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GMO free milk: A system comparison of Germany and Switzerland

Authors
Stefan Mann and Thomas Venus

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
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Corresponding author	Stefan Mann, e-mail: stefan.mann@agroscope.admin.ch
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Table of contents

Abstract

The paper compares the Swiss and the German approach to satisfying the demand for milk produced without genetically modified (GM) feed. While the Swiss industry has stopped imports of GM feed into the country, market partners in Germany use feed that is free of genetically modified organisms (GMOs) only to fill certain market niches. From a cost-benefit standpoint, the German strategy is the less costly and probably more efficient one. Taking into account that GMO-free feed may be an integral part of a sustainable production system, the presented system comparison indicates that the current solutions in the two countries are suitable to fulfill the demand for GMO-free milk.

Keywords: comparative economics, consumer protection, milk

1 Introduction

Throughout the recent decades, a significant segment of the population has expressed reluctance to consume food that contains genetically modified organisms (GMOs) (Loureiro and Hine, 2001; Evanson and Santiello, 2004; Kolodinsky, 2008). This aversion does not only apply to crops with an altered DNA structure but also to products from animals that have been fed or treated with materials produced with gene technology (e.g., Roosen et al., 2003). In the U.S., the focus of the discussion is on milk from cows treated with the rBST hormone (Wang et al., 1997), whereas in Europe, the emphasis is on the demand for GMO-free milk, which usually is defined as milk originating from cows that have not received genetically modified (GM) feed (Bickel et al., 2009).

Due to the credence good (Ekelund et al., 1995) characteristic of the GM product attribute, the demand for GMO-free products can be satisfied by positive or negative labeling (Phillips and Isaac, 1998; Ford Runge and Jackson, 2000). In the U.S., voluntary negative labeling is used for all products that neither are GMOs nor contain GMOs. In some European countries, negative labeling is used to complement the mandatory GM-labeling with a voluntary option to label livestock products derived from animals raised without GM feed. The herein presented analysis takes advantage of the variety in legal and economic settings found in different markets. It aims to compare a system in which GMO-free milk is the only variety of milk available in the country with a system in which GMO-free milk is offered as a market niche. Results are expected to help develop appropriate regulations with a more empirical and a more system-based approach than that available to date.

The methods applied to reach this objective are described briefly in the next section. Section 3 then provides a description of the two case studies from both a legal and an economic perspective. Section 4 describes a cost-benefit analysis of the two cases, whereas Section 5 takes a more system-based stance before conclusions are developed in Section 6.

2 Methodology

The first step was the selection of the two cases. The EU provides a rather well-defined framework for GM products. While member countries can choose whether GM crops may be produced on their land, the European Single Market prevents any barriers on trading GM products. One of the EU member countries with the strongest consumer demand for GMO-free products and with the greatest reluctance towards GMOs is Germany (Gaskell et al., 2010; TNS Opinion & Social, 2010), which was chosen as a study case for analyzing GMO-free milk as a market niche. An adjacent country in which GM feedstuff is neither produced nor imported is Switzerland. Switzerland's entirely different, more restrictive approach to fulfilling the demand for GMO-free milk serves as a second study case in order to compare Germany's market-based selective solution with a cartel-based holistic solution. For this comparison, two broad sets of activities had to be undertaken to, firstly, gain sufficient understanding of the systems and, secondly, perform a normative analysis.

For the first part, eighteen interviews with decision-makers in the milk chain were conducted to understand the legal and market framework of chains in Germany and Switzerland. The selection of the interview partners was based on both the significance of each partner's position in the market and the diversity of the interviewed population to ensure all parts of the chain were represented. The resulting interviews with feed producers, traders, dairy farm operators, representatives from non-governmental organizations (NGOs), and members of professional associations[1] were conducted mostly face to face and partly by phone between summer 2012 and spring 2013. Most interviews were transcribed. A content analysis of the interviews (see Mayring, 1988; Krippendorf, 2004) was sufficient to understand the most important determinants of the history, objectives, and strategy of the two programs. Chosen codes (i.e., key terms) partially emerged from the interviews and partially were based on the underlying theoretical framework following a template analysis (Cassel and

[1] Some of the interview partners covered more than one segment, for example, companies involved in both producing and trading feed or persons working for both an NGO and a company.

Symon, 2004). The strict reliance on the codes, based on the guidelines by Carmines and Zeller (1979), then guaranteed a high degree of reliability (Neuendorf, 2002).
The cost-benefit analysis initially presented significant methodological challenges. Honoring the substantial criticisms on willingness-to-pay surveys (Bowers, 1993; Hausman, 2012), a more reliable method was found in the theoretical models by Fulton and Giannakas (2004) and Giannakas and Yiannaka (2006). These authors applied the utility function approach for vertically differentiated products by Mussa and Rosen (1978) to explain the impact of the introduction of GMOs and of GM-labeling on consumer utility and producer profit. We used this model to compare a situation where producers may voluntarily implement a production standard or label with a situation where all producers implement the label as a result of being in a quasi-cartel-based system.

3 Case-study description

3.1 Legal situation

Within the EU, there has been a longstanding debate about the legalization of GMOs in agriculture. In general, several GM crops have been legalized in the EU. Based on a rather vague legal foundation, the German government in 2009 followed the example given by France one year before and banned the commercial use of GM crops in agriculture (Cooper, 2009). These signals sent to the modern agribusiness, however, did not alter the fact that one of the EU's most-valued principles is the single market in which no trade barriers of any kind are allowed. Therefore, GM crops produced in other parts of the EU can be traded freely in Germany, and so can GM soybeans from outside the EU. Hence, there can be no legal requirement for German milk to be GMO free.
The legal situation in Switzerland is somewhat different, although, as in Germany, no GM crops may be grown on farms, based on a referendum in 2005. The main differences to Germany are that there has been no time in Switzerland when certain GM crops were allowed and that the legal framework to outlaw GMO production rests on a firm legal base. This base was established by a public referendum in which 56 percent of voters called for a moratorium on GMOs in agriculture.
In addition, Switzerland has full sovereignty to define import barriers. Among them is the ban on importing germinable GM seed. This certainly strengthens the ban on GMO production in the country. Nevertheless, a press release by Greenpeace (2012) reported that several GM rapeseed crops from Monsanto have been growing near some railway lines in the country, which shows that the protection provided by law is not fully effective.

3.2 Market situation

Of the 300,000 tons of soybeans which enter Switzerland annually, only 17,000 tons are imported as germinable soybeans The vast remainder is imported as meal and, hence, is not regulated by the moratorium on GM seeds. However, in 2007, two years after the moratorium, the last imports of GM feed were registered by Swiss customs. Since then, all market players have been paying the additional price, which—according to the interview partners—fluctuates between 50 and 140 €/t, for buying GMO-free soybeans from Brazil. The market players have to grapple with contamination issues and the disposability of GMO-free commodities and always act under the possibility that some market player might break the unwritten rules of the cartel. From this perspective, it is remarkable that the de-facto-moratorium has worked for over five years.
Two major reasons can explain why the Swiss import oligopoly bade farewell to buying GM feed. The first reason is that until 2007, a lot of attention from the critical part of the public, including NGOs like Greenpeace, was focused on the imports of GM feed. The second reason is that almost all Swiss agricultural products require some sort of quality label. All existing labels include the ban of GM feed for producing milk or meat.
In Germany, the number of market players in the feed import business, according to the interview partners, largely exceeds that of Switzerland. Therefore, a voluntary import moratorium as in Switzerland would

probably be impossible. Indeed, most soybeans imported in Germany are GM seeds used for animal production.
Regarding milk production, however, Venus and Wesseler (2012) were the first to report the existence of GMO-free chains in Germany. Based on their analysis, at least five percent of German milk was labeled as GMO free in 2011. On the political side, the association “Verband für Lebensmittel ohne Gentechnik” publishes information on companies with GMO-free inputs and provides a label for the resulting products.
After the decision to run a GMO-free label is made, dairy operators usually ask feed traders to include GMO-free feedstuff in their portfolio. It was reported that these negotiations initially were not met with acceptance by the feed traders. Although it is increasingly difficult to find GMO-free soybeans on the world market, the separated GMO-free chain as such has become more or less business as usual. In addition, dairy operators inform farmers about the legal feeds available, put them under a respective contract, and hire a control company to check for compliance. The certification process has now been standardized.

Based on the interviews described in the previous section, consumers demanding GMO-free milk in Germany can choose from three different systems:

a) A range of dairy products labeled as GMO free focuses particularly on the added value of the GMO-free attribute and does not differ otherwise from conventional products. This pathway often is chosen by rather large market players. As a reimbursement for using GMO-free feed, farmers receive a rather small margin. While Zott pays a low milk price, the 400 farmers under contract for the GMO-free label (of a total of 3,100) receive a bonus of 1 eurocent (C)/L. Other dairy producers pay only half of this or less as compensation.

b) The most traditional solution to obtain GMO-free products is to comply with the organic production system. Organic farmers never have used feedstuff produced with GMO seed. Three percent of all milk produced in Germany is sold with an organic label (BÖLW, 2011). Obviously, organic milk provides a large number of additional attributes and therefore causes considerably higher costs than conventional milk; according to interview partners, the additional costs amount to 8 C/L.

c) Most interestingly, a considerable number of intermediate production systems has emerged in recent years. These systems aim to be more environmentally friendly and socially sound than conventional systems but more productive than organic systems. Examples are:

    - Haymilk: This label does not describe a diet consisting solely of hay but implies a ban of a range of feedstuff including—in addition to GMOs—silage or industrial side-products like treacle. Certain agricultural practices like fertilizing with compost are outlawed, and some additional prescriptions like a time span of three weeks between fertilizing and using grassland apply.
    - Fair milk: Farmer associations have designed a label guaranteeing, in addition to GMO-free feed, a stable price of 40 C/L and targeting consumers with social objectives. In Southern Germany, the “sternenfair” label implies certain environmental conditions, such as a ban of non-European feed, of more than 30 percent maize on the land, or of more than 1,500 kg compound feed per cow and year.
    - “A good piece of Heimat:” This Southern German label emphasizes local production but includes the obligation to use GMO-free feed, to keep cows in free-stall barns, and to produce milk in the highest quality class ‘S.’

These three programs under c) have in common not only that they attempt to create a new system, but also that they had to introduce their own quality assurance schemes by designing appropriate contracts with farmers and employing control companies. In the second and third example, only a portion of the total amount of milk produced by farmers under contract can yet be sold under the label. Hence, the price farmers receive is a mixed result from two sales channels. Overall, an average added margin between 2 and 5 C/L is paid for milk under the schemes described.

4 Welfare analysis

Based on the considerations of the above case study, we developed a theoretical model to compare the welfare effects of the German market-based selective solution, denoted with superscript M, with those of the Swiss cartel-based holistic solution, denoted with superscript C, from a producers' perspective with exogenously given prices to gain profit π_i where $i \in \{g, n\}$; a dairy then can produce either conventional raw milk derived from GMO-fed animals of quality *g*, or GMO-free raw milk derived from animals fed only with GMO-free feed of quality *n*.[2] Depending on their profit π, dairies would produce either one unit of the conventional product *g* or one unit of the GMO-free product *n*, if these options are available. If dairy operators are faced with the market-based system, they can decide between π_g and π_n^M, and if they are faced with the cartel-based system, they can choose between π_g and π_n^M. If they choose the cartel-based system, all firms in this country have to choose the GMO-free production and will then get a bonus *b* from reduced segregation cost and a systemic advantage which will be explored in Section 5. Assuming that all firms are distributed uniformly but differ by parameter β in their additional costs *c* of producing GMO-free milk, where $c(c \in [0,1])$, then firms profit functions are given as follows:

$$\pi_g = \pi_g \qquad conventionl\ product\ g\ derived\ from\ GM\ feed \qquad [1]$$

$$\pi_n^M = \pi_n - \beta c \qquad marketbased\ GMOfree\ product\ n \qquad [2]$$

$$\pi_n^C = \pi_n + b - \beta c \qquad cartelbased\ GMOfree\ product\ n \qquad [3]$$

Profit-maximizing producers will choose the product that maximizes π_i^j , and the marginal producer with the cost attribute $c(\text{c}: \pi_g = \pi_n^j)$ with $j \in \{M, C\}$ is indifferent to producing type *g* or type *n*. The supply of GMO-free products in the market-based system is given by:

$$c^*: s_n^C = max\left[0, \frac{\pi_n - \pi_g}{\beta}\right] \qquad [4]$$

The supply of GMO-free products in the cartel-based system, if all firms produce GMO free, is given by:

$$c^*: s_n^C = max\left[0, \frac{(\pi_n + b)}{\beta}\right] \qquad [5]$$

If a country attempts to maximize producer welfare, all producers have to choose system j that maximizes their profits. Hence, producer welfare is given by:

$$PW = max\left[\left(\int_0^{s_n^M} \pi_g dc + \int_{s_n^M}^1 \frac{\pi_n}{\beta} dc\right), \left(\int_0^1 \frac{(\pi_n + b)}{\beta} dc\right)\right] \qquad [6]$$

This leads to the decision to choose the cartel-based system if the bonus is larger than the producer loss from cartel-based GMO-free labeling, meaning that the whole country should produce GMO-free milk if the overall benefit for the country of being GMO-free as a unique selling strategy or if the benefit of having less costs in segregating is larger than the loss experienced by some producers who would be better off choosing non-GMO-free. This can be shown mathematically by inequality:

$$Choose\ \pi_n^C\ iff\ \left(\int_0^1 \frac{(\pi_n + b)}{\beta} dc - \int_0^1 \frac{\pi_n}{\beta} dc\right) > \left(\int_{s_{n1}^C}^1 \pi_g - \int_{s_{n1}^C}^1 \frac{(\pi_n + b)}{\beta} dc\right) \qquad [7]$$

Hence, a country is better off choosing the cartel-based instead of the market-based system, if *b* exceeds the threshold in equation [7].

[2] To make the analysis case-specific to fit the case-study approach, producers can be considered as dairies and the products as milk products (or milk in short, as milk is the raw material for all milk products).

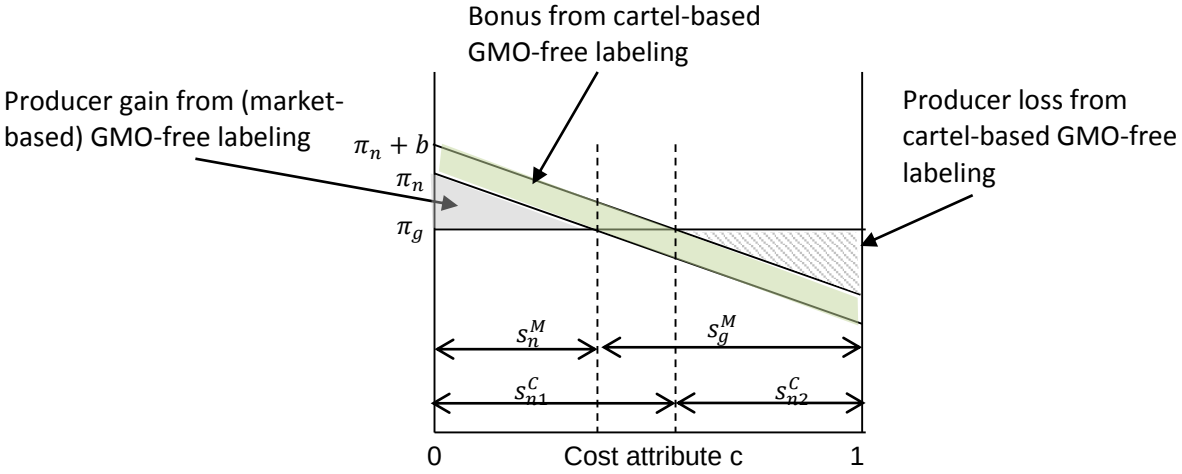

Figure 1: Producer gain from market-based GMO-free labeling as well as bonus and producer loss from cartel-based GMO-free labeling.

The overall costs also can be described in quantitative terms. It was shown above that the additional costs of keeping milk production free of GM feed are caused mainly by the self-restriction to import only GMO-free soybeans, which in turn are mostly used in milk production. A total of 280,000 tons of soybean meal and 17,000 tons of whole soybeans were imported into Switzerland in 2012. Compared to that, the 3,000 tons of soybeans produced nationally are negligible. A methodological problem in GMO-free milk production is the strongly fluctuating price margin for GMO-free soy seed. Although there were certain times when the price for GMO-free seed was below the price for GM seed, the typical price margin for GMO-free seed lies between 40 and 150 €/t or an additional 10 to 30 percent of the world market price. If this value is multiplied by the soybean imports of ca. 300,000 tons, it will result in costs of the supply of GMO-free milk of 12 to 40 million Euros in Switzerland. Divided by the 7 million inhabitants of Switzerland, these are 2 to 5 Euros per consumer and year. It should be mentioned that a large part of these costs is due to segregation and identity preservation, especially for the quality safety system. For example, costs for testing only one transport container amount to 150 to 200 Euros.

Quantifying the bonus of importing only GMO-free feedstuff is difficult due to potentially lower segregation costs and a potential reputation gain for the entire country. It also is difficult to quantify the actual welfare effects in Switzerland, because there can only be speculations about actual purchasing behavior if GM milk were to be offered. If we drew analogies to the German case, there would be 10 percent of consumers with a significant willingness to pay (through purchasing organic or GMO-free milk). Ten percent of the costs of the cartel could therefore be deducted, so that it is plausible to assume that the annual welfare loss will be somewhere between 10 and 36 million Euros, which is 1 to 5 Euros per consumer.

5 A systemic caveat

All considerations above isolate the attribute of GMO-free milk from all other attributes of agricultural production in general and milk production in particular. However, we have known since Dillon (1976) that the system as a whole is often more than the sum of its parts and that this applies to agriculture to a strong degree. We at least should consider the possibility that this presumption also holds in the case of GMO-free milk. This presumption would imply that the utility of GMO-free milk is composed of

- the utility of being GMO free,
- the utility of all other relevant attributes of milk, and
- the utility of the interdependencies of being GMO free and the other attributes.

As soon as such interdependencies exist, skipping the attribute of being GMO free could have much more negative impacts on the utility of milk than visible at first glance.

Although such interdependencies may be assumed, the crucial question is whether there are any empirical hints to their existence. One significant indicator certainly lies in the numerous attempts by market partners to establish agricultural systems which are more environmentally friendly and socially sustainable than conventional farming. Both the initiatives mentioned in Section 3c and their relative success on the market in terms of higher prices indicate that linking several positive attributes in milk marketing generates added value. At this point, it should also be mentioned that, for example, milk sold under the “A good piece of Heimat” is sold in retail with a 30 Cent margin compared to conventional milk, although farmers in the program only receive an additional 2.4 C/L (partly because not all produced milk can be sold under the label). The demand observable at the marketplace seems to be a demand for more sustainable milk rather than a demand for GMO-free feed on its own.

It has been shown empirically that a large segment of Swiss consumers has a significant willingness to pay for the “Swissness” of agricultural products (Bolliger and Réviron, 2008) and that even British chocolate producers try to attach a Swiss image to their products (Pearce, 1999). A tradition of high-quality production and processing is only part of the reason for that; another is the high environmental and animal welfare standards of Swiss agriculture (Baur and Nitsch, 2013).

6 Conclusions

A simple cost-benefit appraisal leads to the conclusion that keeping a whole country free of GM feed is a rather costly solution for providing so-called GMO-free milk to consumers. A limited segment of the population is interested in this attribute, and it causes significant extra costs to deliver it to consumers who are indifferent to the use of GM feed in milk production.

However, Swiss agriculture struggles to maintain and expand an international image of a national farming sector with a high level of sustainability. Our system analysis indicates that this image likely is supported by the ban of GM feed imports into the country. Whereas this approach appears to be an optimal strategy for Switzerland, it cannot be applied by EU member states.

Among the most interesting empirical observations in this project is certainly the fact that not the state but market partners in Switzerland have decided to not import any GM feed, despite the considerable extra costs. Apparently, the “invisible hand” of the market supports the notion of a systemic threat to Swiss agriculture if GM feed was to be imported.

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