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# MODELLING THE LIBERALISATION OF MARKET ACCESS*

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## Abstract

*Differences regarding the liberalisation of agricultural markets are a central issue in the current Doha Round of WTO negotiations. The positions of the individual countries and country groups differ significantly as far as market access is concerned. The positions can be explained by the existing levels of market support and thus by potential agricultural income losses as a consequence of market liberalisation.*

*The purpose of this paper is to analyse the dynamic impacts of different adjustment steps in endogenous development trends of markets and of exogenous market access and the resulting interactions between the agricultural markets. Adjustment steps of market access can consist of an expansion of tariff quotas and in a reduction of import tariffs. Our simulations show that price development and thus the development of the revenue from agricultural products depend on several factors. In addition to domestic supply and demand the temporal design of market liberalisation is a key influencing factor.*

* This paper is based on a project commissioned by the Swiss Federal Office for Agriculture („Simulation der Marktentwicklung im Umfeld unterschiedlicher Ergebnisse der WTO-Verhandlungen“).

# 1 Introduction

At the end of July 2004, the members of the WTO defined the framework for the continuation of the negotiations constituting the Doha Round. Negotiations were resumed during the ministerial conference which took place in Hong Kong at the end of 2005, whereby the foreseen passage of the modalities relating to the sectors market access, internal support and export subsidies was not completely accomplished within the basic agreement. While the member countries confirmed the abolition of all export subsidies by the end of 2013, progress was also made in the field of domestic support. On the other hand, it has not yet been possible to deal with the matter of the liberalisation of market access. Therefore, the current year will see intensive negotiations aimed at concluding the Doha Round by the end of 2006.

From the point of view of countries with small imports of agricultural products, further negotiations will focus not only on the reduction of domestic support but mainly on the modalities relating to market support. In this context, there are two decisive elements, namely "reduction of import tariffs" and "expansion of tariff quotas". The demand of the small countries for a moderate reduction of tariffs stands in opposition to the objective of large exporter countries which involves the widest possible liberalisation of market access. In this case, tariff reductions would take place according to a graduated reduction formula, whereby different modalities would be defined for the various stages. Generally speaking, higher import tariffs should be reduced more rigorously than lower tariffs. At the same time, the question of sensitive products would be given due consideration in the negotiations. Subsequently, the individual WTO member countries would be given the opportunity to designate such products for which milder reduction formulas can be applied. However, an expansion of tariff quotas or similar measures would be required in return for these exceptions.

The supply and demand sides and their relationship represent two components which are of significant importance when assessing the possible impacts of the different negotiating positions on domestic product markets. At producer level, this has an effect on prices and price conditions for agricultural products. At the same time, price conditions for agricultural products relate to the consumer markets and the question of the prices at which the product markets are in balance. In addition to domestic supply and demand quantities, the question of market access is of great importance within the context of the current WTO negotiations. On the one hand, this relates to additional imports resulting from the expansion of tariff quotas while on the other hand, a tariff reduction leads to a relative enhancement of the competitiveness of imports compared to domestic products which, depending on domestic production, generates additional pressure on prices.

This paper aims at analysing the dynamic impacts of market liberalisation on the Swiss milk and meat market. It focuses on the effects of different exogenous development trends and on the resulting endogenous interactions between the milk and the meat market. For this purpose, we develop a dynamic simulation model that translates the principles of market access

and the interactions between different partial markets (section 2) into a feedback structure (section 3). Model simulations are run for different scenarios that allow differentiating between endogenous market development patterns and the effects of different negotiation positions concerning market access (section 4). On this basis, conclusions are drawn regarding modelling the liberalisation of market access and the provision of decision support for agricultural policy (section 5).

# 2 Tariff quota system from an economic point of view

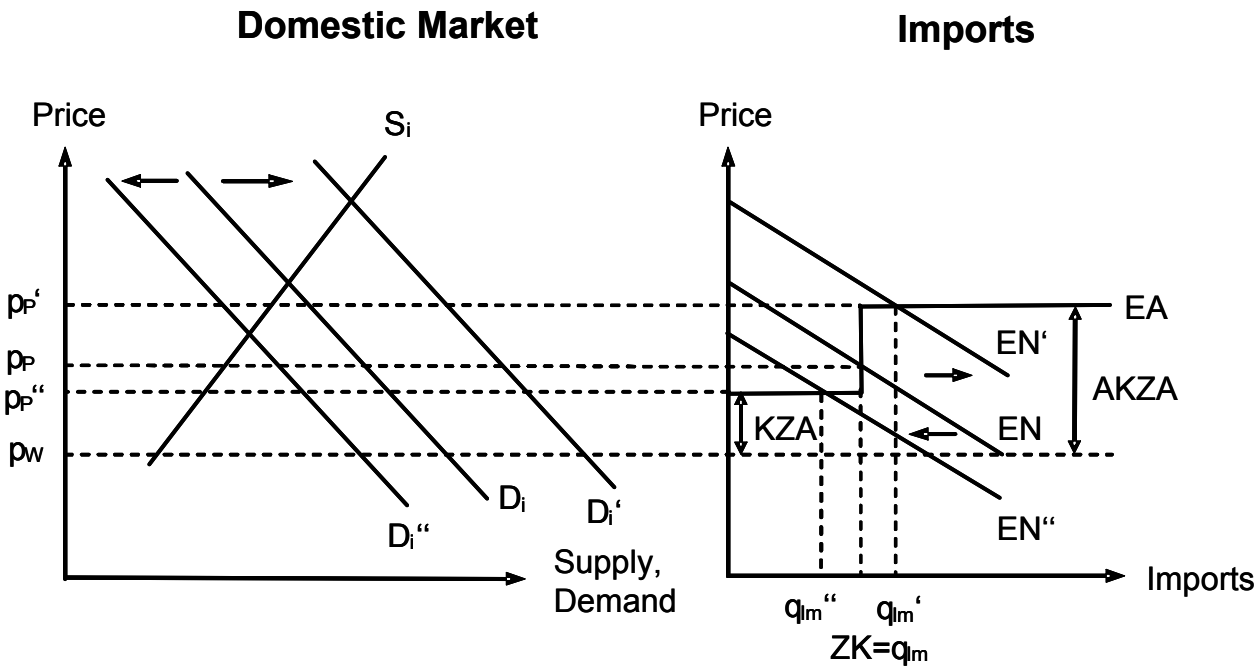
In small industrialised countries like Switzerland, the regulation of market access is of decisive importance for price development in the agricultural sector. Within a tariff system, market access for foreign products is achieved exclusively via tariffs. On the other hand, within a tariff quota system access is limited not only by price but also by quantity. During the Uruguay Round of the WTO negotiations, agreement was reached on a minimum market access in the form of tariff quotas for the most important agricultural products. Under the tariff quota it is possible to import at a lower tariff rate; these minimum quantities must be imported regardless of the domestic market and price situations. In the event of strong price reductions or high imports, market access can be restricted by additional tariffs foreseen by a special protective clause. Outside of the quotas, market access for many products will be restricted by means of prohibitively high tariffs (Jörin 2001).

The impact of this system on domestic producer prices is illustrated in Figure 1. The domestic supply function $S_i$ and the domestic demand function $N_i$ are given. Demand exceeding the domestic supply is covered by imports (import demand function $E_N$). The market access of the respective product is limited by means of the tariff quota ZK, whereby the quantity ZK can be imported at the low, fixed quota tariff rate (KZA). Additional imports are subject to out-of-quota tariff rates (AKZA) which are likewise fixed. This means that there are two kinks in the import supply function (EA). The extent to which the vertical line of the import demand function influences the import quantity $q_{Im}$ and the domestic producer prices $p_P$ depends on the import demand function and the difference between the two tariff rates.

In the initial situation, the domestic producer price $p_P$ results from the point of intersection of the import demand function EN and the import supply function EA. In this case, the quota is binding and the imports $q_{Im}$ correspond to the tariff quota ZK. The illustration shows clearly that minor shifts in the import demand function EN lead to marked changes in prices. The price fluctuations are not due to a change in the import system, but are dependent upon domestic fluctuations in supply and demand. On the other hand, stable prices result when the point of intersection between the import demand function EN' and the import supply function is situated on the horizontal line due to a shift in the domestic demand function $D_{i'}$. In this case, the domestic producer price lies at the high level $p_{P'}$ (world market price $p_W$ plus

AKZA). By way of contrast, a low domestic demand quantity $D_{i''}$ and a low import demand (EN'') results in a domestic producer price of $p_{P''}$ ($p_W$ plus KZA). In this case, the tariff quota is not used to the full.

*Figure 1: Effects of price support by means of tariff quotas (Koch 2002, p.69)*




| | | | |
|---|---|---|---|
| $S_i$: | domestic supply function | $D_i$: | domestic demand function |
| EA: | import supply function | EN: | import demand function |
| $p_P$: | domestic producer price | $p_W$: | world market price |
| $q_{Im}$ | imports | ZK: | tariff rate quota |
| KZA: | quota tariff rate | AKZA: | out-of-quota tariff rate |

The argumentation shows clearly that the impacts of liberalised market access do not depend solely on the abolition of tariffs and a possible increase in tariff quotas, but rather that market balances are also influenced by changes in domestic supply and demand quantities. Therefore, assessment of the impacts of market liberalisation on domestic product markets must inevitably also give due consideration to the domestic market situation. In particular, the development of these markets over time in relation to the schedule for the market access is of great importance. By nature, both these aspects are dynamic, whereby they have a direct influence on price and quantity developments on the domestic markets.

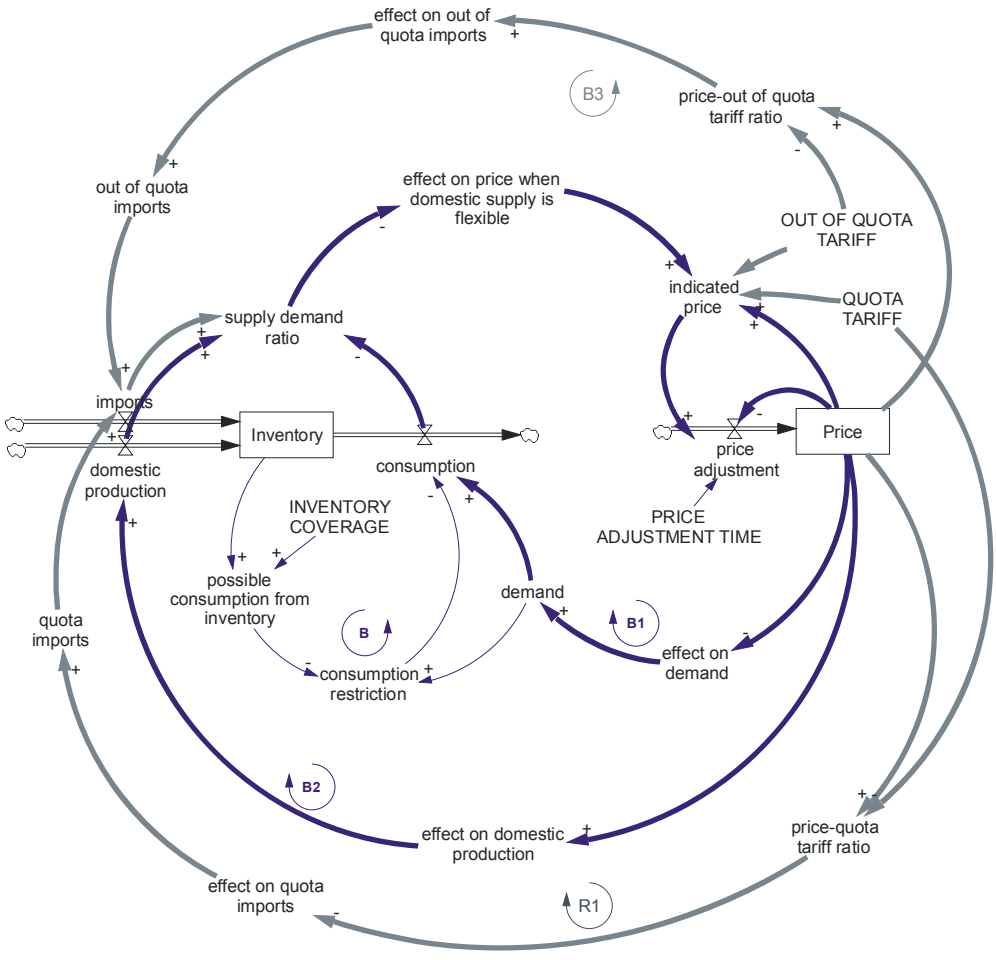
# 3 Modelling tariff quotas systems

Based on the theoretical presentation, the following elements, which must be interrelated (also over time), must be modelled to illustrate a market with an import quota system:

- development of domestic supply, whereby this depends on price developments and producers' reactions to changes in prices and costs;
- development of domestic demand, which depends not only on price developments and consumers' reactions to changes in prices of the respective products but also on rival products;
- development of border protection, whereby the effect of this depends not only on the development of quantity limits and tariffs but also on developments in domestic supply and demand.

The first two points were described in an earlier paper (Flury et al. 2005a und b). The key elements of the last point are illustrated in Figure 2. The Figure translates the mechanisms described in Figure 1 into a feedback structure. This structure illustrates how the ratio between current price and out of quota tariffs or quota tariffs, respectively, determines the amount of domestic production and imports. The two balancing loops B1 and B2 are the classical demand and supply loops that equilibrate demand and supply through the price mechanism.

*Figure 2: Tariff quota systems from a feedback perspective*



Domestic supply not only depends on the potential market price but also on the market entrance situation. Domestic supplies are suppressed as long as the market price lies in the range of tariff quotas. The market entrance situation changes if demand exceeds the quantities supplied by imports at quota tariff price. The resulting demand surplus provides incentives for domestic suppliers to start production and this incentive increases through the reinforcing feedback loop R1. In this situation, neither quotas nor tariffs restrict domestic supply and the domestic market mechanism. Any change in price here leads to an adjustment of domestic supply without consequences for imports.

Further increases in demand will eventually lead to a situation where the potential market price exceeds the relevant price for an out-of quota tariff condition. The balancing feedback loop B3 now restricts domestic supplies and prevents additional production incentives for domestic producers. Instead, imports at out-of quota tariff price are used to supply the quantities required to meet desired consumption.

Figure 2 provides an aggregate view of one central aspect of our simulation model. The entire model distinguishes several partial markets:

- meat market: beef and veal, pork meat, poultry meat;
- milk market; drinking milk, fresh milk products and milk specialities, cream, butter, cream and soft cheeses, hard and semi-hard cheeses as well as long-life milk products.

The proceeds-costs ratios between these partial markets guides production decisions, i.e. decisions whether to produce milk or beef and veal.

# 4 Results

In this section we test for the effects of different exogenous development trends and the resulting endogenous interactions between the milk and the meat markets. In a first step (section 4.1) we analyse how the domestic market situation will evolve without further liberalisation steps. Only technical progress and changes in consumption preferences will impose pressure on adapting production decisions and production structures. The knowledge about this baseline development provides background information for future negotiation positions as it illustrates where negotiation flexibility arises from the development of internal processes on the milk and meat markets. In a second step (section 4.2) we analyse the effects of a liberalisation of market access for agricultural inputs. This allows costs for agricultural inputs to decrease. As a consequence, domestic production can become more competitive which is an important prerequisite for facing the liberalisation of market access for agricultural outputs. In a last step (section 4.3) market access both for agricultural inputs as well as for agricultural outputs are liberalised and different WTO negotiation scenarios can be tested.

## 4.1 Internal market development trends

In a first step we test for the effects of technical progress and changes in consumption preferences on the development of the domestic milk and meat markets. For these simulation runs, no further steps concerning the liberalisation of market access are undertaken.

Figure 3 to Figure 6 show the baseline development of market balance for beef and veal, milk, poultry meat as well as pork meat. The baseline development combines technical progress and changes in consumption preferences. The figures also show the development of market balance with technical progress only, i.e. when consumption preferences remain unaltered during the simulation horizon.

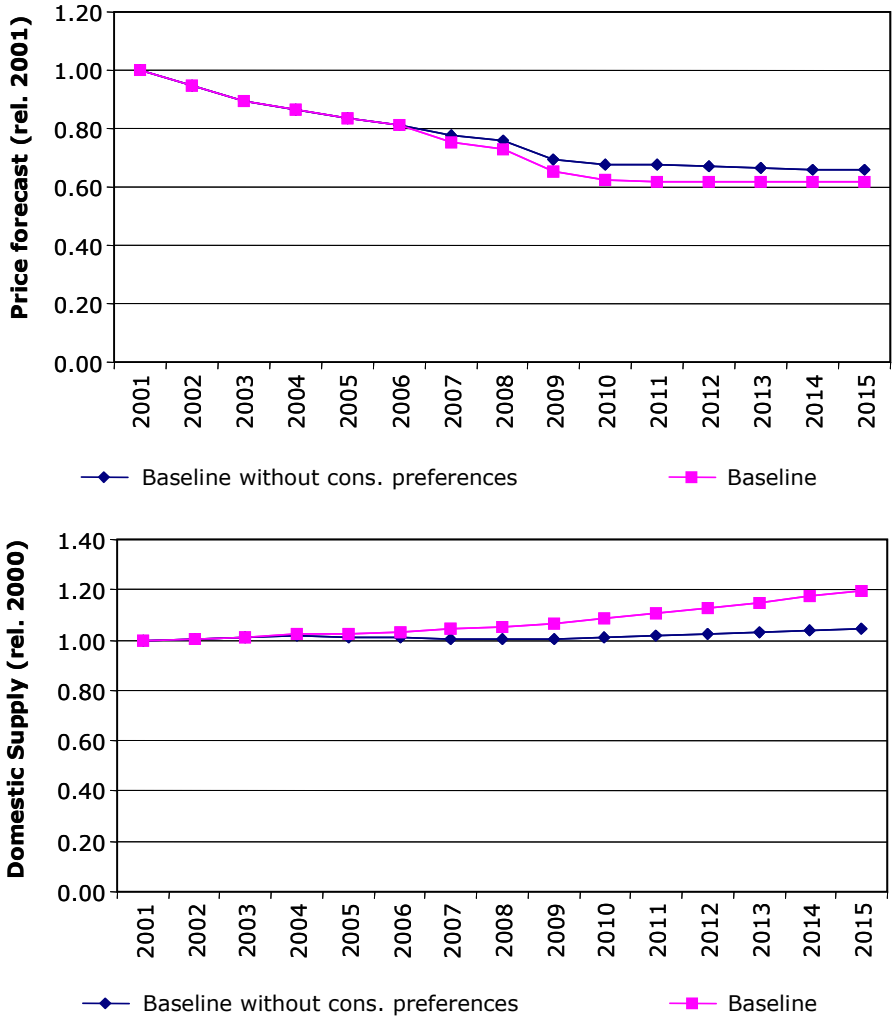
For technical progress and changes in consumption preferences the following assumptions are made (Mack und Flury 2006):

- Technical progress: +1.2% per year for milk production, 0% per year for beef and veal production, +0.3% per year for pork meat production, 0% per year for poultry meat production.
- Consumption preferences: -1% per year for beef and veal, -0.35% per year for pork meat, -0.2% per year for poultry meat.

### Milk market, beef and veal market

The development of the markets for beef and veal (Figure 4) has to be interpreted jointly with the development of the milk market (Figure 3). Milk price declines gradually in the first ten years as a consequence of a reduction and rearrangement of the remaining internal market support. Eventually, milk price reaches a level where Swiss milk products (especially cheese) become competitive on export markets so that price can be stabilised at a level of approximately 60% of the initial value. Due to the decrease in milk price milk supply can be held constant in the first period (technical progress, decrease in the price for beef and veal). Domestic supply starts growing above its initial value when exports are made possible and price stops declining because milk products are competitive on the European milk market (small country case).

*Figure 3: Baseline development of market balance for milk*



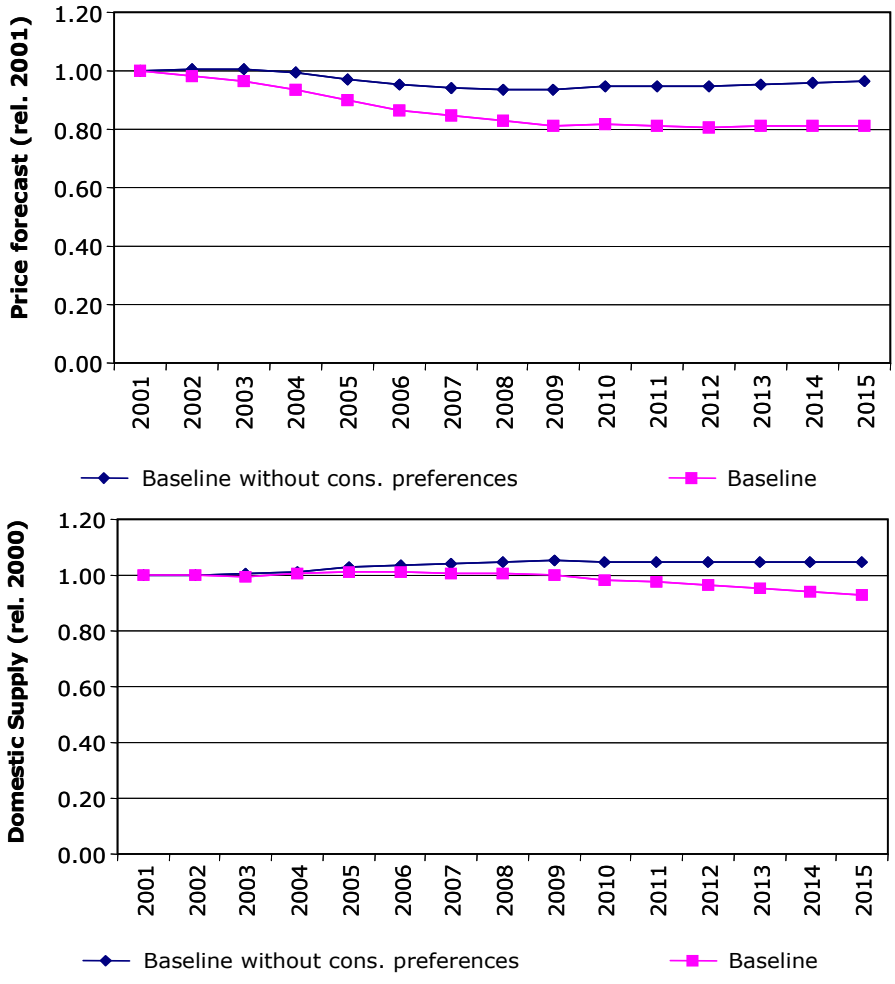

On the markets for beef and veal price decline parallel to price decline on the milk market can be observed for the first ten year period. Price decline on the markets for beef and veal are caused by a decrease in consumption preferences. In the past, there has been a noticeable decline in consumer preferences for beef and veal. In recent years, consumption has declined in average by one percent per year. For the purposes of the simulation it is assumed that this trend will continue in future. Consequently, prices sink even when domestic production remains unchanged. Since consumers do not react elastically to changes in prices for beef and veal, the price sinks in percentage more strongly than the demand.

Production quantities of beef and veal depend not only on price developments but are also directly linked to milk production since over 50% of the meat involved is a tie-in product (Flury and Rieder 2005). At the same time, there is a strong relationship between beef production and the utilisation of grassland. Therefore, declining prices for beef and veal do not necessarily lead to a slump in meat production. This is confirmed by the simulation. In spite of a decline in prices, there is a slight increase in production between 2001 and 2008 which causes prices to go down even more. After the year 2009 domestic supply sinks below the

initial quantity leading to a reduction in pressure on prices. At this point in time milk products become competitive on export markets so that a shift from meat towards milk production can be observed (as reflected in the development of domestic supply on the two markets).

These baseline development trends are altered to some degree when consumption preferences are assumed to remain constant over the entire simulation period (blue lines in Figure 4 and Figure 3). Under these circumstances the production of beef and veal is more competitive so that domestic supply of beef and veal increases slightly with a corresponding decrease in price. No shift from meat to milk production occurs so that the domestic supply of milk remains more or less stable and milk price equilibrates at a level that lies above the baseline milk price.

*Figure 4: Baseline development of market balance for beef and veal*

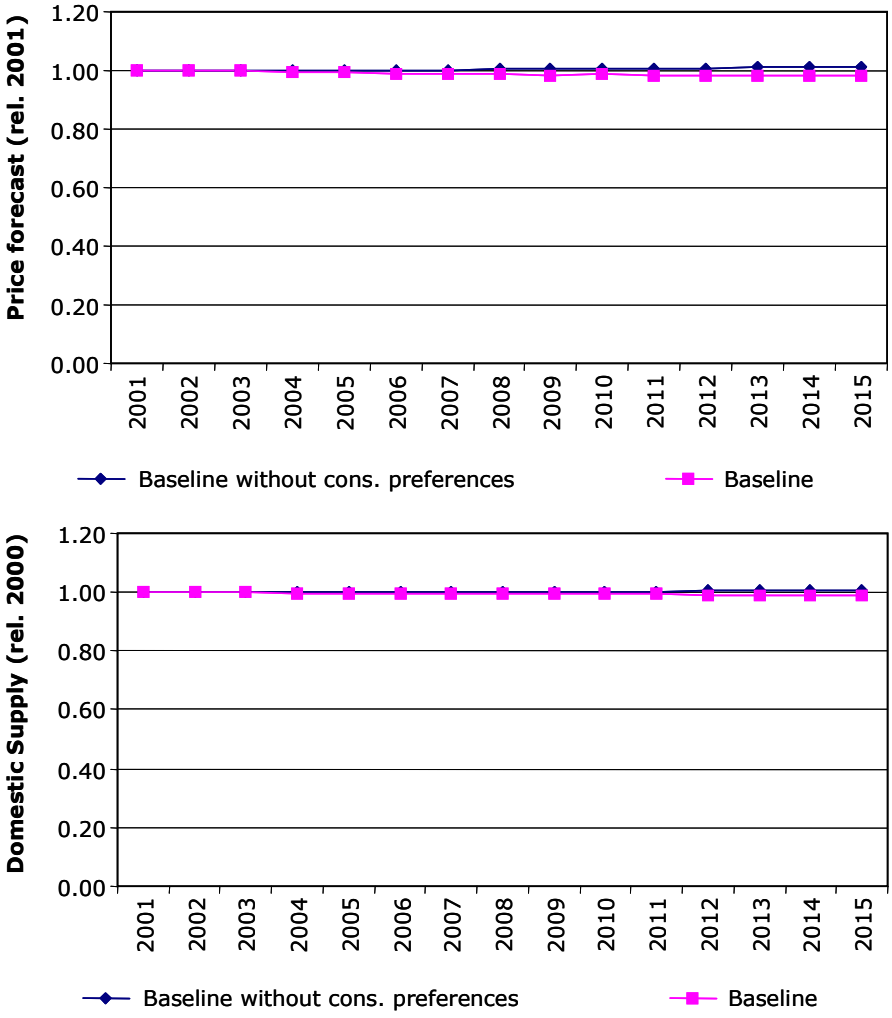



## Market for poultry meat

Contrary to the milk and the beef and veal markets no changes on the poultry market can be observed for the baseline scenario (Figure 5). This market experiences neither technical progress nor significant interactions with other partial markets. Prices for agricultural inputs also remain unchanged in this scenario and consumption preferences change only slightly. Price

and domestic supply therefore remain almost constant over the entire simulation horizon. The difference between the baseline run and the run “baseline without consumption preferences” shows the influence of changes in consumption preferences.

*Figure 5: Baseline development of market balance for poultry meat*

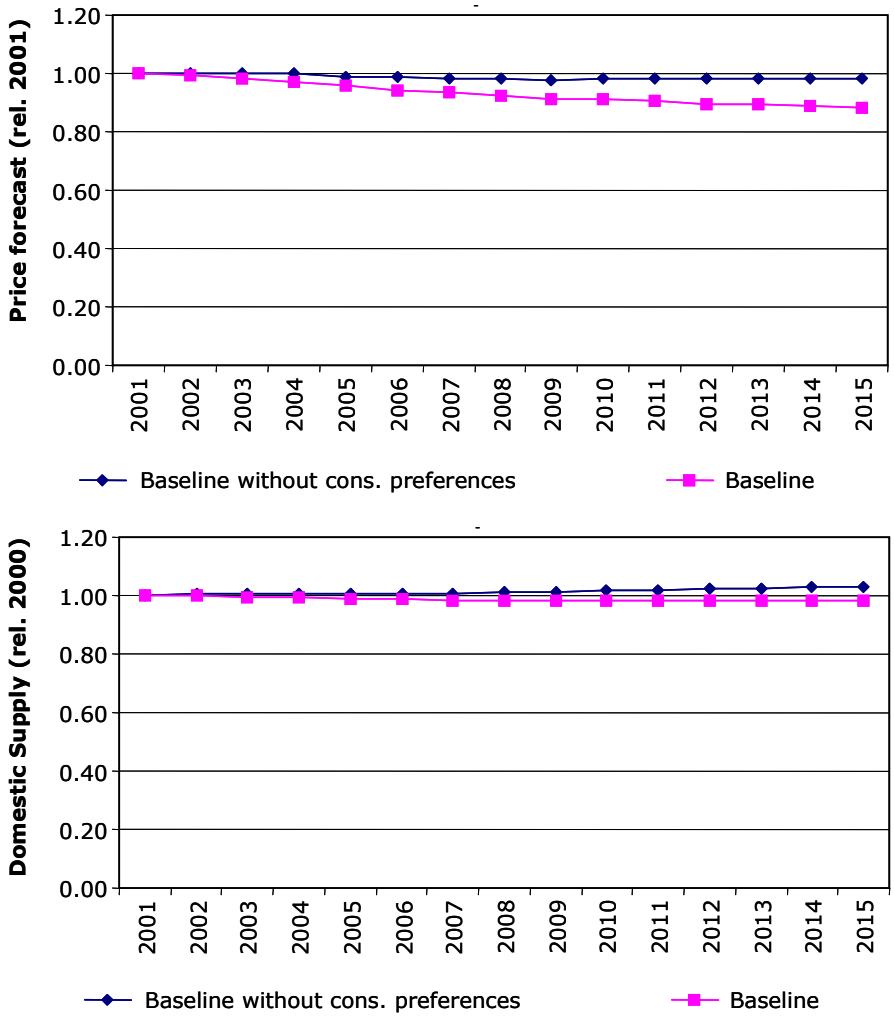



## Market for pork meat

While the market for poultry meat is almost independent from the other milk and meat markets the developments on the market for pork meat are linked to the developments of the market for beef and veal. Figure 6 illustrates the combined effect of two processes on the baseline development of the market for pork meat. On the one hand, consumption preferences decline over the simulation period. This is reflected in the price reduction. As price in the baseline scenario declines less than the price for beef and veal there is the additional effect of a shift from pork consumption towards the consumption of beef and veal (cross price effects). Nevertheless, the domestic production of pork meat remains more or less constant because technical progress compensates for the effects of price decline. When consumption preferences remain unchanged the production of pork meat even increases slightly as a con-

sequence of a minimal decrease in price. In this case technical progress compensates for the negative cross price effect of declining prices for beef and veal (see Figure 4).

*Figure 6: Baseline development of market balance for pork meat*




## Conclusions to internal market development trends

The simulations about the baseline developments presented in this section have shown three different processes that determine the dynamic behaviour of the milk and meat market without further liberalisation of market access:

1. Price adjustments to changes in consumption preferences and to technical progress.
2. Production adjustments to price changes in the own partial market (followed by further price and production adjustments in the own partial market as a consequence of the two balancing feedback processes B1 and B2).
3. Production adjustments to price changes in other partial markets (followed by further price and production adjustments in the own partial market as a consequence of the two balancing feedback processes B1 and B2).

## 4.2 Liberalisation of market access for agricultural inputs

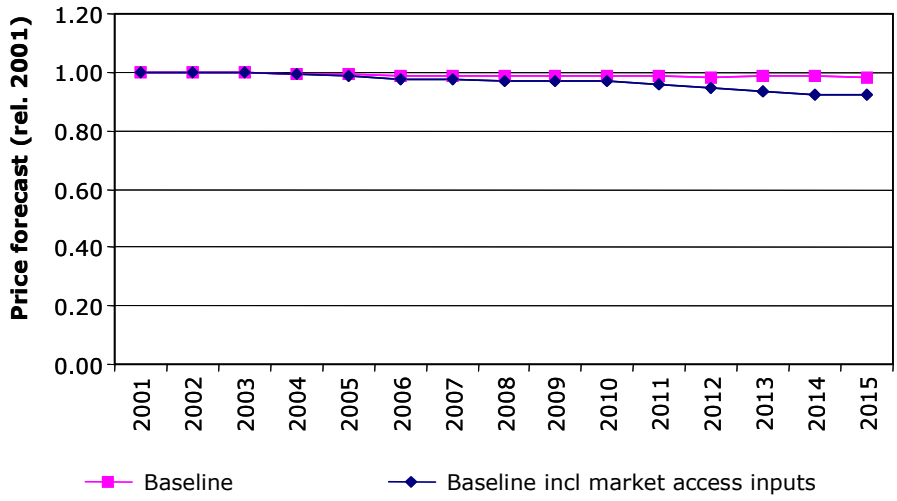
Although the outcomes of further trade liberalisation negotiations remain unclear as of today there is broad consensus that Swiss agriculture will face significant changes resulting from the liberalisation of market access. It is therefore important that Swiss agriculture becomes more competitive on domestic and in addition on export markets so that a maximum of today's market shares can be retained and so that the agricultural sector can be strengthened for the implementation of ongoing WTO trade negotiations.

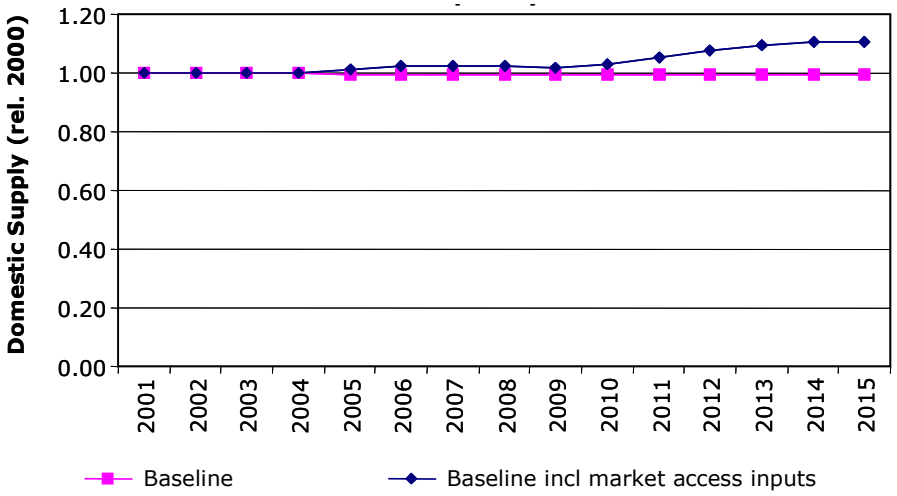
One possibility to do so is to decrease input prices. This can be achieved by lowering tariffs for inputs, i.e. by liberalising market access for agricultural inputs. For our calculations we therefore assume that the central market for feed grains will be liberalised. As a direct result of this, prices for animal feed will sink by 30%, which will enhance the competitiveness of meat production, especially the production of pork and poultry meat. This section only lists the results for the beef and veal market as well as for the market for poultry meat.

### Market for poultry meat

The effects of a decrease of input prices on the market for poultry meat are directly observable. This is due to the fact that fodder concentrate constitutes a major part of production costs. When prices remain unchanged a reduction of costs for fodder concentrate therefore leads to a considerable increase in production. Figure 7 illustrates that a decrease of production costs on the market for poultry meat results in an increase in supply that lies markedly above the baseline level. Price reacts to this pressure and declines below the baseline. As the market for poultry meat is virtually not dependent on other partial markets no significant additional effects such as cross price effects and shifts in production can be observed.

*Figure 7: Development of market balance for poultry meat when market access for agricultural inputs is liberalised*

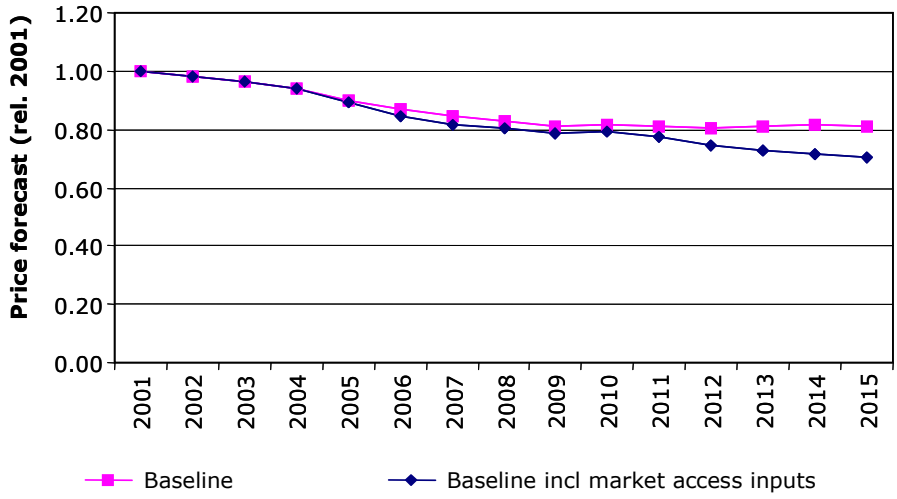


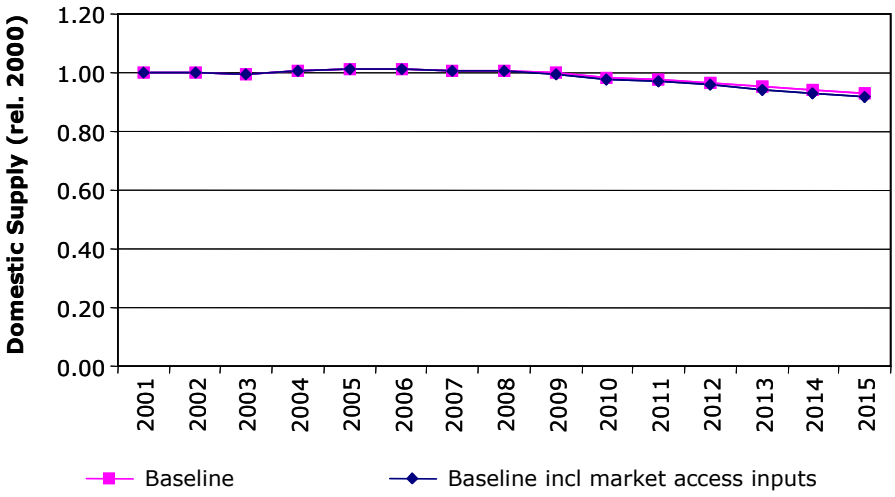



## Beef and veal market

Contrary to the market for poultry meat the beef and veal market incorporates a number of effects on its own market as well as on other partial markets resulting from a liberalisation of market access for agricultural inputs. Production costs on the market for pork meat are heavily influenced by fodder concentrate. Similar to the market for poultry meat, production increases on the market for pork meat and leads to a decline in price for pork meat. At this point in time cross price effects lead to pressure on the price for beef and veal so that the price for beef and veal falls below the baseline level towards the end of the simulation horizon. The production of beef and veal, however, remains virtually unchanged. This is due to the fact that the share of fodder concentrate on total costs is significantly lower than in the case of pork or poultry meat production. On the other hand, beef and veal production is tied to milk production and to the available grassland area. These two effects are, however, virtually independent from the development of prices for agricultural inputs.

*Figure 8: Development of market balance for beef and veal when market access for agricultural inputs is liberalised*






## 4.3 Liberalisation of market access for agricultural inputs and outputs

In section 4.1 and 4.2 we have tested the impacts of two kinds of development scenarios:

1. Processes that take place independently from processes on international markets and independently from trade negotiations.
2. Measures that aim at making Swiss agriculture more competitive so that the effects of market access liberalisation are as little harmful as possible.

This section analyses the impacts of liberalisation of market access for both agricultural inputs and outputs on the dynamic behaviour of the Swiss milk and meat market. In the study commissioned by the Swiss Federal Office for Agriculture we tested for the impacts of market liberalisation under a wide range of negotiation scenarios. These scenarios combine various steps towards reducing tariffs for pork, poultry meat, beef and veal. In some cases, combinations between a (reduced) tariff reduction and compensation by means of higher tariff quotas are also given. In this paper we restrict ourselves to the example of one scenario and the partial market for meat:

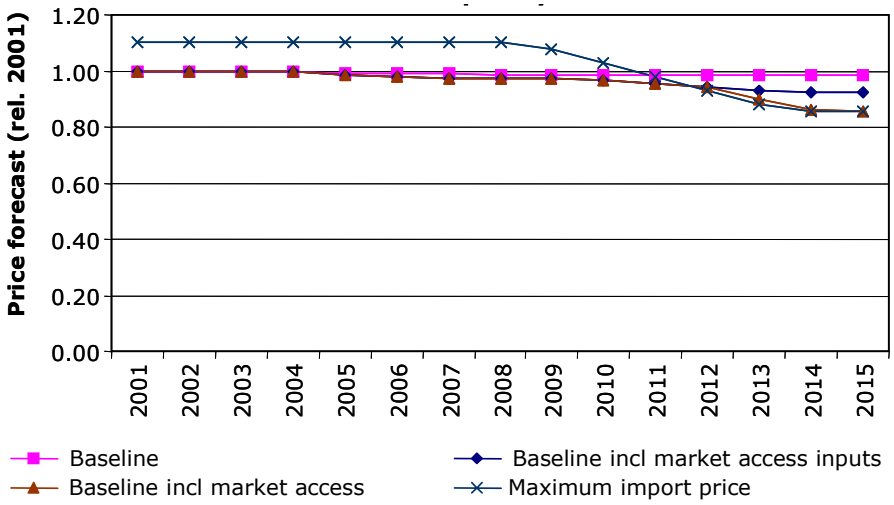
- on average, tariffs for imported poultry meat and imported beef and veal are reduced by one third;
- on average, import tariffs for pork sink by 45%;
- market access quantity restrictions remain unchanged.

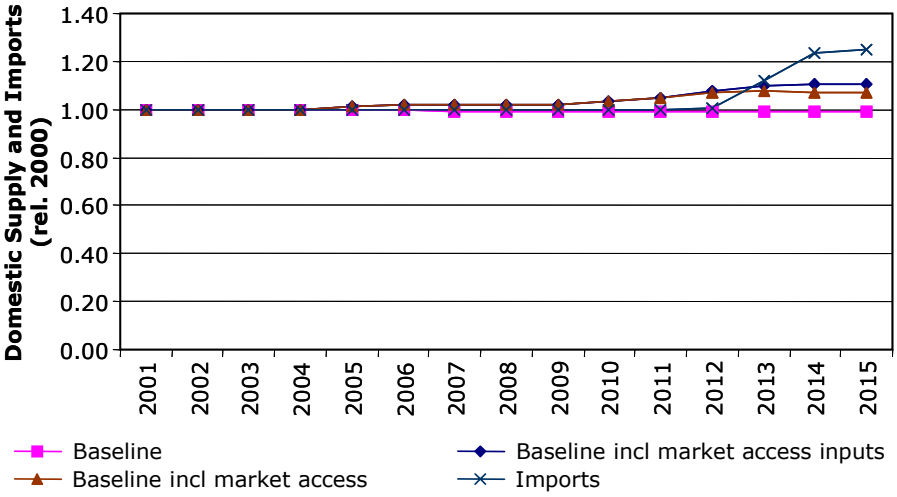
The adaptation phases for market access will take place during the years 2009 to 2013, whereby it is assumed that a linear reduction will be occur. As in the preceding section we assume that market access for agricultural inputs is liberalised and thus that the prices for animal feed will sink by 30%.

## Market for poultry meat

Figure 9 illustrates the effects of a partial liberalisation of the poultry meat market. Price development is shown in the upper section of the Figure while the developments of domestic production and imports are depicted in the lower section. The interpretation is based on the development of the maximum import price (import price plus out of quota tariff) which remains unchanged at CHF 4300 per tonne up until the year 2008 and then sinks to CHF 3360 by 2014. The direct comparison with the domestic price shows that the maximum import price up until 2010 is higher than the domestic price. Thus there are no imports at out-of-quota rates. Consequently, up until 2010 the domestic producer price results from the development of domestic supply and domestic demand (balancing feedback processes B1 and B2). The supply quantity rises steadily between 2005 and 2012 as a result of technical progress on the one hand and sinking feed prices on the other. Due to increasing production quantities, prices go down slightly since the additional supply quantities increase pressure on domestic prices, i.e. a market balance can only be achieved at lower prices. From the year 2011 onwards, the domestic producer price follows the course of the maximum import price as, from an economic point of view, it is reasonable to import additional quantities at this price. At this point in time, the balancing feedback loop B3 starts to dominate model behaviour. Consequently, imports of poultry meat increase noticeably from 2011 onwards. Due to the marked decline in prices there is an increased demand for poultry meat since consumers react elastically to price reductions for poultry meat. In spite of sinking producer prices, domestic production remains more or less stable as the decline in price is off-set by feed prices which started to go down noticeably in 2009.

*Figure 9: Development of market balance for poultry meat when market access is liberalised for agricultural inputs and outputs*



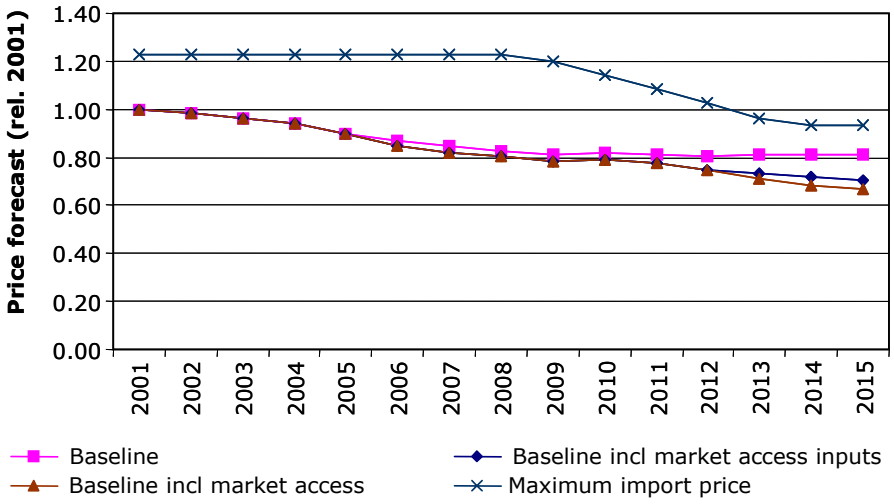


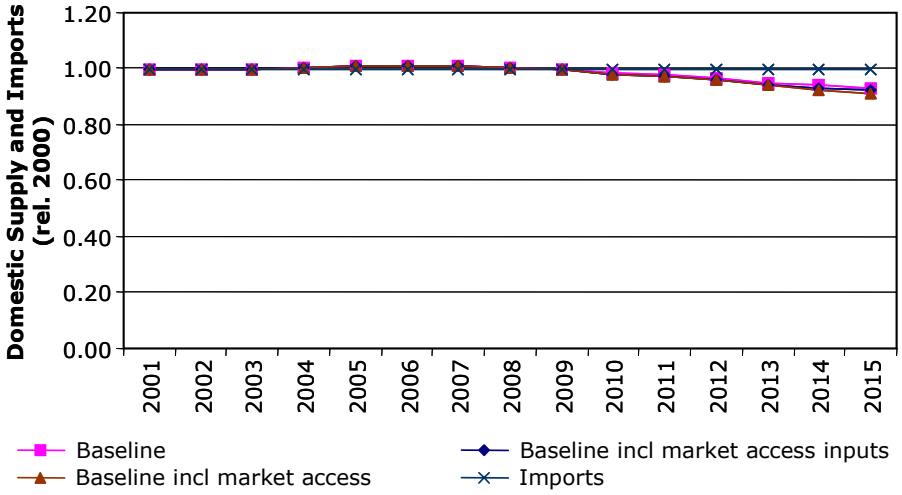

## Beef and veal market

The results for the beef and veal market are illustrated using the same structure as was applied to the poultry meat market (Figure 10). The direct comparison reveals that domestic producer prices are situated below the maximum import price over the entire time horizon; consequently the assumed tariff reduction has no influence on domestic market balance and this is confirmed by unchanged imports. Thus, developments for beef and veal depend on two effects at home:

1. Reduction in consumption preferences.
2. Interactions between the milk market and the beef and veal market as described in section 4.1.

*Figure 10: Development of market balance for beef and veal when market access is liberalised for agricultural inputs and outputs*






# 5 Summary and Conclusions

This paper developed a dynamic simulation model for the analysis of the dynamic behaviour of the Swiss milk and meat market under a wide range of development trends. These development trends are influenced by four key factors:

1. Internal development: technical progress.
2. Internal development: consumption preferences.
3. Exogenous influences: liberalisation of market access for agricultural inputs.
4. Exogenous influences: liberalisation of market access for agricultural inputs and outputs.

Simulations have shown that internal market developments determine the impacts of exogenous influences such as market access liberalisation scenarios. The dynamic simulation model therefore provides valuable decision support for agricultural policy. Without the simulation model agricultural policy decision makers would decide on the basis of the current market situation. The current situation, however, has different sensitivities than market development form a dynamic perspective.

The sensitivities are a crucial influencing factor for positions within WTO trade negotiations. The simulation model provides background information on which products can become sensitive both in the course of internal market developments and as a consequence of market access liberalisation scenarios. On this basis different priorities can be assigned to market access steps so that highly sensitive products continue to benefit from high protection levels. As compensation, however, concessions have to be made in partial markets that are less sensitive, again both in the course of internal market developments and as a consequence of market access liberalisation.

In addition to estimating the impacts of given market access scenarios the simulation model allows to determine the range of market access conditions within which agricultural products become sensitive.

To put the results of our market access liberalisation scenario in section 4.3 into perspective, it must be stated that this scenario with a tariff reduction between 35% and 45% corresponds to a moderate liberalisation step. The liberal export countries are demanding tariff reductions of up to 80% in the course of the on-going WTO negotiations. This would put considerably more pressure on the markets investigated. In the event of reduction measures of this magnitude, the option of a lower tariff reduction and compensation by means of higher tariff quotas gains considerable importance. In this case, although Swiss agriculture would face competition from higher import quantities, price pressure on the overall market is less pronounced than under a unilateral reduction of tariffs. On the other hand, the results of the scenario presented here indicate that concessions between partial markets are possible. In the case of pork, beef and veal the assumed liberalisation measures have no impact on the domestic market; this is also not the case in the event of other moderate reduction steps. Therefore, further concessions in these markets are not sensitive and this opens up leeway for negotiations regarding sensitive markets, such as poultry meat. On the other hand, it must be borne in mind that, with regard to their production value, the markets for pork, beef and veal are much more important and therefore concessions in these sectors involve a great financial risk.

The simulation results demonstrate clearly the value of a dynamic examination process. On the one hand, this applies to the interrelationships between the partial markets on the demand side where price changes in one partial market likewise influence demand in the other markets. On the other hand, the simulations show the leeway that exists for the on-going WTO negotiations whereby the development of domestic supply and demand exerts considerable influence on the potential impacts of market liberalisation.

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