



Farmers' valuation of incentives to produce genetically modified organism-free milk: Insights from a discrete choice experiment in Germany

J. A. Schreiner*¹ and U. Latacz-Lohmann*†

*Department of Agricultural Economics, Christian-Albrechts-Universität zu Kiel, Olshausenstraße 40, 24118 Kiel, Germany

†School of Agricultural and Resource Economics, University of Western Australia, Crawley WA 6009, Australia

ABSTRACT

This paper investigates farmers' willingness to participate in a genetically modified organism (GMO)-free milk production scheme offered by some German dairy companies. The empirical analysis is based upon discrete choice experiments with 151 dairy farmers from 2 regions in Germany. A conditional logit estimation reveals a strong positive effect of the price premium on offer. Reliable feed monitoring and free technical support increase the likelihood of scheme adoption, the latter however only in farms that have been receiving technical support in other fields. By contrast, any interference with the entrepreneurial autonomy of farmers, through pre-arranged feed procurement or prescriptive advice on the part of the dairy company, lowers acceptance probabilities. Farmers' attitudes toward cultivation of genetically modified soy, their assessment of the market potential of GMO-free milk and future feed prices were found to be significant determinants of adoption, as are farmer age, educational status, and current feeding regimens. Respondents requested on average a mark-up of 0.80 eurocents per kilogram of milk to accept a contract. Comparison of the estimates for the 2 regions suggests that farmers in northern Germany are, on average, more likely to convert to genetically modified-free production; however, farmers in the south are, *ceteris paribus*, more responsive to an increase in the price premium offered. A latent class model reveals significant differences in the valuation of scheme attributes between 2 latent classes of adopters and nonadopters.

Key words: genetically modified organism-free milk production scheme, farmer valuation, discrete choice modelling, latent class analysis

INTRODUCTION

European consumers have been shown to be critical of new technologies such as the use of genetically modified feed or growth hormones in animal husbandry (Bredahl, 2001; Burton et al., 2001; Lusk et al., 2003). A comprehensive review of consumers' attitudes toward new food technologies revealed that perceived naturalness is highly valued. Moreover, the use of genetically modified organisms (GMO) in food production affects purchasing behavior more adversely than other novel food technologies such as nanotechnologies (Rollin et al., 2011). According to Costa-Font et al. (2008), citizens of Northern European countries and France are less tolerant to genetically modified (GM) food than citizens of the United States and southern European countries. In a study among French consumers ($n = 97$) on willingness to pay (WTP) for food products that differ in their content of GM ingredients, Nussair et al. (2004) found that 35% of respondents are generally unwilling to purchase such products and that a GM-free guarantee raises the WTP for biscuits by 8%. A cross-cultural comparison of consumers' WTP for rib-eye steak confirms that European consumers are more adverse toward the feeding of GM corn than US consumers. For example, the German respondents were willing to pay \$4.40 per pound more than US consumers for a steak produced without GM feed (Lusk et al., 2003). In general, European consumers are willing to accept increasing food bills to obtain products without GMO.

In response to these market developments, some retailers and processors have begun to impose GMO-free requirements on the primary stage of production. In Germany, the production of GM-free milk is one such example that has gained significant importance in recent years, in particular in Bavaria (Dorfner and Uhl, 2011). Some dairies, mostly located in the south of Germany, have included this value-added quality concept into their product portfolio. To increase transparency and aid consumers' purchasing decisions, a voluntary GM-free label based on the Law on the Execution of Genetic Engineering (EG-Gentechnik-Durchführungsgesetz)

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¹Corresponding author: jschrei@ae.uni-kiel.de

was introduced. Farmers who voluntarily accept the requirements for GM-free milk production must prove that they did not use feedstuffs listed as GM feed in EU Regulations 1829/2003 and 1830/2003. Dairy companies wishing to use the label have begun to develop GM-free production schemes in accordance with the law. These schemes offer a producer price increment to compensate farmers for the additional costs implied by the requirements. The increment varies between 0.5 and 2.0 eurocents per kilogram of raw milk (corresponding to an increase of 1 to 5% of the milk price) and depends mostly on the marketing success and type of products sold (Venus and Wesseler, 2012).

This paper aims to assess the willingness of dairy farmers to participate in a GM-free milk production scheme that a German dairy company is planning to launch. More specifically, we wish to clarify how the production requirements and the incentives offered by the scheme affect the willingness of farmers to participate and how much influence farm structure, farmer characteristics, attitudes, and region have on adoption behavior. The empirical analysis is based on discrete choice experiments (**DCE**) with 151 dairy farmers from 2 key milk production regions of Germany. Discrete choice experiments are mainly applied in fields such as marketing and environmental economics to analyze preferences of customers or citizens for certain attributes of consumer goods or environmental assets in hypothetical settings.

A brief overview of studies at the consumer level related to the acceptance of GMO in food (Burton et al., 2001; Lusk et al., 2003; Rigby and Burton, 2005) was given previously. The following review therefore focuses on relevant studies applying DCE at the producer level.

Birol et al. (2008) provided a comprehensive review of the application of DCE in Europe. The studies reviewed were designed to inform the implementation of policies relating to the environment and the agri-food sector. A large number of DCE have been conducted to investigate farmers' willingness to participate in agri-environmental schemes. Because such schemes are complex and adoption is influenced by many factors (Edwards-Jones, 2006), including characteristics of farm and farmers, the DCE method provides information on how schemes can be designed effectively. The valuation of scheme components is reflected by specific willingness-to-accept estimates that can be calculated by including payment as one of the attributes.

Espinosa-Goded et al. (2010) investigated the factors affecting farmer's willingness to participate in a proposed agri-environmental scheme paying Spanish farmers to cultivate alfalfa (a nitrogen-fixing crop). Farmer respondents were confronted with choice sets in which they had to choose among alternative contracts, each

involving distinct implementation requirements and a given compensation payment. The results indicate that free choice of the land offered for the program and unrestricted use of the alfalfa crop significantly increase respondents' willingness to sign a contract, as does previous experience with agri-environmental scheme participation. Acceptance is also influenced by regional conditions and by farmer and farm-specific characteristics. Significant differences were found in the ranking of attributes between different regions.

Jaeck and Lifran (2013) investigated the willingness of farmers to implement agro-ecological practices such as weed control and crop rotation in rice production. They applied a latent class model to account for heterogeneity in farm structures and farmer preferences. It was concluded that farmers' concern for environmental issues is a main driver for the implementation of environmentally friendly practices. Birol et al. (2006) used a DCE to investigate Hungarian farmers' preferences for traditional agricultural practices in home gardens, including crop variety diversity, maintaining landraces, integrated crop and livestock production, and organic cultivation. They found that the valuation of home garden attributes depends on household structure and regional conditions, such that in regions with a lack of food market access, poorer soils, and heterogeneous agro-ecological conditions, home gardens that are rich in crop variety diversity are highly valued. Socio-economic factors such as age and education were also found to affect preferences.

Studies investigating the acceptance of marketing schemes at the producer level are rare. Olynk et al. (2012) conducted a survey among Michigan dairy farmer to estimate the welfare losses when the option to use recombinant bovine somatotropin (**rbST**) is eliminated from the set of technologies. They designed choice scenarios with varying milk and corn prices, production practices (use of rbST or rbST-free), and different levels of milk production trends. They revealed that farmers, whether using rbST or not, had statistically significant welfare losses from the elimination of this technology. Whereas the Olynk et al. (2012) study dealt with a technology aimed at increasing productivity, the present study focuses on the acceptance of production methods to produce premium milk for a niche market.

Only a small number of studies have investigated the influence of farmers' attitudes toward GM technology in agriculture. Cook and Fairweather (2003), for instance, examined changes in intentions, attitudes, and beliefs of farmers regarding the use of GM technology and concluded that attitudes are a key factor for the decision-making process. In particular, producers' concerns about environmental risks, adverse effects on future generations, market acceptance, and commercial

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