (URAA). The second analyses the impact of splitting up price and income policy, and the last one examines the effects on the welfare of consumers.

7.1 URAA impact analysis

The major consequence of the reform is the welfare gain from the agricultural trade liberalization. Table 6 illustrates this point showing some results of two scenarios with and without the implications of the Uruguay Round Agreement on Agriculture. The URAA column gives the results when only the URAA consequences are simulated. In the case where the UR agreements are ignored, the change in social welfare is negative. The reason is on the one hand the decrease of the farm welfare because of the milk rent diminution and on the other hand the increase in agricultural expenditure. The rise of direct payments larger than the reduction of production subsidies leads thus to an increase in the VAT rate. However, when these agreements are taken into account, the change in aggregate welfare becomes positive. Running only the agricultural trade liberalization brings a social welfare gain in the long run of 0.15% to the consumers.

Another impact of the Uruguay Round Agreement on Agricultural is the decrease of the VAT rate required for keeping the government budget balanced.

Table 6: URAA impact analysis (in % change)

	Reference	Without URAA		Only	With URAA	
	(in mio.)	AP 02	DP&MS	URAA	AP 02	DP&MS
Welfare[a]	454'111	-0.05	-0.03	0.15	0.10	0.10
Tax rate[b]	6.18%	2.43	2.92	-5.08	-2.42	-1.57
Volume for agricultural goods						
Output	11'712	-1.43	2.11	-1.77	-3.14	0.64
Exports	376	-2.99	15.24	-1.15	-3.03	14.79
Imports	3'399	1.95	0.17	4.92	7.02	4.05
Volume for food goods						
Output	23'935	-1.64	-0.20	-0.85	-2.42	-1.04
Exports	2'774	-2.70	-1.71	-3.14	-5.29	-4.54
Imports	5'220	1.34	0.73	13.24	14.76	13.62

[a]Aggregate equivalent variation.
[b]Tax rate on the industrial goods and services.

The lowering of customs duty leads to a decline of import prices of both agricultural and food products, which increases thus the imported volume of these goods. This has a large positive impact on the boarder revenue generating a 5.08% diminution of the VAT rate when running the URAA scenario only. The global reform implies however a smaller diminution of the VAT rate due to the rise of direct payments.

When the direct payments are only at 2 bio. (DP&MS scenario), the incentive for the public good production is not sufficient to lower the agricultural production. Ignoring the UR agreements, the substantial reduction of the output subsidies for the scenario AP 02 implies a volume change for the domestic goods of -1.4% and for the exported goods of -3%. The financial resources coming from the decrease with respect to the status quo (scenario AP 02) of the production subsidies and the direct payments are allocated to social and structural policies in the DP&MS scenario. These input subsidies increase then the agricultural production. As these ones do not affect the food sectors, the decline of the output subsidies leads to a reduction of the food production. This one is however attenuated in the DP&MS scenario by the diminution of the factor cost, whose prices adjust between the different sectors in the long run. These reasons explain why the volume of the agricultural exports increases whereas the one of the food exports decreases.

7.2 Splitting up price and income policy analysis

The major result here is the large increase in the public good production. As it is shown in table 7, the larger positive variation is achieved by the MS scenario. In this case, the maximum incentive is reached since the direct payments are at their highest level and the production subsidies at their lowest level. This result

Table 7: Agricultural policy analysis (in % change)

	Reference	Scenarios				
	(in fr.)	AP 99	AP 02	DP	MS	DP&MS
Public good						
Output	1'522[a]	37.59	47.66	29.05	49.42	30.65
Price	1.00	9.30	10.60	1.97	9.30	0.71
Tax rate[b]	6.18%	-0.85	-2.42	-1.59	-2.40	-1.57
Agricultural goods						
Production price	1.05	0.12	-0.81	-4.88	-2.31	-6.34
Market Price	1.00	0.17	0.91	-2.13	0.54	-2.49

[a] In mio. Swiss francs.
[b] Tax rate on industrial goods and services.

confirms that the decoupled direct payments conditional on an environmentally friendly farming are really an incentive for the production of the public good. Taking the AP 02 scenario, a comparison can be made with the actual situation. The increase in the public good production of 48% may be related to the 95% of agricultural useful area farmed in an ecological way, knowing that only 44% was farmed in this way in 1995. However, for the DP and DP&MS scenarios, the price of the public good decreases compared to the status quo (scenario AP 02) which leads to a reduction of the agricultural production. The farmers find more profitable to produce in a more industrialized way which rises then the production of the agricultural goods with respect to the benchmark year.

Generally speaking, the agriculture after the reform costs less to the government as the VAT rate on the industrial goods and services decreases in each scenario. Moreover, the simulations show that it is less expensive for the government to give to the farmers large incentives for the public good production (scenario AP 02 and MS) rather than to support them through labour and capital subsidies (scenario DP and DP&MS).

Regarding the production prices of the agricultural goods, they incur a downward pressure due to the reduction of the production subsidies. The pressure is higher for the DP and DP&MS scenarios since a fraction of the direct payments is allocated to the social and structural policies. These subsidies to primary factors emphasize then the decrease of the production price.

Finally, the reform has a positive impact on the market prices of agricultural goods for the AP 02 and MS scenarios. However, the decrease of the direct payments with respect to the status quo (scenario AP 02) in the DP and DP&MS scenarios has a negative impact on the prices of these products. This drop in prices comes from the allocation of 500 mio. of direct payments to the production factors, which allows the farmers to supply less expensive goods.

Table 8: Welfare analysis (in % change)

	Reference	Scenarios				
	(in mio.)	AP 99	AP 02	DP	MS	DP&MS
Farm hh welfare[a]	8'672	-1.96	-4.43	-3.66	-5.00	-4.22
Nonfarm hh welfare[b]	445'439	0.14	0.19	0.18	0.19	0.19
Social welfare[c]	454'111	467	444	481	425	465
Milk Rent[d]	608	-40.22	-76.40	-58.86	-83.88	-66.10

[a]Equivalent variation of farm households.
[b]Equivalent variation of nonfarm households.
[c]Aggregate equivalent variation (in mio. swiss francs).
[d]Rent from the quota on raw milk production attributed to farm households.

7.3 Welfare analysis

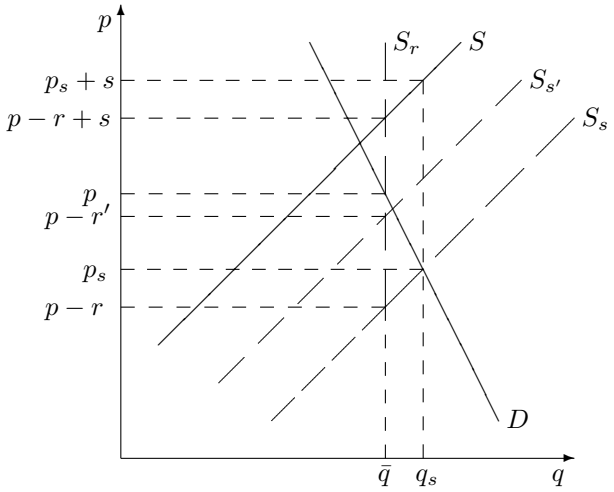
The major result from the welfare analysis presented in table 8 is that farm households are largely worse off. The equivalent variation is negative up to 5% in the MS scenario, which simulates the competitiveness improvement of the agricultural and food sectors. The explication stands on the side of the raw milk quota rent. In this scenario, the rent diminishes of almost 84%, which reduces the revenue of the farm households of 510 mio. The reason of the rent decline comes from the fall in the raw milk production subsidies.

Figure 1 illustrates the situation on the raw milk market in 1995. Taking into account the production quota $\bar{q}$ of 3.2 bio., the output subsidies are the area $[(p - r + s) - (p - r)] \cdot \bar{q}$ and the quota rent, the area $[p - (p - r)] \cdot \bar{q}$. Knowing that the rate of subsidy s is 23 centimes and that the rate of the rent r is 19 centimes implies a production price $p - r + s$ of 1.04 franc for a market price p of 1 franc. In other words, the farmers receive a net subsidy of 4 centimes for each unit and get the amount of the rent directly in their income. When there is a cut in the production subsidies, the supply S_s shifts to the left to $S_{s'}$ reducing the quota rent which is now represented by the area $[p - (p - r')] \cdot \bar{q}$. Assuming that the demand stays unchanged, the production and market prices do not vary, which implies that the net subsidy does not change. It is thus only a redistribution of the rent to the primary production factors rather than directly to the farmers. That means that a more or less important part of the milk quota rent is transferred to the nonfarm households depending on the size of the output subsidy reduction.

Comparing the DP and DP&MS scenarios to the AP 02 and MS scenarios respectively, the decrease of the milk rent is however reduced of 18% approximatively. In these scenarios, a fraction of direct payments is allocated to the social and structural policies. This support measure to the primary factors reduces the production cost which diminishes the market and production prices, and offsets then partially the diminution of the production subsidies.

Regarding the nonfarm households, they are better off as there is a positive

Figure 1: Raw milk market



change of their welfare. This is mainly due to the fact that they benefit directly from the agricultural trade liberalization. The income distribution is not very much modified, except a rise in the price of land. Naturally, the upward pressure exerted on this factor by the direct payments is increasing with the level of these ones. However, the rise of the direct payments do not have this impact on the labour and the capital since their price adjust between the different sectors in the long run.

The consequences on the social welfare are positive but follows from the aggregation of the different impacts on the consumers. On the one hand the farm households incur a large loss of their welfare due to the important fall of the milk quota rent. On the other hand, the welfare of the nonfarm households rises because of the reduction of the production subsidies and the partial agricultural trade liberalization. The social welfare is determined as the sum of individual utilities weighted by the consumption level. This one happens to be only 2% for farmers. The result of this is that the small welfare increase of most of the population dominates the large decrease of farmer welfare and implies then a positive social welfare. However, this impact is relatively small since the aggregate equivalent variation is not greater than 500 mio. in the best case, which corresponds to an increase in social welfare of 0.11% for the scenario DP.

8 Conclusion

The reform of the Swiss agricultural policy is based on the double mandate of agriculture laid down in the federal Constitution since 1996. Agriculture has to be competitive and to produce in a sustainable way public services such as the maintenance of the landscape or the protection of natural resources. The strategy developed to attain this objective consists in splitting up price and income policy.

The supply of food products is from now on governed by the market, while directs payments decoupled from production[7] retribute services without market value. This multifunctional feature of agriculture is represented through the joint production of a public good and an agricultural private good. The explicit modelling of agricultural policy instruments allows, among others, to capture the rents from production and tariff rate quotas, and to attribute them to the different households. Incorporating these key elements into a computable general equilibrium model, it is then possible to analyse the impact of the agricultural reform on the welfare of farm and nonfarm households.

Simulations show that the objective of the reform is clearly achieved. The remuneration of public services through decoupled direct payments implies that 95% of the agricultural useful area is now farmed in an ecological way. The competitiveness improvement of agriculture leads to a decrease of agricultural production and import prices. However, the farmers incur a welfare diminution due to the non-compensated reduction of the raw milk quota rent generated by the decline of price support. On the other hand, the nonfarm households benefit largely from the lowering of price support and the liberalization of agricultural trade. Depending on the orientation of the future agricultural policy, it implies social welfare gains from about 450 millions of Swiss francs. In conclusion, the Swiss agricultural reform gives new prospects in the reconciliation of the sustainability and competitiveness notions. This work is a first attempt to model these aspects. It hopes then to contribute to the current debate of the multifunctionality of agriculture.

[7]This kind of transfers does not distort trade and thus is recommended by the World Trade Organization.

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