AgBioForum, 18(1): 26-33. ©2015 AgBioForum.

Is "GMO Free" an Additional "Organic"? On the Economics of Chain Segregation

Stefan Mann
Agroscope, Switzerland

After organic farming arose as a chain separate from conventional food production in many parts of the world in the last quarter of the 20th century, another separate chain emerged in recent years—the chain for food free of genetically modified organisms (GMOs). This article summarizes the lessons learned from segregated organic chains and compares them with new findings gathered from GMO-free chains of soybeans, maize, and milk in Western Europe. Two mechanisms are found to be widespread to cope with the transaction costs of segregation: a specialization of businesses or entire countries and a "downwashing" process, during which a sequence with decreasing quality requirements is used in facilities. The main role of the state is to create a framework that provides a high degree of credibility for the product information provided.

Key words: GMOs, organic, chain segregation, Europe.

Introduction

Once there was a time when agricultural economists dealt with only one type of segregation in the food supply chain—the segregation between white and black workers (Tang, 1959). The agricultural products were judged exclusively according to their physical qualities and segregation in the supply chain happened naturally: "Adaptation of certain varieties to certain regions has segregated them when production was undertaken" (Erdman, 1933, p. 717). Foremost, it was organic farming that posed the first challenge to this world of natural segregation. Born in opposition to the increasingly industrialized agricultural production around 1900, it was the first time that a novel, competing agricultural system emerged in the farming sector. As there was no reliable way for a visual distinction between organic and non-organic products, the need for segregation arose.

During the fourth quarter of the 20th century, producers and consumers witnessed the introduction of systematic segregation in the supply chain. Whereas local labels were introduced as early as 1965 (DeSoucey & Téchoueyres, 2009), certainly requiring some form of segregation, the need to compensate lower yields by higher prices led to large-scale efforts in the organic movement to establish separate chains (Vogt, 2001). In recent years, the introduction of genetically modified organisms (GMOs) in agriculture and the opposition against them provided a second cause for large-scale segregation. A research project currently funded by the European Commission (PRICE)[1] has examined the mechanisms of segregation in the GMO-free chain. Some theoretical models had been drawn previously (Moschini, Bulut, & Cembalo, 2005), but this now offered an option for an empirical comparison of and a subsequent conclusion about commonalities in the economics of segregation.

The collected knowledge about segregation in the organic sector is summarized in the next section. This is followed by the main findings regarding segregation mechanisms for GMO-free food. Using the example of Switzerland, the role of the state in segregation is then explored. Finally, commonalities and differences between segregation in organic and GMO-free markets are compared, and conclusions are drawn.

Lessons from Segregating Organic Food

A buyer of organic food usually pays a positive price margin compared to conventional products. The attribute for which this margin is paid usually cannot be perceived in the product's external characteristics and therefore strongly depends on the credibility of the production modes. Therefore, credence certainly is an important product attribute (Pascucci, 2007; Wirth, Love, & Palma, 2007). Whereas many food labels suffer from a lack of credibility (Nilson, Tunçer, & Tidell, 2004), it is the strength of organic production to be sufficiently well established to potentially attain a high level of credibility. A review of the literature about the segregation experience over the last decades of organic

1. *PRactical Implementation of Coexistence in Europe. For more information, see http://ec.europa.eu/research/bioeconomy/agriculture/projects/price_en.htm.*

farming suggests that there are two important categories through which credibility is achieved and in which segregation takes place. In want of better terms, they can be described as technical and cultural segregation.

Technical Segregation

Technical segregation describes the measures undertaken to guarantee that the product purchased under the organic label was produced by organic standards. There is, as Sidern, Maquet, and Anklam (2005, p. 332) reported, "not yet a method for routine use in authentication of organic food products." Therefore, a clear necessity prevails to separate organic from conventional goods and document this separation accordingly if organic food is to be sold with an extra margin. Consequently, all major organic standards require product segregation throughout the marketing chain (Oberholtzer, Dimitri, & Greene, 2005). Eventually, this requirement boils down to organization and engineering; a lot of recent literature (Thakur & Hurburgh, 2009; Varga & Csukás, 2010; Zhang, Feng, Xu, & Hu, 2011) deals with the identification of suitable technologies for accomplishing a high degree of reliability in the segregation process.

A good example for technical segregation is the debate about mixed conventional/organic farms. In Switzerland, such combinations are outlawed by the organic association, whereas in the European Union (EU), mixed farms are allowed. After a major scandal involving Lower Saxonian (North German) chicken farms, the regional minister of agriculture demanded a ban on German farmers managing organic and conventional product lines on the same farm. It becomes increasingly obvious that the borders of a farm business provide a good first condition to organize segregation. Another example is the enforced requirement in the EU for organic farms to use 100% feed from organic production (Sylvander & Le Floc'h-Wadel, 2001). This action originates from (and underlines) the will to provide a product with a real distinction. The segregation has to be maintained in a cradle-to-grave approach for all steps in the chain—all the way through processing and packaging until an organic label is put on the product on the retail shelf. Altogether, the margin paid by consumers should exceed the costs of segregation, including labeling (Giannakas, 2002).

Cultural Segregation

Organic farming never has been understood merely as a technical alternative to conventional agriculture; it has always been a cultural challenge for the conventional agri-food chain. The actual formula of this challenge differs: Clunies-Ross, Cox, and Lowe (1994) call it a challenge of the productivist paradigm while Darnhofer (2005) calls it a struggle against commoditization. In any case, organic farming is dedicated to setting a sign against today's practice of conventional agriculture.

This signal has been translated often into an institutional segregation exercised for cultural reasons. It covers the realms of education, administration, and retail, none of which would be involved in the technical distinction of organic from other food products. Moschitz, Stolze, and Michelsen (2004) reported movements towards integration in the areas of training and advice and simultaneously of segregation in the area of vocational training. Michelsen, Lynggaard, Padel, and Foster (2001) showed how segregation in administration has contributed to the segregation of organic farms from general agricultural institutions.

Organic stores are the most visible sign of cultural segregation. However, Tondel and Woods (2006) wrote of decreasing specialization in retail outlets: organic food is more and more present on the mainstream supermarket shelves. The world market leader for organic food, Whole Foods Market, Inc., is one prominent example for a successful concept of increasingly mixing organic with other (more or less healthy) food products. For Groier (2013), this development is only part of what he described as the conventionalization of organic farming. Other indicators are food scandals involving several organic farms (Hoffmann, 2011), as well as the growth of organic farms in size by which the popular image of small, idyllic farms is increasingly compromised.

Although the term conventionalization does not explicitly distinguish between technical and cultural phenomena, it should be mentioned that, from a technical viewpoint, organic farming hardly has made any significant moves towards conventional agriculture. The standards about acceptable farm inputs as a whole have not decreased. All observed developments of conventionalization are within the realm of cultural segregation. The distinction between technical and cultural segregation enables us to recognize an important trend: although cultural segregation decreases, technical segregation will remain intact as long as organic and conventional agriculture are two separate systems.

Observations from Segregating GMO-Free Food

To give a fairly broad overview of the institutionalization of segregation for GMO-free feed and food, three important agricultural subsectors will be described for selected EU countries and for Switzerland, where segregation plays the most important role internationally. These three subsectors include soybeans with a largely imported supply; maize with a largely domestic supply; and milk, which is basically always GMO-free but where attention is paid to the feed used for the cows.

Soybeans

The most important soybean producer within the EU is Italy, which is the tenth-largest producer worldwide. Nevertheless, although Italy produced 554,000 tons in 2010, its soybean meal consumption was estimated at 3.3 million tons. Soybeans are a typical import good in the EU and therefore are influenced strongly by conditions on the world market. The world's two main soybean producers are Argentina and the United States. However, these two countries offer almost no GMO-free species. The GMO-free market has long been dominated entirely by Brazil. Established and formalized partnerships between producers, trading companies, crushers, and certifiers have guaranteed for a long time a steady supply of GMO-free soybeans from Brazil.

For many years, the additional price margin for GMO-free soybeans has been increasing, caused both by increased demand from Europe and Asia and by the expansion of GM species in Brazil. The latter fact currently is leading to problems in the delivery of guaranteed GMO-free soybeans from Brazil. India is the world's largest vegetable oil importer and does not cover its own soybean consumption but currently covers some contracts for the delivery of GMO-free soybeans, as India is the only major producer relying exclusively on non-GM soy.

In the EU, segregation takes place only in some regions. In Portugal, for example, there is neither organized supply nor sufficient demand for GMO-free soybean chains (Quedas & Trindade, 2012). This fact helps to explain why many multinational suppliers—including most market leaders like Cargill and Bunge—have decided not to offer GMO-free soy products. Other firms—such as ACTI in Germany or Nidera in Italy—usually on a national scale, have decided to specialize in importing GMO-free soybeans or soybean products. Only a few companies except freight businesses run segregated GM and GMO-free chains in one enterprise.

Market partners in Switzerland follow an even stricter approach. Although it would be legal to import GM soybeans in any processed form, no import has been recorded since 2008. The most likely reasons for this phenomenon include that all major Swiss quality labels require GMO-free feeding and that the Swiss Consumer Association opposes GMOs in agriculture. Feed importers are concerned about the high price margins for GMO-free soybeans but do not import GM soy meal.

The example of soybeans is well suited to show that segregation, when demanded by a sufficiently large share of consumers, is accomplished often through a specialization that liberates the system from the burden of managing two separate channels. In the EU, this specialization usually occurs on the enterprise level, whereas in Switzerland, segregation is left to producers in other nations, as the whole country is specialized to non-GM soybeans.

Maize

The EU is largely self-sufficient with maize, at least in years with good climatic conditions. In the European regions where GM maize is grown (predominantly Spain but also the Czech Republic and Romania), there is hardly a demand for segregation. Operators of Portuguese bakeries, for example, often do not know whether the maize meal they process comes from GM or GMO-free sources.

Countries with a demand for GMO-free maize obtain their imports largely from countries without GMO production. The Ukraine and Hungary, where GMO production is banned generally, are important exporters to many EU countries, whereas Russian suppliers mostly deliver to selected Northern European countries. The import to countries therefore is organized less along the lines of the EU borders but rather along the lines of GM and GMO-free production.

This means that there are (mainly) two differently designed supply chains of maize in the EU. On the one hand, there are cases where consumers do not care and therefore the knowledge about product characteristics is lost partially and gradually throughout the supply chain. On the other hand, there are cases where consumers care and where deliveries of maize from countries open to GMO production simply are avoided. The relevant segregation level is national.

Milk

A large number of quality labels in the animal sector require the guarantee that no GM feed is utilized in the production process both for meat (Varacca, Boccaletti, & Soregaroli, 2013) and for milk. Likewise, a number of dairy and meat companies run their own programs in which they guarantee the same. In both cases, it is usually the representatives of the labels or of the companies who prepare feed suppliers for the necessity to deliver feed with a "GMO free" label. Thus, the farmer does not have to identify possible sources for animal feed.

For Switzerland, the described situation does not occur because all domestic animal products are produced without GM feed; as Mann, Venus, and Reissig (2014) argue, this leads to welfare losses by causing additional costs to consumers without a preference for GMO-free products. However, there is an ongoing discussion whether this attribute should be labeled explicitly in order to distinguish imported animal products (often produced with GM feed) from domestic products.

For the milk market in the EU, three different strategies for labeling GMO-free milk can be distinguished:

a. Large market players offer a range of dairy products that are labeled as GMO-free and that focus on this particular added value but do not differ otherwise from conventional products. The margin that farmers receive for using GMO-free feed is rather small. The large dairy Zott, for example, was the 100th enterprise to use the "GMO free" label for a part of their products. Zott pays a relatively low milk price but pays the 400 farmers under contract for the "GMO free" label (of a total of 3,100) a bonus of €0.01 per liter (C/L). The competitor Bauer recently has decreased its bonus from 0.5 to 0.3 C/L for farmers under the label.

b. Adherence to the organic production system offers the most traditional strategy to obtain GMO-free products, because organic farmers do not use GM seed in feedstuff production. In Germany, 2% of all milk produced has an organic label. This label includes numerous additional attributes and therefore causes considerably higher costs (on average 8 C/L) than the conventional milk label.

c. An emerging strategy in milk production is an intermediate system between conventional and organic production. Within this novel approach, producers focus on environmentally friendly and socially sound methods while maintaining a relatively high level of productivity. Examples for such systems are

   - Haymilk: Within this system, the use of certain feedstuffs and agricultural practices is banned. The Haymilk label guarantees that neither GMOs nor silage or industrial side-products like treacle are used. Furthermore, fertilization with compost is prohibited, and a time span of three weeks between fertilizing and using grassland is prescribed.

   - Fair Milk: This label was developed by farmer associations and mainly targets socially concerned consumers. It not only implies the use of GMO-free feed but also guarantees a stable price for farmers (40 C/L). Additional environmental conditions may apply. For example, the Southern German "sternenfair" label warrants that cows are not fed non-European feed and are fed less that 1,500 kg compound feed per cow per year. Moreover, under this label, land use for maize production is restricted to a maximum area of 30%.

   - A Good Piece of Heimat: Besides indicating the local origin of the milk, this Southern German label requires the use of GMO-free feed, the maintenance of cows in free-stall barns, and the production of milk in the highest quality class 'S.'

Whereas some dairies specialize in GMO-free milk, others process milk of different qualities. In the latter case, a principle has emerged that can be described as "downwashing." The filling process starts with organic milk. After the amount of organic milk has reached the maximum storage capacity, the machines switch towards GMO-free milk. Any leftovers from organic milk in this process do not cause difficulties, as organic milk is always GMO-free. After a sufficient amount of GMO-free milk has been produced, the plant switches to conventional milk, for which it is irrelevant whether leftovers of GMO-free milk enter. Only when the stores of conventional milk have reached their maximum, machines are cleaned and then used again to process organic milk.

On the Interplay Between Society and Government

"How are we to conceive of the policy process if not as a response to societal pressure?" (Hall, 1993, p. 278). While there have been complex answers to this question (Boyle, 1998; Pierson, 2000; Schmidt, 2008), it certainly improves the understanding of public needs and demands in order to follow and analyze the institutional framework by which governments support and secure segregation processes. While the previous sections described European experiences in general, this political supplement focuses on the Swiss situation for three reasons. First, Switzerland as a non-EU member does not have the distracting and complicated division of competencies between national and supra-national powers. Second, Switzerland is certainly in need of segregation due to the preferences of its consumers which already have been described for the case of GMO; in organic food, the consumption market share in Switzerland is 10%, one of the highest internationally. Third, the Swiss policy has been less frequently described than EU legislation (Haslberger, 2000; Levidow, Carr, & Wield, 2005; van Asselt & Vos, 2008).

As in many other countries, the Swiss government has its own ordinance to regulate and protect the organic label. The legal frame would allow a governmental label, but the private label in Switzerland is so strong that the government has not developed a public label so far (of the 6,000 organic farmers, only 380 do not use the label of the organic association Bio-Suisse according to Dudda, 2012). However, the ordinance forces all producers to get certified if they intend to use "organic" as an attribute.

In the case of GMO labeling, the situation in Switzerland is slightly more complicated. As mentioned above, imports of GMO food and feed are allowed as long as no germinable seeds enter the country. Since 1999, the government has issued an ordinance about both negative and positive labeling. Positive labeling is mandatory except if less than 1% of the food product comes from GMO and no alternative would be available. Negative labeling (by using the term "produced without GMO") is not mandatory, but provided as an option—both for crop and animal products. As a precondition for its application, it has to be documented thoroughly that no GMOs have been used in the production process. It should also be mentioned, however, that neither positive nor negative labels currently can be found on Swiss supermarket shelves. As no GMO products (not even feed) are imported, the mandatory positive label has never come into force. And food producers do not bother to use the negative label either because consumers are mostly aware that all food in the country is GMO-free.

Apparently, the government's objectives in the two sectors are similar, even though the organization of these objectives differs. These objectives are two-fold. One is that consumers are informed about the relevant product attributes, technically rather than culturally. The other is that this information always matches reality. For the two objectives, precautionary measures are taken that are supposed to prevent opportunistic behavior by market actors that could threaten consumer trust in the system. A loss of credibility would result in the impossibility to run segregated markets which would, in turn, cause significant welfare losses.

Discussion

Whereas the segregation of organic products over the last decades contained elements of cultural and technical segregation, the segregation of emerging GMO-free food products widely lacks the element of cultural segregation. Many proponents of organic farming have challenged the agricultural system as such and claimed to provide a paradigmatic alternative, but this general discussion rarely occurs with respect to GMO-free products. Although there is an intense and partly emotional debate about the pros and cons of GMO in agriculture (Entine, 2013; Seralini et al., 2013), the emotions rarely translate into the marketing concepts of GMO-free food. The sober and factual communication strategies for GMO-free food make clear that this segment of the food market hardly claims to represent a cultural alternative to the mainstream. The preference for GMO-free food products is largely in line with the preference for flavored mineral water or for brown eggs.

Regardless of how the technical segregation has to be organized, it is important both to governments and to companies (if they consider their voters/customers), and certainly is a strong parallel to the organic market. Technical segregation is therefore organized as an interplay between market actors and the state. In general, two main forces drive the organization of technical segregation, namely economies of scale and the intra-regional heterogeneity of preferences, of which the latter leads to "frustration costs" (Biehl, 1994; Schmitt & Sadowski, 2010).

Segregation activities generate costs, but in utilizing economies of scale, large amounts of transaction costs can be saved. The best example for this strategy is seen

in Switzerland: no Swiss food processor needs to think about GMO-free soybeans or maize, because only GMO-free crops enter the country; this is not based on a government directive but based on a consensus among the trade partners. Therefore, the legislation directing segregation on a product level remains somewhat unused.

In the EU, the situation is somewhat similar for maize, where actors in areas with a demand for segregation usually avoid imports from countries producing GM maize. As this segregation on a national scale is not feasible for soybeans in the EU, many companies choose the second-best strategy by specializing in either GM or non-GM commodities. Therefore, the costly intra-firm segregation process can largely be avoided in the whole system.

Switzerland's strategy of segregation on the national level is probably not the most efficient due to the second driver, the frustration costs arising from the intra-regional heterogeneity of preferences. There are a lot of consumers in Switzerland (and any other country) who do not care whether the milk and meat they buy is produced with GM feed, but they, too, have to pay the bill for the high prices of GMO-free feed. The same effect would occur if a dairy with a monopoly in a region specialized in non-GM feed. Vice versa, by specializing in GM feed, a company would cause frustration costs among consumers preferring GMO-free milk.

These two driving forces and their interaction are illustrated in Figure 1, focusing on the scale on which products are segregated. From a smaller level (e.g., intra-firm) towards a larger level (e.g., national) of integration, the technical costs decline, but consumers' frustration costs rise exponentially, so that the resulting total costs have their minimum somewhere on an intermediate level L_{min}.

When companies target a consumer group with highly heterogeneous preferences regarding GMOs, they will not benefit from specializing in GMO-free or GM products. In this case, the method described as "downwashing" in the previous section contributes to lowering transaction costs. By switching from higher to lower qualities within the process, the necessity to avoid any contamination can be minimized to a considerable degree. In these cases, it appears that L_{min} is below the enterprise level. On the other hand, potentially there may be cases where it may be efficient for countries to outlaw GMO-food. This is the case when the technical costs of necessary labeling after allowing GMO-food into the country exceeds the (then negligible) frustration costs of the few who do not care. But usually, governments will be better off if they focus on reliable certification and labeling strategies.

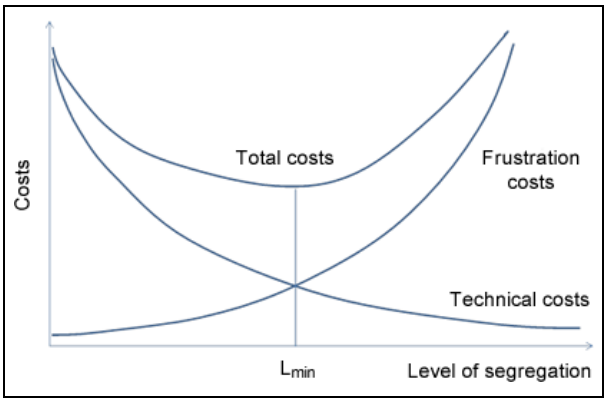

Figure 1. The cost function of technical segregation.

Conclusions

The introduction of organic agriculture as a separate production system required segregation from conventional agriculture. This included both cultural and technical segregation, both for credibility reasons, albeit in different realms. Culturally, a moral justification of the separate system and a separation from mainstream agribusiness was intended. Technically, a separation of organic from non-organic products was necessary. Several decades later, GMO-free food was established as a second segregated production system. But this time, the focus was much more on the technical side of segregation than on the cultural side, despite an intense debate about the pros and cons of genetic technologies. The significance of cultural segregation has at least weakened.

This new focus on the technical aspect of segregation enabled a clearer understanding of the driving forces of segregation. It is becoming evident that the institutional level of segregation can be optimized by minimizing the sum of technical costs and frustration cost. An optimized model of segregation will always contain both activities by the state and activities by private companies. Companies will have to decide if they specialize on either side of the chain and, if not, how to manage the coexistence of both lines. The state will have to install a certification and control system that guarantees the credibility of all product information. However, future research is necessary to complete this picture and to adapt it to different socio-economic conditions.

References

Biehl, D. (1994). Fiscal federalism in Germany. In A. Mullins & C. Saunders (Eds.), *Economic union in federal systems*. London: The Federation Press

Boyle, E.H. (1998). Political frames and legal activity: The case of nuclear power in four countries. *Law & Society Review, 32*(2), 141-158.

Clunies-Ross, T., Cox, G., & Lowe, P. (1994). Challenging the productivist paradigm: Organic farming and the politics of agricultural change. In P. Lowe, T. Marsden, & S. Whatmore (Eds.), *Regulating agriculture*. London: David Fulton Publishers.

Darnhofer, I. (2005). Organic farming and rural development: Some evidence from Austria. *Sociologia Ruralis*, *45*(4), 308-323.

DeSoucey, M., & Téchoueyres, I. (2009). Virtue and valorization: Local food in the United States and France. In D. Inglis & D. Gimlin (Eds.), *The globalization of food*. London: Berg.

Dudda, E. (2012). Biomarken: Bekommt die Knospe Konkurrenz? [Biomarkers: Does die Knospe get competition?] *LANDfreund, 1.9.2012*, 8.

Entine, J. (2013, July 8). *Roseanne Barr effect: Should crop biotechnology supporters engage science rejectionists?* Washington, DC: Genetic Literacy Project. Available on the World Wide Web: http://www.geneticliteracyproject.org/2013/07/08/the-roseanne-barr-effect-should-crop-biotechnology-supporters-engage-science-rejectionists/.

Erdman, H.E. (1933). The economic basis of market grades: Discussion. *Journal of Farm Economics*, *15*(4), 717-719.

Giannakas, K. (2002). Information asymmetries and consumption decisions in organic food product markets. *Canadian Journal of Agricultural Economics*, 50(1), 35-50.

Groier, M. (2013). *Wie weit darf Bio gehen*? [How far can you go organic?] Vienna: Federal Institute for Less-Favoured and Mountainous Areas (BABF).

Hall, P.A. (1993). Policy paradigms, social learning and the state. *Comparative Politics*, *25*(3), 275-296.

Haslberger, A. (2000). Monitoring and labeling for genetically modified products. *Science*, *287*(5452), 431-432.

Hoffmann, C. (2011). *Beiträge des Informationsmanagements zur Qualitätssicherung in der ökologischen Schweinefleischproduktion in Deutschland* [Contributions to information management for quality assurance in organic pork production in Germany]. Stuttgart, Germany: Hohenheim University Press.

Levidow, L., Carr, S., & Wield, D. (2005). European Union regulation of agri-biotechnology: Precautionary links between science, expertise and policy. *Science and Public Policy*, *32*(4), 261-276.

Mann, S., Venus, T., & Reissig, L. (2014). GMO-free milk: A system comparison. Agribusiness, submitted.

Michelsen, J., Lynggaard, K., Padel, S., & Foster, C. (2001). *Organic farming in Europe: Economics and policy.* Stuttgart, Germany: Hohenheim University Press.

Moschini, G., Bulut, H., & Cembalo, L. (2005). On the segregation of genetically modified, conventional and organic products in European agriculture: A multi-market equilibrium analysis. *Journal of Agricultural Economics*, *56*(3), 347-372.

Moschitz, H., Stolze, M., & Michelsen, J. (2004). *Further development of organic farming policy in Europe with particular emphasis on EU enlargement*. Brussels: European Commission.

Nilson, H., Tunçer, B., & Tidell, Å. (2004). The use of eco-labeling like initiatives on food products to promote quality assurance—Is there enough credibility? *Journal of Cleaner Production*, *12*(5), 517-526.

Oberholtzer, L., Dimitri, C., & Greene, C. (2005). Price premiums hold on as U.S. organic produce market expands. Washington, DC: US Department of Agriculture, Economic Research Service.

Pascucci, S. (2007). Governance structure, perception, and innovation in credence food transactions: The role of food community networks. *International Journal of Food System Dynamics*, *1*(3), 224-236.

Pierson, P. (2000). Increasing returns, path dependence, and the study of politics. *American Political Science Review*, *94*(2), 251-267.

Quedas, F.B., & Trindade, C.P. (2012). *Portuguese maize and soybean supply chain* [Internal Working Paper]. Santarém, Portugal: Instituto Politécnico de Santarém.

Schmidt, V.A. (2008). Discursive institutionalism: The explanatory power of ideas and discourse. *Annual Review of Political Science*, *11*(2), 303-326.

Schmitt, M., & Sadowski, D. (2010). A cost-minimization approach to the international transfer of HRM/IR practices: Anglo-Saxon multinationals in the Federal Republic of Germany. The *International Journal of Human Resource Management*, *14*(3), 409-430.

Seralini, G.-E., Mesnage, R., Defarge, N., Gress, S., Hennequin, D., Clair, E., et al. (2013). Answers to critics: Why there is a long term toxicity due to a roundup-tolerant genetically modified maize and to a roundup herbicide. *Food and Chemical Toxicology*, *53*(3), 476-483.

Sidern, Y., Maquet, A., & Anklam, E. (2005). Need for research to support consumer confidence in the growing organic food market. *Trends in Food Science and Technology*, *16*(8), 332-343.

Sylvander, B., & Le *Floc'h*-Wadel, A.L. (2001). Consumer demand and production of organics in the EU. *AgBioForum*, *3*(2&3), 97-106. Available on the World Wide Web: http://www.agbioforum.org.

Tang, A.M. (1959). Economic development and changing consequences of race discrimination in Southern agriculture. *American Journal of Agricultural Economics*, *41*(5), 1113-1126.

Thakur, M., & Hurburgh, C.R. (2009). Framework for implementing traceability system in the bulk grain supply chain. *Journal of Food Engineering*, *95*(4), 617-626.

Tondel, F., & Woods, T. (2006). *Supply chain management and the changing structure of U.S. organic produce markets*. Paper presented at the American Agricultural Economics Association. Annual Meeting, Long Beach, CA, July 23-26.

Van Asselt, M.B.A., & Vos, E. (2008). Wrestling with uncertain risks: EU regulation of GMOs and the uncertainty paradox. *Journal of Risk Research*, *11*(1-2), 281-300.

Varacca, A., Boccaletti, S., & Soregaroli, S. (2013). Economic aspects of segregation between GM and non-GM crops along the food supply chain. Paper presented at the American Agricultural Economics Association. Annual Meeting, Washington, DC, August 4-6. Available on the World Wide Web: http://ageconsearch.umn.edu/bitstream/151428/2/Boccaletti_AAEA_2013%20(1).pdf.

Varga, M., & Csukás, B. (2010). On the way toward the sector spanning agrifood process traceability. *Journal of Agricultural Informatics*, *1*(1), 8-18.

Vogt, G. (2001). Geschichte des ökologischen Landbaus im deutschsprachigen Raum—Teil II [History of organic farming in Western Europe—Part II]. *Ecology & Agriculture*, *119*(3/2001), 47-49.

Wirth, F.F., Love, L.A., & Palma, M.A. (2007). Purchasing shrimp for at-home consumption: The relative importance of credence versus physical product features. *Aquaculture Economics and Management*, *11*(1), 17-37.

Zhang, X., Feng, J., Xu, M., & Hu, J. (2011). Modeling traceability information and functionality requirement in export-oriented tilapia chain. *Journal of the Science of Food and Agriculture*, *91*(7), 1316-1325.