



**International Food and
Agribusiness Management Review**

***Official Journal of the International
Food and Agribusiness Management Association***

**Volume 16: Issue 4
2013**



International Food and Agribusiness Management Review

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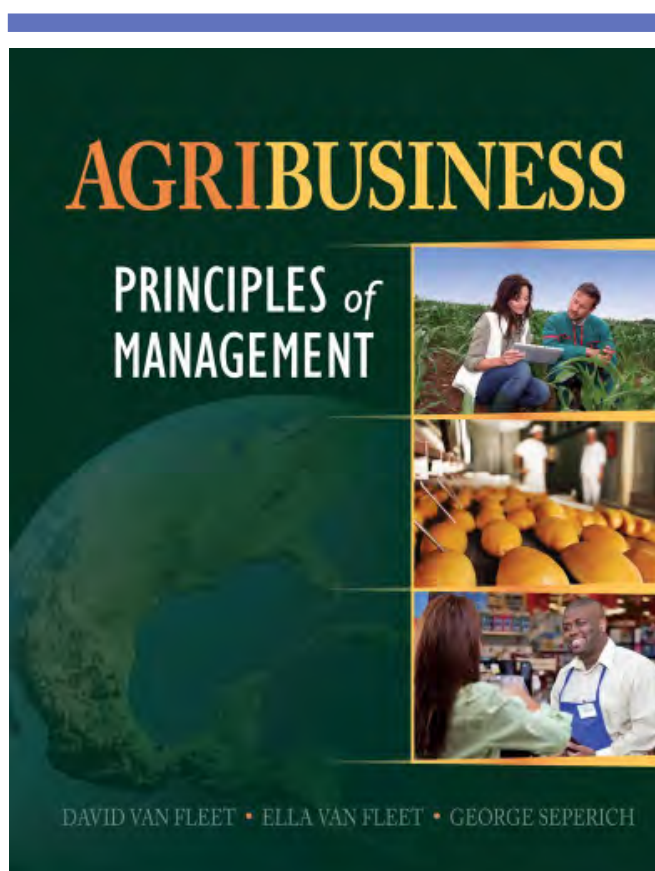
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Hardcover: 576 pages

Publisher: Cengage Learning; 1st Edition

© 2014 Already published

Language: English

ISBN-10: 1111544867

ISBN-13: 978-1111544867

Price: \$99.95

Available from: CENGAGE Learning or Amazon

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EDITOR'S NOTE

Dear Readers,

Well we have done it! Not only are we providing readers another jam-packed issue of the IFAMR, we breached, for the first time in September, 17,000 articles downloaded in one month. That is a 31% increase over September, 2012. So our open access, electronic and broad distribution model is providing our authors the impact they expect.

We have a full issue that nicely reflects our growing international presence. We are especially proud of the three articles from Brazilian scholars. Several years ago the IFAMR made a concerted effort to improve its ranking within the Brazilian journal scoring system. Scholars in Brazil are incented to achieve, for example 320 points over three years. Our high A2 ranking provides a Brazilian author 80 points, or 25% of the requisite, with just one publication. Not surprisingly our submissions from Brazil are rising very quickly.

Check out the call for the Best Paper Competition. Submit a paper proposal by November 30, 2013 and then the full manuscripts are due January 30, 2014. The IFAMR partners with the IFAMA to help bring more polished work to the Symposium, which makes for a richer and more dynamic conference. Authors win because they get to present their work, receive comprehensive blind reviews of their manuscript, get more feedback at the conference, are entered into an international scholarship competition, and can emerge within nine months of submission with a published manuscript in our special conference issue.

I want to congratulate IFAMR Managing Editor, Dr. David Van Fleet of Arizona State University on his new book, *Agribusiness: Principles of Management*. Check out the advertisement for his book inside this issue. The IFAMR provides real value to its advertisers and sponsors because of our high-volume of downloads, citations, and visits. Journal costs are entirely paid by scholars that publish with us. Thus, advertising and sponsorships revenue go a long way to help the IFAMR invest so that we can better serve the needs of our authors.

Speaking of finances, the IFAMR will change its fee structure starting January 1, 2014. We will continue to charge \$750 USD to cover the expenses associated with publishing a 15 page manuscript. However, each additional page will cost the author \$50 USD. The page charge includes all tables, figures, and appendices. This change is to meant to provide authors an incentive to be become more concise in articulating research results.

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Peter Goldsmith, Executive Editor, IFAMR



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Restructuring of the Corn Supply Chain in Brazil: Facing the Challenges in Logistics or Regulation of Biotechnology

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Abstract

This study aims to analyze the effects of corn segregation on Brazilian transport and storage logistics, and how it impacts global competitiveness.

A partial equilibrium model as a Mixed Complementarity Problem (MCP) was developed to guide the implementation of more effective policies and support new investments. The Cartagena Protocol on Biosafety requirements affects the logistics of transport and storage in Brazil. Intermodal flows were most affected and significant commercial reductions occurred in the regions farthest from export ports. This research is original in its use of a model and forecast scenarios to measure how biotechnology regulatory issues directly affect infrastructure logistics. Establishing stringent identity preservation systems affects these projects, since intermodal flows are most affected by such systems.

Keywords: segregation, partial equilibrium models, transgenic crops, cereal sector and logistics

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Introduction

Biotechnology encompasses a variety of technologies able to introduce and enhance the characteristics of living organisms, allowing the generation of new products, processes and services in many sectors of the economy worldwide. These developments are based on the emergence of Genetic Engineering which occurred about thirty years ago. This new technological standard aims to lead to a substitution of fossil fuels and capital-intensive technologies, beginning the search for new biologically based technologies in food and energy. Unlike most other methods of plant breeding, modern biotechnology and biotech crops are strictly regulated regarding the issues of food and environmental security.

Up to the present moment, over 272 biotechnology events and 25 biotech crops have passed the regulatory barrier in several countries and many of them have been marketed during the last fifteen years (ISAAA 2012).

The adoption of biotech crops by farmers around the world occurred over a short time period. Since 1996, the planted area has increased to 94 times its original area, and in 2011 it reached the milestone of 160 million hectares, an increase of 8% over the previous year (James 2011). In 2011, Brazil maintained and strengthened its position as the second largest producer of biotech crops in the world. According to James (2011), transgenic crops occupied 30.3 million hectares, an increase of 4.9 million hectares in relation to the previous year - the largest absolute increase observed in any other country in the world.

Borges et al. (2009) have shown that the potential benefits of agricultural biotechnology hold as much importance as the perceived benefits regarding the acceptance of Genetically Modified Crops (GM) in Brazil. This means that for a group of experts able to foresee biotechnology benefits, the present generation of GM foreshadows even bigger impacts. Focusing on a few traits - herbicide tolerance (HR), insect resistance (IR) and diffusion in platform crops (soybean, corn, cotton and canola) - GM crops have shown significant impacts on the world's agriculture, mostly in the leading export countries (Oliveira et al. 2012).

The success of the diffusion processes in different countries is clear: the diffusion path, when compared to what happened with hybrid corn in EUA in the late forties and fifties, is impressive: an s-shape pattern reaching levels of adoption by farmers of over 80% in soybean (Brazil); cotton (India, China); and canola (Canada). This revealed growers' preference for GM cultivars, despite the negative role of regulatory pressures, particularly grain importing countries (Oliveira et al. 2012).

Galvão (2012) estimates gains in the gross operational margin of corn (winter harvesting) in Mato Grosso in 2011 in Brazil, ranging from 5.6% for IR traits and 11.8% for stack (IR and HT) varieties. This takes into account that the cost of GM seeds is almost ten times more than that of conventional seeds. Risk reduction, a sharp decrease in pesticide usage (mostly in cotton, reducing, on average, the number of pesticide applications from 18 to 5 per crop cycle) and the reduction of Greenhouse Gas Emissions (GHG's) are other important determinants of the impacts of the adoption of GM crops. Barrows et al. (2013) add a new argument: these effects generate an extensive margin from the adoption of GM, raising the value of marginal product of

complementary inputs. In other words, there are additional impacts to those generated by the direct effects of GM adoption, generating a systemic effect on agriculture.

However, the proliferation of biosecurity systems at the country level, as Phillips (2010) points out, raises the cost of regulation process to amounts near US\$ 150 million by new event. Firms after selecting the most promising results (several years before the launching of the new seed), begin to collect information on issues from biosafety experiments to mechanisms of communication to the consumer such as labeling, identity preservation, segregation and traceability processes. It generates barriers to entry to small innovative firms, leading firms to focus on platform crops and the few traits (IR and HT). This process is tougher when legislation imposes bans on doing research, produce and even commercialize products derived from GM crops.

While developed countries have established their rules for dealing with agricultural biotechnology based on their national strategies and priorities, developing countries are doing so in less flexible circumstances. According to Zarilli (2005), instead of enjoying the freedom to assess the risks and benefits that agricultural biotechnology can bring, developing countries increasingly rely on the demands of their trading partners to define their guidelines.

Silveira and Borges (2007) argue that the leading agriculture exporters are prone to implementing a soft biosafety legislation, or at least accepting information that had been generated by similar processes carried out in the recent past. Brazil, up to the year 2005, was an exception, imposing serious restrictions on the registration of GM crops and able to cope with the European countries legislation. However, according to Galvão (2012), after the Decree 5,591 that regulates the Biosafety Law (November, 2005) the average time to approve a new trait has been reduced from 50 to less than 10 months, generating a healthy environment for research, production and commercialization of GMOs.

The international regulations on genetically modified organisms (GMOs) have been, in theory, designed under the rules of the Convention on Biological Diversity (CBD) through the Cartagena Protocol on Biosafety (CPB) and the World Trade Organization (WTO). These rules, in turn, are based on the standards and guidelines of *Codex Alimentarius* to address the issues of food security. From the theory to the practice, there is a distance covered by the complexity of forming multilateral protocols in which the consensus is the rule. The space for collective action causes the constitution of the CPB, with respect to its specific provisions about GMOs, experience several deadlocks.

Immediately, the CPB would affect, more intensively, the markets of soy and corn, products with great participation in the global agricultural production. Regarding economic impacts, these will depend on the compliance costs to the CPB, which correspond to the costs of the resources needed to fulfill the legal requirements established by the parties.

From the viewpoint of handling logistics, segregation implies higher costs for storage and transport (Schlecht et al. 2004). The system of full segregation for grains requires a greater amount of compartments in the storage units or the need for the establishment of silos with lower capacity in order to allow segregated storage.

An evaluation of the implementation of the CPB for the Brazilian soybean in order to fit the term "contain" was carried out by Oliveira et al. (2012). The study indicated a loss in competitiveness for Brazil in the international market; considering the cost of the tests to identify two transgenic events, segregated logistics and reduction of international trade, these losses reached US\$ 1.57 billion. This amount represented 13.8% of the foreign currencies generated by exports of soybeans in Brazil in 2009.

In the case of corn, this reduction may be even more significant, as the number of transgenic events to be evaluated is superior to soybean, on an average of six. Another point concerns the spatial production; corn production is much more fragmented in the territory than soybean production, which makes it very difficult to establish routes that make it possible to calculate the impact of measures aimed at full segregation of conventional versus transgenic loads. Differently from soybean, gene flow affects corn plants. In countries when pollen is viable in a short period, such as European countries, adventitious presence can generate serious problems for segregation, regarding the threshold level of 0.5% required by EU authorities. In Brazil, studies (CIB, 2006) suggest a distance of 200 meters between varieties as a measure to avoid gene flow effectively. It is therefore possible to control adventitious presence in the case of Brazil using good practices. However, when low-level standards of adventitious presence has been demanded by CPB, this becomes a new source of concern.

Accordingly, the aim of this paper is to analyze the effects of segregation of corn on the logistics of transport and storage of Brazil and its impacts on competitiveness in the international market, in a context of building new institutions, in this case, from the simulation of resolutions undertaken by the Cartagena Protocol on Biosafety, CPB.

The treatment of the proposed problem requires the search for new analytical tools and simulation scenarios. Thus, the proposal is to develop a partial equilibrium model as a Mixed Complementarity Problem (MCP), which aims to provide guidance for the implementation of more effective policies that support new investments in the sector.

In Brazil, from 2003 to 2006, an intense debate took place on the costs of complying with alternative rules of CPB (main contain versus contain). The importance of the papers prepared for the debate with different stakeholders, as shown in Oliveira (2011), was that the results were very easy to interpret, in spite of the requirement of a certain degree of knowledge on economics to understand the methodology developed. These works have contributed to convincing the majority of public managers to take the issues raised by the Cartagena Protocol in the field of external trade seriously.

On the one hand, these papers have contributed to alerting stakeholders, mostly public managers, to the risks of generating trade diversion when taking the stringent versions of CPB. On the other hand, these studies, including this paper, informs people involved in full segregation that contamination in storage and transportation activities demands particular facilities dedicated to segregation, and as a result, premiums; in other words, to pay attention to the link between logistics and contracts.

In section 2 we examine the key role of regulation in the formation of markets for biotech products and the implications of the Cartagena Protocol (CPB) through Article 18.2 of the logistics of transport and storage of corn in Brazil. Section 3 shows the model adopted - Mixed Complementarity Problem (MCP) - to analyze the issue of genetically modified (GM) corn and the construction of the scenarios used. Section 4 shows the main results obtained with the MCP implementation and the impacts of imposing CPB in the Brazilian corn trade flows. Finally, section 5 shows the main findings and contributions of the research.

Implications of Identity Preservation Systems

Corn production in Brazil, along with soy, contributes to approximately 80% of the grain production in the country (Duarte 2011). Unlike soy which has immediate liquidity, the production of Brazilian corn is focused on domestic supply. Recently, however, exports of this cereal have been held in significant quantities, contributing to greater support for domestic corn prices.

Brazil is third place in the global ranking of corn production, behind the United States and China (USDA 2012). According to Duarte (2011), the economic importance of corn is characterized by various forms of its use - from feeding to the high-tech industry. One of the main uses is in the composition for poultry and pigs; we must mention, however, that nowadays corn is incorporated in the bioethanol chain as the main raw material in the production of clean fuels, such as in the U.S.

Although versatile in its use, corn production has basically followed the growth of production of pigs and poultry, both in Brazil and around the world. An important aspect that should be highlighted is the location of industrial units of pigs and poultry in Brazil. The Southern region still produces the majority of these animals and has shown growth in this activity. More recently, the production of pigs and chickens in the Central-West region is showing strong growth, linked to the increased production of soybean and corn in the region. This trend is fully justified because of the weight of corn and soybean in the final cost of feed, both for poultry and pigs.

A counterpoint, however, of this productive migration to the Central-West region needs to be mentioned. The cost of transport, especially in Brazil, where infrastructure conditions are poor, ends up burdening the good, with direct implications on the cost of production of corn, when transported over long distances. On the one hand, there is a tendency to consume corn as close to production areas as possible, but on the other hand, when considering exports of corn in the Brazilian ports located at distances beyond a thousand miles of the Central-West region, the share of transport cost becomes more evident.

That said, it can be noted that the regulatory aspects regarding the segregation of the load, by implementing full segregation preservation systems, besides the implications on the diffusion of technology, greatly affect the production costs and the logistics configuration of corn transportation.

According to Oliveira (2011), who assessed the implications of a full segregation system for the Brazilian soybean case proposing a scenario in which the costs of testing to identify transgenic

events and segregated storage were added to the logistical costs. Strict measures can alter the economic efficiency of infrastructure projects existing in Brazil. This is because a segregation system makes regions far from the port of export become less competitive due to the increase in logistical costs through the identity preservation system, invalidating transportation projects that would probably not have the same load demand for movement.

The mandatory implementation of processes that lead to an increase in fixed costs, with no direct connection to the fulfillment of the objectives of the Cartagena Protocol (CPB) - especially through Article 18.2 - should be viewed as a new component in the process of creating technical barriers to trade, with negative effects on agricultural producers in exporting countries and on consumers in importing countries.

The CPB was created based on the precautionary principle. In situations where the potential risks are unknown for reasons of scientific uncertainty, countries may restrict, and even prevent, the importation of living modified organisms (LMOs) (Mackenzie et al. 2003).

Based on this principle, the CPB establishes, in Article 18, the requirements and necessary steps with regard to handling, transport, packaging and identification of all loads that contain or may contain LMOs. The purpose of this analysis is restricted to loads of LMOs-FFPs (living modified organisms intended for direct use as food or feed, or for processing), whose requirements are set out in paragraph 2.a of Article 18 (Mackenzie et al. 2003):

2. Each Party will take measures to require that documentation accompanying:
 - (a) living modified organisms intended for direct use as food or feed, or for processing, clearly identifies that these "may contain" LMOs and are not intended for intentional introduction into the environment, as well as a contact point for further information. The Conference of the Parties serving as the meeting of the Parties to this Protocol will take a decision on the detailed requirements for this purpose, including specification on its identity and any unique identification, no later than two years after the entry into force of this Protocol (CTNBIO 2010).

Although in its original text the Protocol uses the expression "may contain", most importers of agricultural products requires the load to be identified with the use of the term "contain".

According to Vieira Filho et al. (2006), when interfering in contractual and export decisions about the grain export chain, the statement "contain" opens the door to demands aimed at generalizing the requirements of identity preservation systems based on tests. This causes undesirable impacts on the configuration of the trade - encouraging verticalization in producer countries and fostering grain production in less efficient countries from an agricultural point of view.

The implementation of CPB also depends on the definition of "detailed requirements". According to Kalaitzandonakes (2004), these requirements can be separated into three groups. The first one concerns the specification of the accidental mixing of LMOs in export loads, i.e., what is an acceptable level of adventitious presence and when is labeling required. The second group covers the information that must be provided by exporters and how it should be collected, such as labeling with "may contain" or if additional information to identify or quantify the LMOs

is necessary. Finally, the third group relates to issues involving decisions about how the importer receives and, in turn, uses the information provided by the exporter.

After the controversial debate at the COP-MOP3, the members of the Cartagena Protocol agreed to consider two options for identifying GMO loads. The choice of the term "may contain" for loads in which events are not precisely identified, can easily be operationalized by including a list of likely events with the load; as a result the impacts on trade flows would be well reduced. The term "contain" requires additional measures, where the identity of GMOs contained in loads must be determined by an Identity Preservation System (IPS) based on tests, including a list of events in it.

Although the benefits of this change are highly debatable, its application would generate highly significant additional costs (Boüet et al. 2010; Kalaitzandonakes 2004). More specifically, under the term "contain", countries that produce and export non-GM products would be exempt from checks and tests, while countries that export GM products would have to test each load to verify the accuracy of the identification of each event.

Despite the assertions of authors like Zarilli (2005) that developing countries have less defined regulatory principles than developed countries, this criticism does not apply to the case of Brazil, which is marked by ambiguity arising from being a major exporter of agriculture and a residual importer - of wheat, barley and a few non-tropical products (Silveira 2010). Brazil also boasts great biodiversity and centers of origin of cultivars (such as Peru, Colombia, Mexico, Costa Rica, Turkey, China and others). Thus, the delay for the definition of the biosafety policy in Brazil is due less to a lack of training in the area than to the conflicts that still exist between different social players involved directly and indirectly in the regulation process (Borges et al. 2009).

The cost structure for the identity of preserved crops differs from the commodity market because it includes the costs plus the segregation and expenses to mitigate the risks specific to the IP markets. The risks stem from one or more factors of pricing (price premium, quality and information) and instruments for the fulfillment of international protocols, among which, the Cartagena Protocol on Biosafety, aspects which are more prevalent in IP grains than in conventional grains (Boüet et al. 2010).

These costs and risks have direct implications not only on trade relations, but also on transportation logistics and storage. According to Boüet et al. (2010), despite advances in biotechnology, aspects such as infrastructure and transportation continue to be factors that limit the potential of modern agriculture.

The issue of the disposal of the Brazilian harvest is a key factor that affects agribusiness at its base, substantially changing the marketing, pricing and competitiveness of the sector. The logistics infrastructure must have the ability to move and store the entire national agricultural production and also provide systems for imported products to satisfactorily meet domestic demand.

As the requirements of Article 18.2.a of the Cartagena Protocol imply additional costs in trading, particularly in transboundary movements, it is necessary to understand the effects of these measures.

The exploitation of the potential expansion of grain production depends on establishing an efficient system of transportation. Such a system will have to store larger volumes at lower costs, thus allowing the grain sector to increase its contribution to the domestic supply of food and maintain its position in the international market.

In general, countries with limited land areas guide their transport in road transportation, while countries with large areas, with the exception of Brazil, prioritize rail and waterway transport, as these modes are more efficient and competitive when transporting long distances.

According to Caixeta-Filho (2010), what has been observed in the Brazilian agricultural economy in recent decades is the real revolution of its spatial arrangement, where agribusiness occupied borders such as the North and Central-West regions, and have advanced to the Northeast, generally through activities that incorporate modern production technologies. This way, introducing a whole chain of support for the main business, i.e., input suppliers, storers and processing industries are clustered around the production areas, in order to minimize transportation costs, while complying with the principles of economic rationality.

According to Caixeta-Filho (2001), the average distance covered by these loads becomes greater than 1600 km, on the other hand, considering the total of loads moved by rail, the average distance is less than 500 km. This is due certain factors such as lack of infrastructure logistics, problems with storage, relatively low cost of land, growing distances between producers and consumers poles.

In this context, the change in the direction of flow of agricultural production is due to a reduction in transportation costs caused by multimodality and a reduction in the distance to the exporting port.

However, the reality in Brazil shows an inefficient transport system (Figure 1). According to the data from ANTT (2006), the mode of road transport has absorbed more than half of the cargo transportation in Brazil. This predominance of road transport can be explained by the difficulties facing other modes of transport to efficiently cater to rising demand in the more remote areas of the country, which are not provided with railways or waterways.

According to Oliveira et al. (2012), the compliance costs to the CPB correspond to the costs of the resources needed to fulfill the legal requirements established by the parties. They depend on three factors:

- the nature of identification of the LMOs required;
- the country's position in the global market of agricultural commodities (if the country is an exporter or importer, and a producer of GM crops);
- the internal conditions of each country, such as logistics conditions and expertise to safely and inexpensively perform tests.

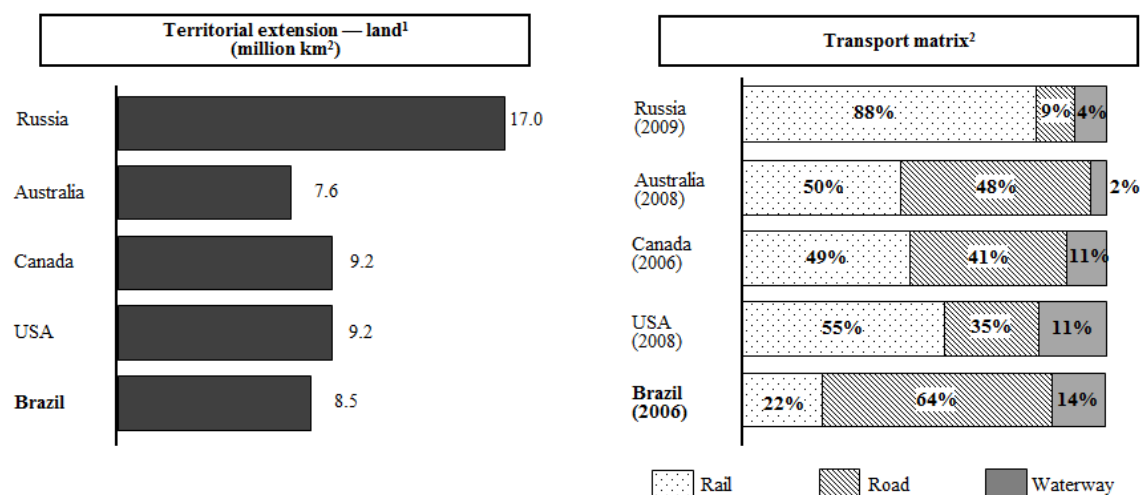


Figure 1. Territorial extension and load transport, selected countries.

Notes. 1) Total territorial extension minus areas covered by water. 2) Does not consider air and pipeline transportation.

Source. CIA World Factbook (2010) for territorial extension; Bureau of Transportation Statistics (2010), International Transport Forum (2010) and ANTT (2006) for transport matrix (as cited in Oliveira 2011).

Studies carried out in the United States, Argentina and Brazil show that the cost of testing LMOs vary according to: a) the number of samples to be analyzed; the type of testing required by the Protocol (simple identification, using the protein test, qualitative assessment, quantitative assessment); b) the number of events that will be tested; and c) the number of crops that will be evaluated (Silveira 2006; Kalaitzandonakes 2004). Thus, evaluating the determinations of Brazil on the CPB and technical measures that may arise from it is an important tool to analyze the impacts of the adoption of the Protocol, taking into account the specific logistics of each signatory country.

Methodology

In order to quantify the potential impacts of the costs of implementing the CPB for Brazil, with a focus on the organization of the Brazilian logistics of transport and storage, we use a partial equilibrium model formulated as a Mixed Complementarity Problem (MCP).

The partial equilibrium models elects a sector or product under consideration and examines the effects of a variation (exogenous) of the relative price on the balance of the industry, assuming that the allocation for the rest of the economy remains unchanged (Alvim 2003; Cavalcante and Mercenier 1999).

The most frequent use of partial equilibrium models with endogenous prices has been observed in problems related to competition for interregional markets (Yavuz et al. 1996). They have also been applied to simulate the impact of trade policies in different markets (McCarl and Spreen 2001). Furthermore, it is important to note that the theoretical structure of this model can be expanded, to include multi-exporter and importer regions, multimodal transport and multi-

commodity. In addition, they can be used to simulate the impact on markets that occurred through the application of trade policies, such as quotas, subsidies, tariffs, among other (Oliveira et al. 2012).

As the present study comprises an analysis of the impact of CPB on the Brazilian corn market, the partial equilibrium approach was adopted. The choice of this method provides a detailed review of the effects of implementing the CPB in Brazilian commercial flows, as well as the advantage of allowing the easier incorporation of tariffs, tariff quotas and grants.

Another approach to partial equilibrium models is the one shown in the form of a Mixed Complementarity Problem (MCP). The use of the MCP has been proposed by Thore (1992), Rutheford (1995) and Bishop et al. (2001), and is already used by Alvim (2003) and Alvim and Waquil (2004).

A complementarity problem consists of a system of simultaneous equations (linear or nonlinear), which are described as inequalities, from the functions of supply and demand. The PCM is equivalent to the Kuhn-Tucker conditions, which are necessary and sufficient to maximize the Social Net Payoff function (NSP), which in turn, implies achieving balance in all markets and regions.

Samuelson's formulation shows that maximizing the NSP function, given by the sum of the surplus of producers and consumers, minus shipping costs, and subject to regional balance equations, generates a framework of optimality conditions. It is however noteworthy that Samuelson warned of the problems associated with the use of his model to make inferences about social welfare, hence the expression "Social Net Payoff" which excludes a reference to the social welfare (Samuelson 1952). For a problem of nonlinear programming in which the objective function is differentiable and concave, with linear constraints (differentiable and convex), the result is the global maximum, since the optimal point satisfies the Kuhn-Tucker conditions (Takayama and Judge 1971).

Furthermore, the MCP has the advantage of allowing the easier incorporation of rates, quotas and grants to the model (Bishop et al. 2001).

The MCP proposed to analyze the Brazilian corn market is given below:

Indexes:

i = supply regions ($i = 1, \dots, 7$)

j = domestic demand regions ($j = 1, \dots, 3$)

k = international demand regions ($k = 1, \dots, 3$)

r = transport routes ($r = 1, \dots, 15$)

Variables:

p_i = supply price

p_j = domestic demand price

p_k = international demand price

z_i = quantity supplied

y_j = quantity consumed by domestic demand

y_k = quantity consumed by international demand

$x_{..}$ = quantity transacted

Parameters:

t_{ij} = cost of transport

φ_i = shadow price associated with the supply region i

λ_j = shadow price associated with the domestic demand region j

μ_k = shadow price associated with the international demand region k

$$(1) \quad 0 \leq \varphi_i \perp \sum_j x_{ij} + \sum_k x_{ik} \leq z_i$$

$$(2) \quad 0 \leq \lambda_j \perp y_j \leq \sum_i x_{ij}$$

$$(3) \quad 0 \leq \mu_k \perp y_k \leq \sum_i x_{ik}$$

$$(4) \quad 0 \leq x_{ij} \perp p_i + t_{ij} \geq p_j \quad \forall_{i,j}$$

$$(5) \quad 0 \leq x_{ik} \perp p_i + t_{ik} \geq p_k \quad \forall_{i,k}$$

For the " \perp " symbol, it is understood that at least one of the adjacent inequalities must be satisfied as strict equality. This is nothing more than a formality of the complementarity that we saw earlier, when describing the Kuhn-Tucker conditions. Equations (4) and (5) are thus submitted to facilitate the inclusion of the *ad-valorem* rate or tariff entailed by the cost of testing to identify transgenic events. In the MCP, elasticity coefficients are included in the restrictions (1), (2) and (3), replacing the quantities produced and consumed by the following expressions:

$$z_i = a_i \cdot \varphi_i^{b_i}$$

$$y_j = c_j \cdot \lambda_j^{-d_j}$$

$$y_k = e_k \cdot \mu_k^{-f_k}$$

The inclusion of the *ad-valorem* rate was based on the work of Bishop et al. (2001). Considering the condition of zero net (5), the inclusion of a parameter tax_{ik} , representing an *ad-valorem* rate or tariff, occurs by incorporation in the model in equation (5). This is because, in this study, the rate has implications only on flows earmarked for the international market. Modifying the condition of zero net, as follows, we have:

$$(6) \quad (p_i + t_{ik}) \cdot (1 + tax_{ik}) \geq p_k \quad \forall_{i,k}$$

In this case, the rate is a result of the imposition of tests for identification and quantification of LMO events, plus the cost of segregated storage on the flows for the international market, as the CPB imposes measures on transboundary movements.

When equilibrium is attained, if there is a trade flow between producing regions and international demand, the price of the product in the region of supply, plus the cost of transport, after the imposition of the LMO tests and segregation, should be equal to the price of international demand. Otherwise, if there is no commercial flow, the price in the region of international demand would be smaller than the price in the region of supply plus transportation costs and tests.

In the model, we initially identified and selected regions of supply and demand for corn. The selected states are part of the Southeast, Central-West and Southern regions. We analyzed the behavior, in recent years, of the variables: corn production, average yield, cultivated area, exports and consumption of corn in the pig and poultry production. The choice of states that comprised the model was based on the expressiveness of these regions in the participation of the variables analyzed. The aim was to characterize the dynamics of these regions, which hold prominent national expression and great potential for expansion based on agricultural frontiers.

The states selected are: Paraná, Mato Grosso, Mato Grosso do Sul, Goiás and Minas Gerais as regions of corn supply, due to their expressiveness in the production and/or export; São Paulo, Santa Catarina and Rio Grande do Sul as regions of demand. The corn importing countries considered are Iran, China and Japan.

To characterize the regions of excess supply and demand, we started from the following premise: if soy production is greater than the amount processed, this region is characterized as a region of excess supply, otherwise, this region is characterized as a region of excess demand. For the State of Mato Grosso and Paraná, we identified different microregions (consisting of a cluster of cities with characteristics similar to agricultural production, industrial and economic activities), both with respect to production and processing, due to the regional heterogeneity that implies different trade flows and the use of different transport routes.

The data that make up the model (production, consumption, marketing prices of the domestic and international market, price elasticities of supply and demand, freight of different modes and costs of LMO tests) were based on the year 2011. Production data were from the Brazilian Institute of Geography and Statistics (IBGE) and the Department of Agriculture of the United States (USDA). The consumption data were based on the Brazilian Association of Chicken Producers (APINCO) and the Brazilian Pork Industry and Exporter Association (ABIEPCS), and the price of corn for domestic and international markets were based on the advisor Safras & Mercado (2011) and USDA (2012), respectively. The data of price elasticities of supply and demand were based on studies developed by Fuller et al. (2001 and 2003) and FAPRI (2011). The freight from the road, rail, waterway and maritime modes were based on the Freight Information System ("Sistema de Informações de Fretes" - SIFRECA 2011).

Aiming to understand the operational aspects of segregation of LMO grains and calculate the costs related to tests to identify transgenic events and segregated storage costs, we conducted

interviews with key industry players (trading companies, shipping companies and certifiers). This was an exploratory and qualitative research, with semi-structured questionnaires used to assist personal interviews. Some trading companies also authorized visits to facilities, which allowed the observation and viewing of all stages of segregation operations, including boarding ships.

In order to anticipate the cost analysis of implementing potential decisions made in the CPB regarding transboundary flows of a LMO load, we emphasize that the impact of CPB on the trade of corn can be determined by the type of information that must accompany a load containing LMOs. This information may be achieved by one of the three following alternatives:

- a) a simple indication that the load "may contain" LMOs;
- b) identification for the specific LMO in the load; and,
- c) identification and quantification of a specific LMO.

Each of the alternatives required will demand a particular analytical procedure, also resulting in different risks and costs for each.

Based on field research, we determined the cost of tests for the identification of transgenic events, as well as the sampling pattern. There are two methods of LMO analysis: one carried out by analysis of DNA and another by the analysis of proteins. In the first case, the technique used is the PCR (Polymerase Chain Reaction), of a quantitative or qualitative nature. For the protein analysis, the simple ELISA (Enzyme-linked immunosorbent assay) test or the dipstick test can be used. In this test, only one event at a time was detected.

The unit cost was US\$ 3.00 for the dipstick tests and US\$ 300.00 for the PCR. Every 40 tons, 2 samples are taken, which requires 2 dipsticks, giving a total cost of US\$ 6.00. In the case of PCR, we considered the PCR Quantitative Real Time with a cost of US\$ 1,050.00 (US\$ /sample/6events), which performs 3 analyses for every 3,000 tons, amounting to US\$ 3,150.00, including 1 PCR when boarding, 1 PCR at the port of export and 1 PCR on the ship.

Segregated storage costs were incurred by the major companies exporting non-GM corn. Costs in transshipment warehouses were approximately US\$ 13.00/ton and storage at ports of export were, on average, US\$ 10.00/ton.

Thus, the estimated costs of tests and storage were calculated based on the use of the term "contain", i.e., comprising both the identification and the quantification of GM corn. This consideration was made as the option for the term "may contain" would have almost no effect on marketing costs and cause minimal triggers on the logistics structure (Huang et al. 2008; Borges et al. 2009; Kalaitzandonakes 2004; Gruère and Rosegrant 2008; Simões 2008).

We simulated two different scenarios. Scenario 1 was the control, where there were no expenses from LMO tests and segregated storage; trade flows were based only on transport costs, i.e., without the imposition of the CPB in relation to the term "contain".

In Scenario 2, we propose a framework of full segregation in relation to the term "contain". The PCR test was considered when boarding, at the port of export and the ship. The number of dipstick tests varied according to the transport route considered. With each change of mode of transport - which requires transshipment operations, since mixing of cargo can occur - an additional dipstick test was performed. The segregated storage was also considered during the process. Based on these considerations, the *ad valorem* rate calculated was 60% in intermodal flows and 55% in the unimodal flows.

The processing of the information for the MCP developed for the movement of corn in Brazil was carried out using the computer program General Algebraic Modeling System - GAMS (Brooke et al. 1995).

Transportation costs of the road and rail modes in the model were estimated by linear equations based on the distances between the loading and receiving points (source/destination). The behavior of the mode cost (variable of response) was analyzed using a multiple linear regression model. We used monthly data on types of freight used throughout Brazil in 2011, employing data from the Freight Information System (SIFRECA) as a source. For the waterway mode, we used freight practiced in the waterway routes in 2011 and the source was also SIFRECA. We did not perform a regression test, as there were only three waterway routes considered in the model.

Results and Discussion

According to Alvim (2003), mathematical programming models must be validated by checking the consistency of the results of the problem. For Waquil and Cox (1995), the validation presupposes an adaptation of the coefficients and the model structure. The model can be validated by checking how well the solution suggested by the model approximates the real situation. According to Thompson (1981) (as cited in Waquil and Cox 1995), much of the spatial equilibrium models do not generate results identical to the actual data.

Thus, some differences can occur between the results estimated by the model and the data observed, without invalidating the model. In Table 1, we can verify the levels of supply and demand estimated by the model. The volumes committed in 2011 ("Observed Data") and the data estimated from the model ("Scenarios 1 and 2") are also shown.

Scenario 1 corresponds to the control group. In this group there were no expenses with LMO tests and segregated storage; trade flows were based only on transport costs. This scenario represents business transactions without the imposition of the CPB. With the focus of analyzing the impacts under the CPB through Article 18.2.a and considering the use of the term "contain", the segregation test costs were incurred in Scenario 2.

In Scenario 2, the identification and quantification system of transgenic corn events generated a negative impact of 4.49% on trade. International flows were the most affected, with losses of 765,000 tons. The exports to Iran and to Taiwan, which are Brazil's main partners, fell by 10.0% and 5.64%, respectively.

Table 1. Supply volumes, domestic demand and international demand, model estimates (scenarios 1 and 2) and observed data, 2011.

Regions	Scenario 1 (A)	Scenario 2 (B) (thousand tons)	Observed Data (C)	Variation (B)/(A) (%)
Supply				
<i>Total Mato Grosso (MT)</i>	5,084.25	4,826.21	6,610.10	-5.08
North MT	3,826.99	3,627.04	4,957.57	-5.22
Southeast MT	1,257.27	1,199.17	1,652.52	-4.62
Goiás (GO)	3,003.32	2,875.85	4,003.96	-4.24
	1,962.46	1,848.92	2,747.65	-5.79
Minas Gerais (MG)	2,704.33	2,610.61	3,385.99	-3.47
<i>Total Paraná (PR)</i>	4,293.42	4,121.02	5,367.82	-4.02
North PR	2,840.98	2,677.80	3,489.08	-5.74
West PR	1,452.44	1,443.22	1,878.74	-0.64
TOTAL SUPPLY	17,047.78	16,282.62	22,115.52	-4.49
Domestic Demand (D)				
Santa Catarina (SC)	3,179.39	3,210.72	3,028.19	0.99
	130.76	130.94	124.65	0.13
São Paulo (SP)	288.57	289.11	270.71	0.19
<i>Subtotal</i>	3,598.72	3,630.77	3,423.55	0.89
International Demand (E)				
Iran	5,329.65	4,796.90	5,000.00	-10.00
Japan	4,016.32	3,983.33	4,000.00	-0.82
Taiwan	4,103.10	3,871.61	4,000.00	-5.64
<i>Subtotal</i>	13,449.06	12,651.85	13,000.00	-5.93
TOTAL DEMAND (D+E)	17,047.78	16,282.62	16,423.55	-4.49

Source. Research Data (2011)

The most significant commercial reductions occurred in the Brazilian regions farthest from ports of export, where the increase in cost impacting the logistics network is more strongly perceived. The main decreases were in the state of Mato Grosso do Sul (Central-West region of Brazil), 5.79%, followed by the North of the state of Paraná (Southern region of Brazil), 5.74%, and North of the state of Mato Grosso (Central-West region of Brazil), 5.22%.

Scenario 2 provides evidence for the loss of competitiveness of Brazilian corn and as well as the regional impacts. Through the parameters supplied, it is possible to identify how production performance and consumption in the regions analyzed are modified when an international agreement is simulated. To drain the Brazilian production, it is necessary to perform a greater number of transfers, given the long distances to ports of export, as the main competitors - the United States and Argentina - have greater logistical efficiency, thus the reduction in Brazilian competitiveness becomes eminent.

With respect to monetary losses, considering the expenses with tests and storage (US\$ 506 million) and the reduction of international trade (US\$ 212 million), losses reach US\$ 718 million. This amount represents 27.4% of the foreign currencies generated by exports of corn grain by Brazil in 2011, which amounted, according to the Ministry of Development, Industry and Foreign Trade (MDIC), to US\$2.62 billion.

From the simulation of Scenario 2, it is possible to verify that the triggers of the CPB have different reflexes in major producing regions of Brazil. The losses in this scenario ranged from 0.64% to 5.79%. The impact of the measures of the CPB can vary considerably among Brazilian states exporting corn. These differences occur due to conditions of transport infrastructure and storage; logistical options available and their ability to make quick adjustments to meet the segregated movements; laboratory infrastructure and weight of the grain exports for the trade balance of the states. Charts 1 and 2 show the trade flows and the logistics routes used for moving corns in Scenarios 1 and 2, respectively.

Chart 1. Trade flows by transport route, Scenario 1 (thousand tons).

Supply	Demand	Route						
		R1	R2	R3	R8	R10	R14	R15
PR-W	SC		1,001.27					
PR-W	SP	288.57						
PR-W	RS			130.76				
MS	SC		1,962.46					
MG	SC		215.66					
PR-N	Iran					2,840.98		
PR-W	Japan					31.84		
MT-N	Taiwan							3,826.99
MT-SE	Taiwan				276.11			
MT-SE	Japan				981.16			
MG	Iran						2,488.67	
GO	Japan				3,003.32			

Scenario 1. There were no expenses with LMO tests.

Road Route (unimodal). R1; R2; R3; Intermodal route: R8; R10; R14; R15.

Source. Research Data (2011).

In Scenario 1, a portion of corn production in Minas Gerais (MG) was destined for the domestic market, supplying Santa Catarina (SC) in the Southern Region of Brazil, using only road transport (route R2). Another portion of the production was directed to Iran, exported through the port of Vitória (state of Espírito Santo). For this flow, the roads and railways routes were used (intermodal route). Corn was transported by truck up to the rail terminal located in the city of Araguari (MG), and from there it was transported by rail up to the port of Vitória (route R14).

The movement of corn from this region in Scenario 2, where there was an increase in logistic costs by imposing the CPB, changed. The region began providing a greater volume to local markets and started to export corn to Taiwan. In addition to this modification, the route to the

international market changed (the intermodal route (R14) used before in Scenario 1 is no longer competitive). The corn was exported through the Santos port via road route (route R4).

Chart 2. Trade flows by transport route, Scenario 2 (thousand tons).

Supply	Demand	Route					
		R1	R2	R3	R4	R9	R15
PR-W	RS			130.94			
MS	SP	289.11					
MS	SC		1,559.81				
MG	SC		1,650.91				
PR-N	Iran					2,677.80	
PR-W	Iran					1,312.28	
MT-N	Japan						3,627.04
MT-SE	Iran				806.82		
MT-SE	Taiwan				392.35		
MG	Taiwan				959.70		
GO	Taiwan				2,519.56		
GO	Japan				356.29		

Scenario 2. includes testing costs for 1 event and segregation. *ad-valorem* rate: road routes: 55%; intermodal routes: 60%.

Road Route (unimodal). R1; R2; R3; R4; R9. Intermodal route: R15.

Source. Research Data, 2011.

Another analysis that can be made concerns the routes used. In Scenario 1, the exports were made via intermodal options, responsible for 100% of movements (13.45 million tons). In Scenario 2, only 29% of corn destined for the international market was done so by intermodal options (approximately 3.6 million tons). Only exports from the northern region of Mato Grosso used intermodality as competitive option. The implementation of measures of segregation resulted in 71% of intermodal routes being no longer competitive due to the increased cost, and road mode was prioritized and overwhelmed. Thus, the costs of implementing the CPB had a larger impact on intermodal routes due to the greater number of tests required and the increased demand for segregated storage; these factors contributed to the increased cost of transport compared to unimodal routes using only the railroads for transporting corn.

Thus, the logistics of transport and storage is affected by the requirements of the Cartagena Protocol on Biosafety; therefore, the more rigid the identification process, the greater the impact on exports. As a result, the competitiveness of Brazilian corn on the international market is compromised by inefficient logistics in terms of responding to the demands of the CPB at the same speed.

Although the study aims to analyze Brazilian trade flows, as the country has a matrix of unbalanced transportation and logistical bottlenecks, the costs of adapting the infrastructure in the face of norms and standards set by the CPB are higher when compared to key competitors,

United States and Argentina, who have better logistics. The corn produced in Argentina travels shorter distances between production areas and ports of export; the Americans prioritize the waterway mode - at a lower cost compared to other modes - to distribute their production.

However, the impacts of the CPB for Brazil not only depend on the level of demand for segregation, but also on the fulfillment of the measures of the Protocol by the main importers that must demand the same requirements for non-signatory countries, Argentina and the United States. Therefore, if the United States and Argentina do not have to follow the norms and standards set out by the CPB, Brazil may become even less competitive.

A further evaluation was made of Scenario 2 through sensitivity analysis of two parameters used in the model: the price elasticity of supply and the price elasticity of demand. According to Law and Kelton (1991), sensitivity analysis can be defined as a technique that allows, in a controlled way, the conduction of experiments and research by means of a simulation model. This type of analysis is an important tool to observe trends and evaluate the impacts associated with: (a) changes in the values of input variables and system parameters, and (b) structural changes in a model. These impacts are determined by analysis of the output variables.

Thus, a number of simulations are carried out to evaluate the international trade of Brazilian corn (already considering the imposition of the CPB and its impact), from the positive and negative variation of these parameters. The parameter price elasticity of supply is associated with producing regions in Brazil, and the parameter price elasticity of demand is associated with regions of domestic and international consumption.

According to Alvim (2003), the price elasticity of demand measures the response of consumers to changes in price, while the price elasticity of supply measures the reaction of sellers to changes in price. When a change occurs in market prices, there may be changes in the volumes consumed and produced that are more or less intense, depending on the inclinations of the curves of supply and demand of the product evaluated. In this study, the price elasticities of supply and demand are different depending on the region, and therefore certain changes in prices may imply more or less intense variations in each region.

When simulations regarding the behavior of price elasticity of supply are carried out, it must be considered that this variable may vary if there are alterations such as technological changes in the production and/or marketing or new alternatives in production. As for the price elasticity of demand, this may vary in the countries analyzed in relation to the base scenario, if there are changes in income, substitutes, or simply consumer preferences.

Thus, for Scenario 2 we simulated a 50% increase in price elasticities of supply and demand, C2S+50 and C2D+50, respectively, and a 50% decrease in the price elasticities of supply and demand, C2S-50 and C2D-50, respectively.

- C2D+50: the price elasticity of demand became more negative. For example, for São Paulo the price elasticity of demand was Scenario 2 = -0.10 and went to Scenario 2D+50 = -0.15.

- C2D-50: the price elasticity of demand became less negative. For example, for São Paulo the price elasticity of demand was Scenario 2 = -0.10 and went to Scenario 2D-50 = -0.05.

In the scenario with the imposition of the CPB (Scenario 2), all trade flows show losses when the price elasticity of supply in producer regions increases (CS +50) (Figure 2), i.e., consumers respond negatively to this change. This picture has a good approach with the implications of the CPB, as, besides the increase observed in transportation costs for segregation (simulated in Scenario 2), other expenses can be generated with the adoption of the Protocol, involving additional costs of marketing and operation of a Identity Preserved (IP) system, which can result in price changes, leading to a decrease in total sales volume.

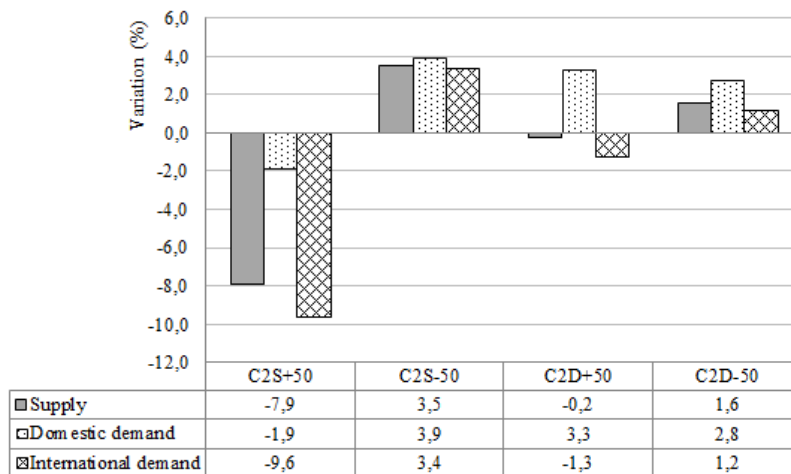


Figure 2. Sensitivity analysis of the marketing of corn to changes in price elasticities of supply and demand, Scenario 2.

Source. Research Data (2011).

In Scenario 2, the trades amounted to 16,282.62 thousand tons, but with the simulation of the CS+50 framework the volume transacted went to 14,995.08 thousand tons (down 7.9%), greater loss observed (Chart 3).

The biggest gain in volume was observed in the simulation C2S-50, with an increase of 3.5%. In this configuration, consumers responded positively to this change, in which it was possible to reduce the negative impacts of the CPB.

Chart 3. Volumes of marketing of corn obtained from the changes in price elasticities of supply and demand, Scenario 2 (thousand tons).

Variables	Scenario 2	C2S+50	C2S-50	C2D+50	C2D-50
Supply	16,282.62	14,995.08	16,856.32	16,242.58	16,537.30
Domestic demand	3,630.77	3,563.19	3,773.67	3,751.86	3,731.22
International demand	12,651.85	11,431.89	13,082.65	12,490.72	12,806.09

Source. Research Data (2011).

Finally, in a scenario of imposition of the CPB, other impacts may occur (positive or negative), according to the perception of the agents involved in the marketing of corn, regarding the benefits of GM corn and the costs associated with segregation. This perception may be reflected in the price level that will interfere in the sales volume, causing an increase or decrease.

Final Considerations

Advances in Brazilian agribusiness can be explained by the success of the combination of factors ranging from more integrated supply chains, intensive use of capital in the various segments that comprise it and government programs to support agriculture. On the other hand, the logistics sector has not been reaching the same level of development and has revealed several weaknesses, either in terms of lack of infrastructure to transport the production, or the inability to adequately store the national harvest.

The logistics of transport and storage, which until now has tried to adjust to the movement of standardized products and in large volumes, must adapt quickly to cope with the growing demand for differentiated products, which must be segregated and will require adjustments in the current logistics system.

From the proposed model we found that trade flows required testing along the chain, which reflected in a decrease in competitiveness of Brazilian corn. The effect is greater in border states, such as Mato Grosso; thus, the requirement of segregation can interfere with the production decisions of farmers just to meet the criteria that are not necessary from the point of view of biosafety. The CPB also results in an increase in opportunity cost when adopting a new technology.

From a competitiveness point of view the implementation of Identity Preservation Systems leading to an increase in fixed costs, with no direct connection with the fulfillment of the objectives of the Protocol, may block the access of farmers to technology, which is easily done by purchasing seed. It also prevents the competition among companies in the market of hybrid seeds being fully exercised. This happens by delaying the release of cultivars resistant to insects and by limiting the offers at the choice of farmers, under the false argument that small farmers prefer local and non-hybrid varieties.

Thus, what we see is a conflict between importers and exporters of agricultural commodities. On the one hand the efforts of importing countries to establish an extremely demanding system on behalf of biosecurity. On the other hand, the large exporters of LMOs are concerned about the costs of implementing the Protocol and the possibility of creating new restrictions on international trade. An important contribution to try to equate these diversions is the implementation of bilateral agreements and/or prediction of mechanisms to reduce tariffs imposed by importing countries in an attempt to reduce the negative impacts of the CPB.

It is worth noting that Brazil is the second largest cultivator of biotech agriculture in the world and offers a complete and rigorous regulatory system. Thus, the protection of consumers and

environment with respect to biotechnology activities is duly guaranteed by the Brazilian legal system.

Today, Brazil faces the challenge of reducing its deficit in transport and storage capacity, a process based on increasing operational efficiency, as well as taking advantage of economies of scale and scope. The imposition of Identity Preservation Systems on a large scale would not only divert the resources needed from agribusiness to accompany the growth rate of Brazil, but would also create uncertainty as to the type of investment that must be made.

Either way, it is critical that discussions regarding the regulation of LMOs envisage investments in infrastructure, so that the positive effects of agricultural biotechnology can be made clear to consumers as well as countries whose talent is manifested in the competitiveness of agribusiness.

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International Food and Agribusiness Management Review
Volume 16, Issue 4, 2013

Consumer Acceptance of a New Traceability Technology: A Discrete Choice Application to Ontario Ginseng

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Abstract

New technologies can limit the threat of economic adulteration but consumers may not accept them. A choice experiment was used to elicit consumer preferences for ‘internal tags,’ a new technology for enhanced traceability and quality assurance. Further, two basic branding options and two signals of product origin are investigated. Results suggest consumers are accepting of products with ‘internal tags’ added and prefer a regional over a national brand. Consumer valuation of the branding options was found to be affected by the presence of one product origin signal. Implications for marketing management decisions are discussed with focus on study design.

Keywords: traceability, quality assurance, new technology acceptance, branding, discrete choice

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Background and Motivation

Reducing the likelihood and impact of public health threats due to contaminated foods is a responsibility of both government and industry. In recent years, economic or economically motivated adulteration has been a growing concern worldwide (Spink and Moyer 2011; Moore, Spink and Lipp 2012). According to the U.S. Food and Drug Administration's working definition, economically motivated adulteration is the "fraudulent, intentional substitution or addition of a substance for the purpose of increasing the apparent value of the product or reducing the cost of its production, i.e. for economic gain" (Lutter 2009). It undermines public and private efforts to raise food safety levels, because the adulterations are unconventional. Branded products or their ingredients are typically counterfeited to reap a premium for an inferior, fraudulent and possibly dangerous product or ingredients. In a recent study, the Grocery Manufacturers Association (GMA) and A.T. Kearny (2010) estimate the annual cost of economic adulteration and counterfeiting of branded products to be \$10 to \$15 billion globally. For an individual company, GMA and A.T. Kearny (2010) estimate the cost of an economic adulteration case to range from 2% to 15% of annual revenues, with smaller companies being relatively more severely impacted than larger ones. The Melamine case which affected more than 30 local and international milk brands and almost 300,000 consumers, with 50,000 hospitalizations, illustrates the potential scale of this global problem (GMA and A.T. Kearney 2010). However, many cases of economic adulteration go unnoticed because regular quality assurance and analysis procedures do not discover the adulteration, or there is no public health damage which would trigger an investigation. Even if discovered, manufacturers or retailers may not inform the public, as long as no public health threat exists or they are required by law to report subsequent recalls.

To stay ahead of fraudsters, or with a more pessimistic view: to keep up with them, industry has a very strong incentive to invest in counter measures for enhanced quality assurance and traceability. Investment areas include rapid analysis techniques and market surveillance systems. The latter raise red flags when changes in prices for ingredients and final products of different quality create incentives for fraud. Since investments in both areas also serve regular quality assurance activities, it is not possible to determine how much of the investments are directed at economic adulteration.

In this paper, we present a study of elicited consumer preferences for a new technology that is aimed at curbing economic adulteration of foods and natural health products. The proposed technology inserts so-called 'internal tags' into foods and natural health products in very small quantities, equivalent to one to five millionths of the product's weight. 'Internal tags' are specific carbohydrate sequences that are synthesized from natural materials (Low et al. 2009). They can be monitored through rapid analysis methods for presence and concentration throughout subsequent stages of the supply chain¹. In addition, there is virtually no limit to the synthesis of sequences so that different sequences can be used for different production periods. This provides the potential for complementing and strengthening existing technologies to curb economic

¹ At the time of the study, development of the 'internal tag' technology was primarily aimed at applications to processed products, such as apple juice or ginseng extract and powder.

adulteration. For example, established traceability technologies, such as barcodes and imprinted lot numbers, are usually applied to the product packaging and easier to counterfeit. Further, established analysis methods for food authenticity, such as DNA or isotope analysis, are only suitable under certain circumstances.

Four focus group interviews had been conducted as pre-study in January 2010 to inform the design of this study. A total of 36 women between the ages of 25 to 65 and over who buy natural health products for personal consumption participated (Informa 2010). The focus groups revealed that scientific details would not be useful for most respondents, e.g. that the ‘internal tags’ are synthesized from oligosaccharides from starch, inulin and pectin, that there are near infinite forms for them to be unique identifiers, that their actual size is 30 to 40 nanometers, or how exactly monitoring would work. Focus group participants stated that the benefits of the technology were tangible to them but also expressed concerns about possible risks, despite a current lack of evidence of health risks. Provided that the latter was confirmed during authorization of the technology, managers would have all the reason to expect that consumers would be accepting of products with ‘internal tags.’ However, there have been promising food-related technologies that have not been taken up in the past. Among the technologies that have faced significant barriers to acceptance, genetic modification and food irradiation have probably received the most attention in both public debate and academic analysis (Olsen, Grunert and Sonne 2010,45).

Strategic management decisions need to be informed about potential acceptance issues of new technologies. Reluctant uptake by industry may turn a first mover advantage into an outsider position and compromise investments. Findings from preference elicitation studies can be shared with supply chain partners to identify additional barriers. Finally, consumer research can be used to develop and implement effective communication strategies. Findings are likely specific to a product or industry, depending on the risk of economic adulteration and awareness of that among consumers. Here, ginseng was chosen for the product-specific analysis. More particularly, the Ontario Ginseng Growers Association had become an industry partner of the project, as they were considering a provincial branding strategy coupled with an effort to increase the level of ginseng processing in the province. For the growers’ association, the lack of market research information about ginseng users is a major constraint. Even broad information about the prevalence of ginseng use is not available in recent publications². The industry saw the potential of the ‘internal tags’ to contribute to safeguarding future investments in processing and branding. Hence, the study was perceived as providing relevant information by answering three important questions for strategic management decisions.

- a) Will consumers accept this technology? Although it has clear and tangible benefits to consumers, they might object to the fact that “something” is added to the natural health product that does not naturally occur in its key ingredients.

² The most recent source of information was Singh and Levine (2006). Based on the 2000-2001 National Population Health Survey, they estimate the prevalence of ginseng use among adults in Canada between 2.6% and 4.8%.

- b) Will consumers be willing to pay a premium for a regional brand? In light of the suggested branding efforts, it would be of particular interest to the growers' association to determine whether consumers would be willing to pay a premium for a regional brand.
- c) Which established signals of traceability and quality assurance are consumers willing to pay a premium for? In addition to the brand, the growers' association could use a manufacturer's guarantee or the Product of Canada label to signal the quality and origin of the ginseng product. Consumers will likely value these signals differently, and their presence could also affect the valuation of the regional brand.

The objective of this paper is thus to illustrate how to get valid answers to these questions to inform strategic agribusiness management decisions about potential acceptability issues of a new technology. The first step is the choice of an appropriate research approach that fits the conceptual model of consumer decision making.

To start, one has to acknowledge that it is appropriate to treat the new technology as a product attribute that is either present in the product or not. Consumers do not use this technology themselves but are subjected to it through consuming a product. More particularly, the new technology represents a so-called credence attribute. For individual consumers, it is impossible or, at least, cost prohibitive to verify its presence. Further, the study is aimed at providing information for pricing and branding decisions for a new product, which requires study participants to state their preferences for the salient product features, including the new technology. Therefore, the discrete choice approach has been chosen for this study. It can be used to provide estimates of consumers' willingness to pay for specific product attributes, which would include the presence of 'internal tags.'

The remainder of the paper is organized as follows. The next section opens with a review of previous discrete choice studies on consumer preferences for food irradiation and genetic modification, two food technologies that have been affected by lack of consumer acceptance. It then discusses the role of information in choice experiments and consumer valuation of traceability. It concludes with a discussion of interaction effects among quality assurance signals, including traceability – an important topic for marketing communication that has received little attention in the literature so far. No attempt is made to provide a comprehensive review of these matters. Instead, it is deliberately selective to illustrate relevant implications for managerial decisions. The third section then presents the methodological foundations of the discrete choice approach and describes the data collection process. This is followed by the presentation of results in section four. The concluding section highlights key findings and discusses how limitations of the current study can be addressed in further research.

Consumer Preferences for New Food Technologies and Traceability

This section presents findings from previous discrete choice analyses of consumer preferences for food irradiation and genetically modified foods that were used to inform the design of our study. In addition, their introduction has raised public controversy, thus their analysis should provide useful insights regarding possible consumer responses.

Food Irradiation and Genetic Modification

Giamalva, Bailey and Redfern (1997) were among the first to report willingness-to-pay estimates from a choice experiment for food irradiation. The technology was described in terms of its benefits, i.e. elimination of the potential risk of food-borne bacteria. They found that more than two thirds of respondents were willing to pay a positive amount for the right to exchange a regular meat sandwich for an irradiated one. They interpreted the significant and positive willingness to pay as indicating consumer acceptance. Subsequent studies produced similar results of general consumer acceptance based on an average willingness-to-pay that exceeded the cost of irradiation, as for example Nayga, Woodward and Aiew (2006) and Shogren et al. (1999) did in semi-controlled field experiments in supermarket settings.

Opposite to food irradiation, the majority of studies investigating consumer acceptance of genetically modified foods reported negative willingness to pay estimates; see for example the review of previous studies by Costa-Font, Gil and Traill (2009). However, when GM foods are linked to tangible benefits to the consumers these products tend to be more acceptable and consumers have also been found to exhibit positive average willingness to pay (Lusk et al. 2002; Lusk 2003). Owing to the credence nature of new food technologies, consumer valuation of different labeling regimes has played a particularly important role in the study of consumer acceptance of genetically modified foods. In a choice experiment with Swedish consumers, e.g., Carlsson, Frykbom and Lagerkvist (2007) could not reject the hypothesis of equal willingness to pay for mandatory labeling and an outright ban of GM products. Similarly, Hu, Veeman and Adamowicz (2005) report for a choice experiment with Canadian consumers that mandatory labeling was valued more than voluntary labeling. Within this context, it is not surprising that labeling strategies from a corporate perspective have received little attention. If so, it is primarily at the level of conceptual considerations, such as MacDonald and Whellams (2007) who point out that North American companies have no ethical obligation to label GM foods. They argue that empirical evidence of consumer concerns is not sufficient, as long as solid evidence of risks to human health is lacking.

The Role of Information for Consumer Acceptance of New Food Technologies

Given the complexity of new technologies from the average consumers' perspective, the impact of information has received due attention in the analysis of technology acceptance. Obviously, discrete choice studies can only focus on essential elements of information and communication and are thus not intended to replicate the full complexity of the real world in their design. Consumers' information activities are embedded in networks, depend on general education and specific knowledge, utilize different media and assign varying levels of credibility to information sources, to name just a few factors. Not surprisingly, the choice of an appropriate technology description is already a challenge, as single words can invoke different responses. Hence, the discrete choice studies on food irradiation by Giamalva, Bailey and Redfern (1997), Nayga, Woodward and Aiew (2006), Shogren et al. (1999) and Teisl and Roe (2010) presented neutrally phrased descriptions of benefits with the aim to have respondents at similar levels of knowledge. However, Hayes, Fox and Shogren (2002) showed that, while separately provided positive and negative information increased and decreased acceptance similarly respectively, negative information was clearly dominating when presented jointly.

While the impact of positive vs. negative information was also of interest to studies on consumer acceptance of genetic modification, research questions addressing the communication of second generation GM foods were practically more relevant. Lusk et al. (2004) found that positive information, i.e. about benefits of genetic modification generally reduced the compensation respondents demanded for the GM product. This was, on average more pronounced among the study locations in the US than in the EU.

Consumer Valuation of Food Traceability

For this study, consumer evaluation of traceability is highly relevant, because the ‘internal tagging technology’ is also a facilitator of traceability. Indeed, many studies report willingness to pay estimates for traceability that are significantly larger than zero (Cicia and Colantuoni 2010; Dickinson and Bailey 2005; Loureiro and Umberger 2007). However, from a marketing perspective, traceability serves the specific purpose of facilitating assurance of credence attributes that consumers value and are willing to pay a premium for in order to differentiate themselves from competitors. Hence, Verbeke and Roosen (2009) see a rather limited potential for product or supplier differentiation on the basis of traceability alone.

Interaction Effects among Signals of Quality Assurance

There is growing body of studies of consumer preference for food safety and quality attributes that are typically presented in the form of labels to participants in choice experiments (Olsen, Grunert and Sonne 2010; Moser, Raffaelli and Thilmany-McFadden 2011; Teisl and Roe 2010). Research in this area is primarily concerned with investigating main effects of these attributes in isolation, while interaction effects among attributes have received less attention. From a practical perspective this is justified, because main effects account for most of the variation in consumer choice. Interaction effects are less often significant and usually significantly smaller in magnitude. Furthermore, taking account of them requires allocating more resources to experimental design (Hensher, Rose and Green 2005, 16ff.). However, they can provide additional valuable insights particularly for marketing communication. A significant interaction effect is present when the consumer valuation of one attribute, say a brand, varies depending on the level of another attribute, e.g. a third party certification seal of sustainable production. If two attributes reinforce each other, i.e. increase willingness to pay above the sum of the main effects, the interaction effect is positive and complementary in nature. If the sign is negative, the presence of both attributes reduces the sum of their isolated impacts; they act as substitutes in the consumer valuation process.

Enneking (2004) explores the brand-specific impact of the safety and quality label (Q&S) on German consumers’ willingness to pay for liver sausage. The Q&S label had been introduced to the German meat market in response to the first genuine German BSE (‘mad cow’) case in 1999. He estimated the brand-specific willingness to pay for the attribute “Q&S label” and thus could show how brand and label interacted: The presence of the Q&S label on a premium brand increased consumer willingness-to-pay more than when present on a less-well known brand. Ubilava and Foster (2009) elicited preferences for safety and quality information attributes among Georgian consumers. A negative interaction effect between quality certification and traceability was found to be strong and robust across model specifications. However, the two

attributes also had significant and considerably larger positive main effects, From a marketing perspective, these results suggest that, despite the negative interaction effect, signalling both attributes on a product would provide the opportunity for a significantly larger price premium than signalling only one attribute.

Ortega et al. (2011) examine Chinese consumers' choices of pork under various safety certification attributes: price, traceability system, government certification, third-party certification, and a product information label. While the traceability system and the product information label have no significant main effect, i.e. they do impact consumers' utility separately, their interaction effect is significant and positive. In other words: the complementary interaction effect increases consumer utility and thus the likelihood of purchasing. This might be due to the perception among consumers that a product information label is only trustworthy when its accuracy is assured by a traceability system.

Methods

Discrete Choice and Random Utility Theory

To elicit consumer preferences for a currently non-existing product discrete choice experiments have been chosen for data collection. Discrete choice models are derived under random utility theory (McFadden 1974; Ben-Akiva & Lerman 1985; Train 2003). When coupled with the assumption that consumers derive utility from consumption of attributes (Lancaster 1966), willingness-to-pay for individual product features can be computed.

To develop the main concept of random utility maximization, assume the rational individual, i , faces a choice among $j = 1, \dots, J$ alternatives. The decision maker could obtain a certain level of utility from each alternative. Thus the derived utility of individual i associated with the choice of an alternative j is denoted U_{ij} , as follows:

$$(1) \quad U_{ij} = V_{ij} + \varepsilon_{ij}$$

where V_{ij} is the observable systematic component of individual i 's utility determined by the alternative j , and ε_{ij} is the random component which captures the non-systematic factors that affect true utility, but are not included in V_{ij} . Assuming a maximizing utility behavior, the individual selects the alternative that yields the highest utility from among the possible alternatives. McFadden (1974) showed that if the difference in the error term is independent and identically distributed with a type I extreme value distribution, the resulting choice probability is the conditional logit choice probability. Hence the choice probability changes depending on how the characteristics of alternatives affect the consumers' utility. The conditional logit model can represent the conditional choice probability of selecting alternative j for individual i :

$$(2) \quad \text{Prob}(y_{ij} = j | x_{ij}) = \frac{\exp(V_{ij})}{\sum_j \exp(V_{ij})} = \frac{\exp(\beta x_{ij})}{\sum_j \exp(\beta x_{ij})}$$

where y_{ij} takes a value of 1 when alternative j is chosen by individual i and 0 otherwise and x_{ij} is a row vector of explanatory variables (or product attributes) that individual i obtains from choosing alternative j , and all other variables are as explained before.

Main and Interaction Effects

The chosen empirical specification of the utility reflects the objective of this study. We estimated a model (Eq. 3) that includes utility from individual attributes and from the interaction of pairs of attributes. Assuming V_{ij} is linear in parameters, the deterministic component of the full empirical model for conditional logit estimation is formulated as follows:

$$(3) \quad V_{ij} = \beta_p p_{ij} + \beta_k x_{ij} + \gamma' d_{ij}$$

where p_{ij} is a price variable for alternative j , x_{ij} is a vector of product attributes, and d_{ij} is a vector of interaction terms of attribute pairs of alternative j . β_p is a price coefficient, β_k is a vector of attribute coefficients, and γ' is a vector of interaction term coefficients.

Willingness-to-Pay as a Measurement of Technology Acceptance

An important outcome of discrete choice analysis is the marginal willingness-to-pay for a change in a product attribute. This measure is defined by the ratio of the attribute and price coefficients:

$$(4) \quad \text{willingness-to-pay}_k = -\frac{\beta_k}{\beta_p}$$

where β_k is the estimated coefficient for attribute k and β_p is the estimated coefficient for price of alternatives. The empirical interpretation of willingness-to-pay is shown in the monetary values that the consumer places on each attribute. Generally, a higher willingness-to-pay for an attribute indicates a greater utility derived from it. For a new technology, as in this study, a willingness-to-pay that is significantly larger than zero can hence be interpreted as an indication of consumer acceptance, while a negative willingness-to-pay would signal a tendency toward rejection.

Experimental Design and Survey Tool

Design of choice experiments leads to the choice of product alternatives or profiles with different attribute combinations. These are to be presented to respondents in choice sets. For efficient design, sufficient variation in product attribute combinations to estimate main and interaction effects at acceptable task complexity is the objective. The first step is the selection of attributes which was based on an analysis of the market for ginseng products and consumer focus groups. As shown in Table 1, three product attributes were chosen in addition to price and the presence/absence of internal tags. The four price levels from \$13.99 to \$19.99 per bottle with 60 250mg-capsules reflect actual retail prices of three national brands at two pharmacy chain stores - Shopper's Drug Mart and Rexall - at the time of the survey.

Table 1. Attributes and levels in the choice experiment

Attributes	Levels of Attribute
Internal tag added	Yes / No
Price/bottle with 60 capsules	\$13.99 / \$15.99 / \$17.99 / \$19.99
Manufacturer	National Manufacturer Brand / Ontario Association of Ginseng Producers
Canadian Ginseng Guaranteed	Yes / No
Product of Canada	Yes / No

The three remaining product attributes present signals of quality assurance or of assurance of origin implying traceability that are currently used in the market. The attribute ‘Manufacturer’ showed either “National Manufacturer Brand” or the “Ontario Association of Ginseng Producers” as a regional, province-based brand. The two remaining signals are either present or absent in the product profile presented to respondents. The “Canadian Ginseng Guaranteed” label was presented to the respondents as a manufacturer’s guarantee that all ginseng material used in this product is from Canada. The “Product of Canada” was described as certifying that at least 51% of expenditures for producing the product were spent in Canada.

The *macro* procedure in SAS 9.2 software was used for a D-optimal experimental design that would allow estimating the interaction effects in the analysis (Hensher, Rose and Greene 2005; Kuhfeld 2005). Using the D-efficiency criterion, D-optimal designs maximize the determinant of the variance of covariance matrix, otherwise known as the determinant of the information matrix. Attributes in D-optimal designs are nearly balanced, nearly orthogonal and designed to yield the maximum amount of information about the coefficients of the attributes in the choice set. We chose to use a full factorial design, because the one four-level attribute and four two-level attributes only have a small number of possible combinations, i.e. $4 \times 2 \times 2 \times 2 \times 2 = 64$. The % *MktBlock macro* was then used to create 32 choice sets with two alternatives each and to divide these choice sets in four blocks of eight sets each. The D-efficiency of this design was 60.54. Each respondent was randomly allocated to one of the blocks of eight choice sets and asked to complete each choice task, an example of which is presented in Figure 1.

Option A and B represent two different ginseng extract products. Please check (✓) the option (A or B) that you would be most likely to purchase.		
Product attribute	Option A	Option B
Price	\$13.99	\$15.99
Internal tag added	No	Yes
Manufacturer	National Manufacturer Brand	Ontario Association of Ginseng Producers
Canadian ginseng guaranteed	No	No
Product of Canada	Yes	No
I would choose:	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1. Example of Choice Set in Experimental Design

The experimental design did not include the option “I would choose neither A or B”. The omission of the “no choice” option may seem problematic because respondents are forced to choose an alternative, if they would rather choose none. Hensher, Rose and Greene (2005), however, suggest that including the no-choice alternative is a decision that must be made according to the objective of the study. By forcing respondents to make a choice, they have to trade off the attribute levels of the available alternatives. Hence, obtaining data from the existing attribute levels and choices leads to a better estimation of the impact of the relationship between different attribute levels (Hensher, Rose and Greene 2005). Further, we could not rule out the possibility that many participants, despite being regular ginseng users would choose neither option in all eight tasks, because the package size or formulation was not their preferred one. This may have led to insufficient sample size. Finally, previous studies did not provide a no-choice option either (Enneking 2004) or showed that there were no significant differences between with and without “no-choice” option data (Carlsson, Frykbom and Lagerquist 2007).

The choice experiment was administered through the Ontario Food Panel³ in April/May 2010 through an online survey. The introduction to the survey provided respondents with a basic understanding of the purpose of the study and a definition of natural health products. Regular users of ginseng products were then identified based on a sequence of screening question about natural health product consumption in the past 6 months. The main body of the survey consisted of four sections. The first set of questions was aimed at capturing respondents’ natural health product consumption and purchasing habits, as well as their perception of product safety and trustworthiness of the various stages in the natural health product supply chain.

The choice experiment constituted the second part. At its beginning respondents received a short description of the new technology and its intended use, “... *to help protect consumers from adulteration and fraudulent activities such as mislabeling, dilution and substituting with inferior material.*” Risks were not mentioned in this description, because the Health Canada approval of the technology required for its commercialization would not be obtained, if risks were evident. To reduce hypothetical bias that leads to inflated willingness-to-pay estimates, a so-called cheap talk script that reminded participants to not neglect the budget effect of their decisions (Lusk 2003) was applied in this study.

In the third section, participants were randomly assigned to positive, negative, and ambiguous information about the new technology, and a control group without any information prior to being asked questions about institutional trust and product safety. Finally, in the fourth section socio-economic and demographic characteristics were elicited. This paper is based on data from section one and two of the survey.

Data and Results

Sampling Procedure

An e-mail invitation to participate in the linked survey was sent to all Ontario Food Panel members but did not mention the topic of the survey. Of the total 5,057 invitations sent out, 286

³ The Ontario Food Panel was initially funded by the Advanced Foods and Materials Network, AFMNet. It is administered through the Department of Food, Agricultural and Resource Economics at the University of Guelph.

failed to reach the panel member, while 1,647 members participated, yielding a response rate of 34.5%. This is rather high compared to similar studies using different survey methods (Baker and Burnham 2001; Lusk, Roosen and Fox 2003; Loureiro and Umberger 2007). Of the completed surveys, 1,436 (87.2%) were from respondents who had consumed natural health products in the past 6 months. Of the 1,436 natural health product users, 178 had consumed ginseng products. The next section will address the non-response error and possible further biases that will require adjustment through survey weights for data analysis. Although our analysis employs data of the ginseng users only, the assessment of biases will be based on the sample of natural health product users, as valid demographic information from outside sources was only available for this larger group.

Non-Response, Possible Biases and Survey Weights as Counter Measures

If not accounted for, non-response error can lead to wrong inferences from biased results (Hensher, Rose and Green 2005). Among the ways to identify non-response error proposed in the literature, comparison of respondents and non-respondents is applicable to this study (Lindner, Murphy and Briers 2001). Ideally the comparison should be based on variables that are directly related to the research purpose, i.e. propensity to accept new technologies. But information on these was not available for non-respondents. Hence, the demographic variables gender, age and education are used, as previous research has investigated links between these variables and risk perception and acceptance of new technologies. Table 2 presents the distributions of these variables for the Canadian population, the sample frame (Ontario Food Panel), non-respondents, respondents, the sample and the target population of natural health product users in Canada.

A second source of bias is related to using the Ontario Food Panel as sample frame. The part of the population that does not use the internet or does not participate in online survey research is obviously not represented in the panel, which may lead to a non-coverage bias. Due to the widespread use of Internet among the general public in 2010, it is a reasonable assumption that this bias was small. A panel selection bias can be observed when comparing panel membership (column 2) to the general population (column 1). The panel is characterized by a higher share of female, older and more highly educated people.

The data for assessing the non-response error is presented in columns 3 and 4 in Table 2. The respondent group includes more female, older and more highly educated panel members than the non-respondent group. Combined with the selection bias of the Ontario Food Panel membership reported in the preceding paragraph, it leads to substantive differences in the gender, age, and education distributions between our sample (column 5) and the target population of natural health product users (column 6). Hence, we had to weight the data to the target population of natural health product users (Biemer and Christ 2008; Gaudino and Robinson 2012). Before describing the chosen adjustment procedure, it is important to address the question whether the observed bias in demographic variables could lead to a bias in new technology acceptance.

Previous research has shed light on the linkages between consumers' demographic characteristics and their attitudes towards and acceptance of new food technologies. Although the diversity of specific study objectives, designs and contexts has produced mixed results, the following evaluations are relevant for this study. First, values and beliefs are generally better

predictors of attitudes and acceptance than demographic characteristics (Lyndhurst 2009). Second, despite generally mixed results, a gender effect appears to prevail with a particular direction, i.e. females being less favorable toward new technologies, while higher education levels are weakly associated with being more accepting of biotechnology and irradiation (Teisl, Fein and Levy 2009). Given the nature of the observed bias, this information would lead one to expect that adjusting for the bias through demographics-based survey weights only has a weak impact on estimation results.

Table 2. Distribution of gender, age and education for Canadians, OFP^a members, respondents, non-respondents, the sample of NHP^a users and NHP users in Canada

	1: Canadian population 20-69 years	2: OFP members	3: OFP non- respondents	4: OFP respondents	5: Sample of NHP users	6: NHP users in Canada^b
N		5057	3,410	1,647	1,436	
Gender						
Female	51.0%	65.1%	63.2%	69.2%	71.8%	55.9%
Age						
20-34	30.5%	24.5%	27.6%	18.0%	17.1%	32.4%
35-54	45.6%	50.5%	50.7%	50.1%	50.6%	45.3%
55-69	23.9%	25.1%	21.8%	31.9%	32.3%	22.3%
Education ^c						
High school degree or less	49.3%	20.0%	21.8%	16.6%	15.5%	44.0%
Trade school or college degree	28.1%	35.3%	35.9%	34.0%	32.6%	30.0%
University	22.6%	44.7%	42.4%	49.5%	51.9%	26.0%

^a OFP stands for 'Ontario Food Panel'; NHP stands for 'natural health product.'

^b Estimated by combining data from Ipsos Reid (2005) and 2006 census data from Statistics Canada (2006).

^c The education data for OFP members and OFP non-respondents included an additional category "Some post-secondary education – not completed." 13% of panel members fell into that category. This category was dropped, because there was no equivalent in census data. The shares in columns 2 and 3 were proportionately adjusted to yield 100%. The data for OFP respondents and the sample came from our survey.

Since we had no information to substantiate how the observed non-response bias in demographic variables would affect the variable of interest, i.e. acceptance of a new technology, we engage in probability weighting only and not in post-stratification adjustment (Gaudino and Robinson 2012; Lusk, Roosen and Fox 2003). Probability weighting is aimed at making the sample distribution of the chosen variables representative of the target population. For our analysis, we chose the variables 'Gender' and 'Education' for probability weighting, because of their magnitude of bias and the stronger evidence of impacting attitudes and acceptance of new technologies reported in the literature review by Teisl, Fein and Levy (2009). In short, the probability weights are obtained by dividing the relative frequency (in %) reported in each cell of the 'Gender' x 'Education' cross tabulation of the target population by the corresponding value in the sample cross tabulation. The weighting of the data was implemented through the STATA 11 command *pweight* (StataCorp, LP. 2009).

Two further features of the weighting process deserve mentioning. First, age was not included as a variable for weighting, because it would have produced sample cross tabulation classes with absolute frequencies of less than ten. This should be avoided as additional biases could be

introduced, because the likelihood of bias increases with decreasing cell count and the bias would be amplified through a large survey weight, which also increases as cell count decreases (Biemer and Christ 2008). Second, no original data about the joint distribution of ‘Gender’ and ‘Education’ was available for the target population of natural health product users in Ontario. The cross-tabulation was constructed by assuming that the share of natural health product users among female (78%) and male (64%) respondents that was reported for the total sample in Ipsos Reid (2005) also holds for each education category. Knowing the distribution of Canadians across education levels from 2006 census data (Statistics Canada 2006) and the usage rates for the three education levels in Ipsos Reid (2005) then allowed estimating the share of females and males in each education category among natural health product users. However, if the estimated population distributions are inaccurate, estimates from weighted data could have greater bias than the ones from the original data (Biemer and Christ 2008). Since our assumption about the joint distribution of gender and education in the target population cannot be verified we will present the results for the unadjusted data first and then compare them to those for the weighted data.⁴

Finally, before turning to describing the sample of ginseng users as the particular group this research is interested in, a brief discussion is in order whether the sample size of 178 respondents is sufficient. As Hensher, Rose and Green (2005) point out determining the minimum required sample size for discrete choice experiments is still not well understood. Early on, rules of thumbs were used like that of Sawtooth Technology (Orme 2010: 65). However, in recent years research has increasingly focused on the relationship between sample size and experimental design (Kerr and Sharp 2010; Rose and Bliemer 2013). Johnson et al. (2013: 6) show for three simulation studies with optimal designs for conditional logit estimations that, “(...) precision increases rapidly at sample sizes less than 150 and then flattens out at around 300 observations.” However, they do not indicate the number of choice tasks per respondent in these studies, which plays an important role in determining minimum sample size. In this regard, Rose (2011) suggests for a D-efficient design with nine or twelve choice tasks, minimum sample sizes of 86 and 55, respectively. Since our design with eight choice tasks is also D-optimal, we can state with some confidence that our sample size of 178 is sufficient for the results to be reliable.

Describing the Sample of Ginseng Users

An overview of the demographic and consumption characteristics of the sample of ginseng users, their motivations to consume ginseng and their consumption and purchase behavior are presented in Table 3. Since no reliable outside information was available, it is not possible to assess whether biases exist with regard to the listed variables. However, compared to the sample of natural health product users in column 5 in Table 2, ginseng users are more likely to be male, more likely to be in the 20-34 years age bracket, and more likely to be in the education level ‘High school degree or less’.

⁴ The construction of survey weights has primarily increased the numbers of males in the lowest education category and reduced the number of females in the highest education category. A complete description of the weighting process is available from the authors upon request.

Table 3. Ginseng users sample (n=178): Distributions of characteristics

Characteristic	Level	Share
Gender	Female	68.5%
Age	20-34	21.5%
	35-54	47.7%
	55-69	30.8%
Education	High school or less	13.5%
	Trade school or college	35.9%
	University	50.6%
Use frequency	Once a week or more	33.6%
	Once a month or more but less than once a week	19.7%
	Less than once a month	46.8%
Usual purchase location	Pharmacy	30.1%
	Supermarket	27.8%
	Health store	27.3%
Reasons for taking ginseng products	Preventing an illness or health condition	90.4%
	Maintaining or promoting my general well-being	49.2%
	Treating an illness or health condition	45.2%

There appears to be no single dominant purchase location type, as pharmacy, supermarket and health store were all stated by about 30% of the respondents as usual purchase location. However, the frequency of using ginseng is rather low, as slightly less than 50% of respondents indicated to use it less than once every month. This does not contradict the fact that 90% of respondents use ginseng products to prevent an illness (i.e. cold), as part of episodic health management likely leading to seasonal use patterns.

Determinants of Product Choice

In the first survey section respondents were asked how important seven factors were in their decision to purchase ginseng products. Figure 2 presents the distribution of importance scores of each factor. The results show that the respondents placed higher values on direct signals of product quality and origin, than on brand, price, and advice from family and friends.

Although none of the signals refer directly to product safety, the focus group interviews in the qualitative stage of this study clearly showed that certified quality and origin, as well as brand very often serve as indicators of safety. Given the high importance scores, in particular for certified quality and origin, we would assume that a new technology for quality assurance and traceability would generally be met with consumers' acceptance.

Further, the importance scores provide an opportunity to cross-check with the results from the choice experiment whether the willingness to pay for the different signals of quality assurance and traceability have the same ranking as the importance scores.

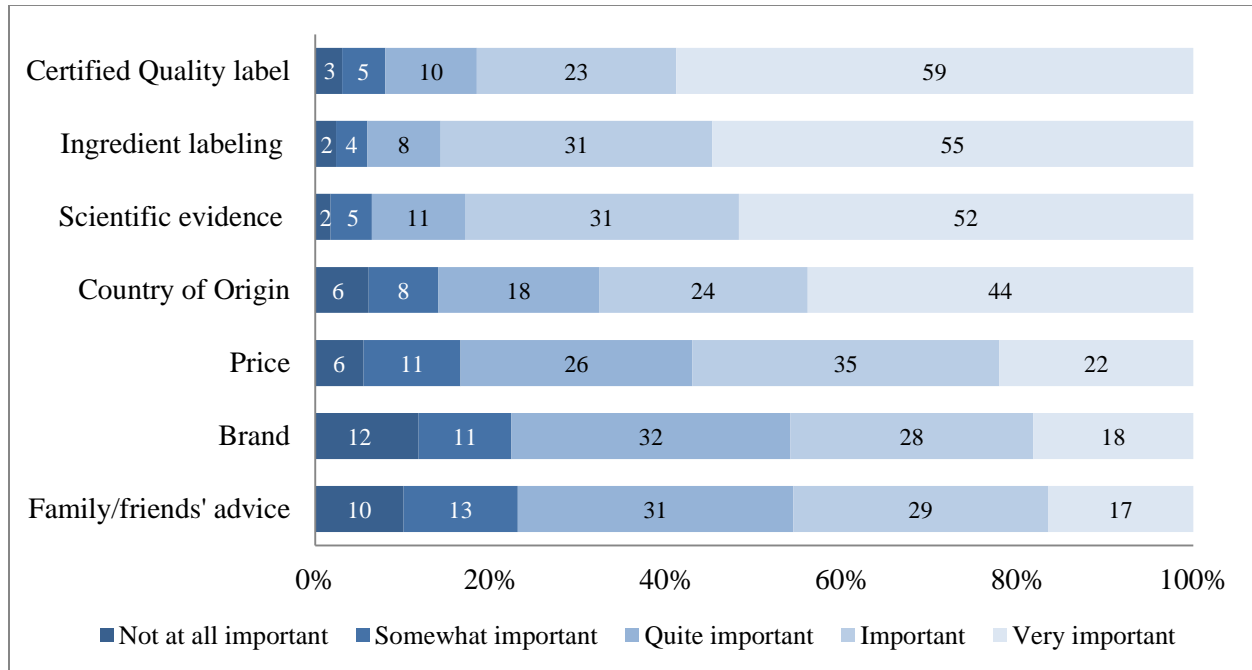


Figure 2. Importance scores distributions of purchase decision factors of ginseng users

Results from the Choice Experiment

The codes and short descriptions of the independent variables for the conditional logit regression are presented in Table 4.

Table 4. Variable descriptions for the Discrete Choice Analysis

Variables	Code	Description
Price	Price	price at \$13.99, \$15.99, \$17.99, or \$19.99/ bottle of 60 ginseng supplement capsules
Internal tag added	Tag	Dummy =1 if product has internal tag added, 0 otherwise
Manufacturer	Brand	Dummy =1 if product is labeled 'National Manufacturer Brand'
Canadian guaranteed	CanG	Dummy =1 if product has 'Canadian ingredient guaranteed' label
Product of Canada	PoC	Dummy =1 if product has 'Product of Canada' label

Estimation results for two model specifications are reported in Table 5. Model 1 includes main effects only, while model 2 includes main effects with two-way interaction effects among quality signals. For model 2, the results are shown for the original, unadjusted data and for the weighted data.

Interpretation of results starts with assessing model fit. Although not exactly analogous to the R^2 statistic of the linear regression model, the pseudo R^2 of 0.30 for the models with unadjusted data would be equivalent to R^2 in the range of 0.6 to 0.7 in ordinary least squares (OLS) regression (Hensher, Rose and Greene, 2005). This model fit is acceptable according to Louviere, Hensher and Swait (2000), who stated that pseudo R^2 values between 0.2 and 0.4 are acceptable for choice models. The likelihood ratio (LR) test for nonlinear restrictions (Elrod, Louviere and

Davey 1992) was used to check for significant differences in fit between models. No significant differences were found between model 1 and model 2 for unadjusted data. When comparing between unadjusted and weighted data for model 2, it has to be noted first that model fit has decreased significantly for the weighted data. Pseudo R^2 is 0.248, compared to 0.305 with the unadjusted data; Log pseudo-likelihood is -745.8 compared to -677.8. The decline in model fit should, however, not be seen as a reason for dismissing the results with the weighted data, since model fit is still in the acceptable range.

Table 5. Conditional logit coefficients (standard errors), (n=178)⁺

Attributes	Model 1, unadjusted data		Model 2, unadjusted data		Model 2, weighted data	
Tag	0.573 ^{***}	(0.086)	0.527 ^{***}	(0.193)	0.533 ^{**}	(0.267)
Price	-0.191 ^{***}	(0.018)	-0.190 ^{***}	(0.018)	-0.155 ^{***}	(0.026)
Brand	-0.286 ^{***}	(0.084)	-0.444 ^{**}	(0.215)	-0.575 [*]	(0.338)
CanG	1.564 ^{***}	(0.095)	1.805 ^{***}	(0.177)	1.593 ^{***}	(0.260)
PoC	1.090 ^{***}	(0.092)	1.088 ^{***}	(0.178)	1.012 ^{***}	(0.240)
Tag*Brand			0.081	(0.189)	-0.013	(0.253)
Tag*CanG			-0.007	(0.183)	-0.014	(0.259)
Tag*PoC			0.028	(0.186)	-0.112	(0.248)
Brand*CanG			-0.101	(0.183)	-0.071	(0.257)
Brand*PoC			0.273	(0.189)	0.585 ^{**}	(0.275)
CanG*PoC			-0.317 [*]	(0.169)	-0.381	(0.254)
Pseudo- R^2	0.302		0.305		0.248	
Log likelihood	-680.7		-677.8		-745.8	

^{*}, ^{**}, ^{***} denote significance at the 10 percent, 5 percent, and 1 percent levels respectively.

⁺ Each respondent was presented with 8 choice tasks, yielding a total of 1,424 (=8*178) possible observations of product choice. 17 choice tasks were not completed so that the total number of observations for the estimation is 1,407.

Turning to the main effects for the product attributes, the signs and magnitudes of the regression coefficients are fairly robust across the models. In most cases, they remain significant at the 1% level. Only for 'Brand' the significance level drops from 1% to 5% from model 1 to model 2. The negative price coefficient is in line with a downward sloping demand curve: a price increase results in a decline in utility derived from the ginseng products, which, in turn, leads to a reduced purchase probability. The coefficients for internal tags imply that the participants in this survey derived higher utility from purchasing ginseng products with the tags than without them. The highest utility is derived from ginseng products with 'Canadian Guaranteed' labeling, followed by the labels indicating 'Product of Canada.' The negative coefficient of 'Brand' shows that respondents prefer a regional brand of Ontario producers over a national brand, which may reflect within-province support for producers and additional trust in their products.

When turning to the interaction effects among the product attributes signaling quality assurance and traceability, we are most interested in those between brand and the two signals of quality assurance. We also included interaction terms for internal tags*quality assurance signals, because, depending on the applicable authorization path, including the 'Internal Tags' under their technical identifier may be necessary. In both models, all coefficients involving 'Internal Tags'

are far from being significant at the 10% level. Instead, the simultaneous use of the ‘Canadian Guaranteed’ label for key ingredients and the ‘Product of Canada’ label are found to have a negative impact on choice probability, which is significant at the 10% level. This result has to be interpreted as respondents seeing the two labels as substitutes. The change in the significance level for the ‘Brand’*‘Product of Canada’ interaction term from unadjusted data to weighted data in model 2 will be discussed below for the corresponding willingness-to-pay estimate.

For ease of interpretation in the context of management decisions, the regression coefficients have been transformed into willingness-to-pay estimates that are presented in Table 5.

Table 6. Willingness-to-pay estimates (\$/bottle with 60 capsules)

Attributes	Model 1		Model 2, unadjusted data		Model 2 weighted data	
Tag	3.006 ^{***}	(0.515)	2.778 ^{***}	(1.021)	3.427 ^{**}	(1.725)
Brand	-1.501 ^{**}	(0.474)	-2.341 ^{**}	(1.169)	-3.698 [*]	(2.201)
CanG	8.209 ^{***}	(0.809)	9.518 ^{***}	(1.219)	10.245 ^{***}	(2.097)
PoC	5.719 ^{***}	(0.645)	5.735 ^{***}	(1.027)	6.507 ^{***}	(1.738)
Tag*Brand			0.425	(1.004)	-0.086	(1.629)
Tag*CanG			-0.038	(0.966)	-0.092	(1.664)
Tag*PoC			0.149	(0.981)	-0.718	(1.601)
Brand*CanG			-0.532	(0.973)	-0.458	(1.672)
Brand*PoC			1.441	(1.008)	3.761 ^{**}	(1.816)
CanG*PoC			-1.671 [*]	(0.902)	-2.451	(1.623)

^{*}, ^{**}, ^{***} denote significance at the 10 percent, 5 percent, and 1 percent levels respectively.

Starting with the unadjusted data models 1 and 2, the significance levels of the individual estimates have not changed when compared to those of the regression coefficients. Willingness-to-pay for ‘Internal Tags’ is about \$3 per bottle. Willingness-to-pay for ‘Product of Canada’ is about twice as high as that for the new technology. Still higher is the willingness-to-pay for ‘Canadian Guaranteed,’ \$8.21 in model 1 and \$9.52 per bottle in model 2. Respondents valued the brand option “National Manufacturer Brand” negatively, which has to be interpreted as positive willingness-to-pay for the “Ontario Regional Producer Brand,” valued at \$1.50 in model 1 and at \$2.34 in model 2. The ranking of willingness-to-pay estimates is in line with the ranking of similar factors affecting the purchase decision reported by Ginseng users in Figure 2. Finally, the negative interaction term for the simultaneous use of the ‘Canadian Guaranteed’ and ‘Product of Canada’ labels can now be assigned a negative willingness-to-pay estimate of about \$1.67 that needs to be subtracted from the sum of the main effects when they are used jointly on the product.

When comparing results for model 2 with unadjusted data to those with weighted data, it can be noted that significance levels and direction of willingness-to-pay for significant estimates have not changed much. However, a clear pattern of change is that standard errors and absolute values of the estimates have increased for the model with weighted data. Since the willingness-to-pay estimates of model two with the original data are relatively high already, a further increase in estimates may be questioned. Two important further changes should be noted that are relevant

for the assessment of the regional branding option. First, although the significance level of the main effect deteriorated from 5% to 10%, its willingness-to-pay estimate increased. Second, the interaction term between 'Brand' and 'Product of Canada' has become highly significant. Its positive sign suggests that the joint use of the 'National Manufacturer Brand' label and the 'Product of Canada' label is valued positively by consumers, in addition to the main effects.

Discussion

The primary objective of this study was to assess whether a new technology for enhanced quality assurance and traceability would be accepted by consumers when introduced to the marketplace. Secondary objectives were to determine whether a) consumers were willing to pay a premium for a regional producer brand, and b) the value of a regional brand could be impacted by existing signals of country of origin that are familiar to consumers. Answers to these questions would inform strategy development of a producer association, as the 'internal tagging technology' can potentially contribute to safeguarding future investment in branding and processing. But it can also be rejected by consumers, such as genetically modified foods in Europe.

The results of the choice experiment point to consumer acceptance and no interference with established signals of product origin. Willingness-to-pay for 'internal tags' being added to the ginseng capsules was positive. Between the two branding options investigated, participants favored the regional brand. In addition, the established quality signals 'Canadian Guaranteed' and 'Product of Canada' were valued positively by the respondents, leading to an increase in willingness-to-pay. This suggests that they should be considered for use in marketing strategy for strengthening quality reputation and assured product origin.

Signaling domestic origin of raw materials, the "Canadian Guaranteed" label was clearly valued most among the three traceability/quality assurance signals. This result is a bit surprising, because this label was clearly described as self-endorsed claim by a manufacturer. A recent study on the acceptance of functional foods in Canada shows that such self-endorsed claims typically are not highly valued by Canadian consumers (Hailu et al. 2009: 260f). The promised Canadian origin of raw materials may have over compensated the possibility of little trust in self-endorsed claims.

The applicability of the discrete choice approach to agribusiness management decisions has been demonstrated by Gallardo (2011). Although this case involves decisions that are possibly more strategic in nature than the one presented by Gallardo (2011), the mechanisms behind implementing a discrete choice study and interpreting the results, basically remain the same. However, an in-depth discussion of the limitations of (any) choice experiment study design and sample representativeness and validity of results are warranted, before conclusions for managerial decision making can finally be drawn.

Critical Assessment of the Limitations of the Experimental Study Design

The experimental design included only those features that were directly relevant to the research objectives. The design, however, can be quickly adapted to address specific questions in

management decision making. More specifically, we did not differentiate between types of ginseng, e.g. Siberian/Asian vs. North American, which are used for different purposes or indications. Similarly, a number of salient attributes, such as package size, dosage, or type of application – pill, powder, or tea – were not included, although they will likely impact choices. However, at the time of data collection, while a pilot study for a new extraction method for ginseng was underway, plans for applying ‘internal tags’ to ginseng extract did not exist, nor an outline of a marketing strategy for products based on the new extraction method. Therefore, investing in a more specific study was not justified.

While Enneking (2004) had used actually existing brands in his study, the branding options in our study were deliberately not based on existing brand options. Although the concept of a ‘National Manufacturer Brand’ may be less accurate in measuring the value of a brand than using a known brand name, there are two strong reasons for not doing so. First, it is obviously problematic to imply that real brands are associated with the use of a new, not yet approved technology. Second, there are a number of established national brands in the ginseng market segment. Not including all may have introduced a bias, while including all would have complicated data collection and analysis. Hence, respondents were provided with examples of national brands in the introduction to the choice experiment. Further, a regional producer brand, as portrayed in the choice experiment, did not exist and thus could not be known to respondents. However, consumers are generally aware of collaborative marketing efforts of Ontario farmers in other sectors and would thus likely perceive the described branding effort as credible.

Conclusion

Recommendations for Marketing and Agribusiness Management

To the best of the authors’ knowledge, only Chrysochou, Chyssochoidis and Kehagia (2009) have yet studied consumers’ perceptions of traceability technologies but included only well established information carriers. The present study thus provides additional insights for a current topic in managerial decision making that has received little attention in academic research so far. Scientific advances will continue to hold potential benefits for enhanced traceability and quality assurance in the food and natural health product industries. Consumer concerns, however, may act as barriers to technology takeup. In light of the preceding discussion, the results of the study will be assessed along the three study objectives to arrive at recommendations for management decisions.

The positive and significant willingness to pay for the presence of ‘internal tags’ has to be interpreted as a signal of consumer acceptance. However, this does not mean that the producers should expect to be able to charge a premium for the presence of ‘internal tags.’ First, the new technology is a means to an end, i.e. assurance of a certain quality. For that quality promise a premium can then be charged. Second, it would require effectively communicating the benefits and use of the technology, which would be costly and risky.

The positive and significant willingness to pay for the regional ginseng producer brand points to a favorable consumer valuation. It likely also reflects within-province support and additional trust in the producers and their direct control over production methods and qualities supplied.

Whether this result can actually be translated into an actual premium will depend on their effective investment in quality assurance and branding. At the time of the study no branding strategy had been developed so that we could not make the branding options more specific. However, as strategy development and implementation planning progress, material to present the branding options more vividly and realistically, such as logos and vision statements would be available. These should be used jointly with existing brand names in a follow-up discrete choice experiment to assess how specific regional branding options would be valued relative to established brands.

The fact that the quality signals ‘Canadian Guaranteed’ and ‘Product of Canada’ received the largest willingness-to-pay estimates indicates that consumers value Canadian origin of a product. The fact, however, that these estimates are considerably larger than those for the regional brand does not mean that a national, i.e. Canadian branding strategy should be preferred over the regional branding strategy. With significant interaction effects between brand and the other two signals being largely absent, it is likely that it would be beneficial to establish a brand with a strong association with Ontario that also signals the Canadian origin to its customers. In that regard, the results of our study do not deviate from the empirical regularity that main effects typically account for most of the variation in a data set (Louviere, Hensher and Swait 2000). For future studies that should be taken as a recommendation to focus on the main effects of the estimation. In our study, they were found to be fairly robust across models and between weighted and non-weighted data.

The issue of using survey weights or not for adjusting sample data is not necessarily of concern to a growers’ association or an agribusiness company that faces a branding decision. But it should not be neglected, as the choice of one over the other may impact the outcome of the decision. In this particular study, the difference in outcomes was rather marginal from a marketing management perspective, given that main effects clearly dominated the results and were only little affected. However, the only compelling or acceptable reason to include results from both weighted and unadjusted data for interpretation was that one data set could not be clearly preferred over the other. In cases where non-response error and/or non-coverage error with respect to the key variables of interest can be clearly grasped and accounted for, the weighted data is preferable.

Finally, while we hope to have illustrated the practical value of our study, a disclaimer is in order that the insights from the choice experiment only have limited value in the preparation for impacts from negative publicity about or campaigning against the new technology.

Acknowledgements

Funding for this research was provided through the Advanced Foods and Materials Network. This is gratefully acknowledged. We want to thank the principal investigator Nicholas Low for the inspiration he has provided throughout the project. Last but not least, we appreciate the suggestions and comments of the anonymous reviewers and the Managing Editor which helped improve the quality of the paper significantly.

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International Food and Agribusiness Management Review
Volume 16, Issue 4, 2013

A Powerful Word: The Influence of the Term 'Organic' on Perceptions and Beliefs Concerning Food

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Abstract

The controversy between altruistic (environment) and egoistic (health) values as explanatory factors of organic food consumption raises suspicions that consuming organic foods is not an end in itself but a means—a way to achieve healthiness rather than an expression of environmental values. In this case, the term 'organic' could be assumed to be a heuristic cue. This paper examines whether the heuristic role of the term 'organic' can indeed be assumed. Personal interviews were conducted with 800 individuals. Results indicated that the term 'organic' plays an important role as a heuristic cue of superiority.

Keywords: organic food, heuristic cue, indicator of perception, consumer behavior.

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Introduction

The organic food market has become one of the most rapidly growing sectors in developed economies around the world, especially in the European Union (Chen 2007). In 2010, this market reached 18.1 billion euros in sales, compared to 10.0 billion euros in 2004 (Schaack et al. 2012).

Organic farming originally began as an alternative production system to help preserve the environment, and reduce the negative environmental impact on natural resources such as soil, air, and water (Stolze et al. 2000; Alonso and Guzmán 2004; González et al. 2005). Other benefits, like rural economic development, also stem from this basic objective (Cobo and González 2001; Ploeg et al. 2002; González et al. 2007).

Therefore, it is understood that organic food consumption should be associated with altruistic motivations or values related to the environment, ecology, animal welfare and rural and local development.

In general, however, studies of organic food consumers do not bear out this assumption. A greater number of reports show that the motives for eating organic foods are more egoistic, focusing on individual health and food safety and hedonistic aspects such as quality or flavor. In other words, a product (organic) with certain benefits or attributes (better for the environment) is bought by consumers who are generally looking more for other benefits (health, safety, quality, flavor, etc.). This situation gives rise to two considerations. Firstly, the only difference between organic and conventional products for the customer in a buying situation is a mark or a word (organic). This distinguishes which products will allow the consumer to make purchases in keeping with his/her motives and values. Consequently, there could be a direct connection between the word and the consumers' values. Secondly, it seems that the word 'organic', chosen to describe and communicate a clear meaning (environmental conservation) is interpreted by consumers in a different way, based on their values and general motivations related to food consumption. Here the term seems to act as a powerful heuristic cue, a way for consumers to save time and effort in assessing and choosing better, healthier, tastier, etc. food. In this regard, it is noteworthy that the only objective difference between organic and conventional foods is that the former are more environmentally respectful. There is more controversy over other properties where organic foods are assumed to be superior to their conventional counterparts, such as healthfulness, quality, taste and smell. In fact, Brennan et al. (2003, 391) conclude that “although consumers have developed beliefs that organic foods are healthier, more nutritious and taste better, these beliefs are generally scientifically unproven”.

The objective of this paper is to analyze whether the term 'organic' acts as a heuristic cue for superiority compared to conventional foods. Operatively, the aim was to obtain empirical evidence about (1) whether organic foods were seen as superior to conventional ones and (2) whether the connotations surrounding them make organic foods superior not only in terms of their environmental attributes but also as regards the other attributes that consumers consider valuable or important.

Analysis of the evocations of the term 'organic' is useful in relation to developing the demand for these products, particularly when creating communication strategies and especially when positioning the products in emerging markets. Therefore, defining the message is very important (for example, environmental conservation or selfish arguments about health, quality and taste). Similarly, the possibility that the term will be interpreted differently from its basic objective (environmental conservation) makes it possible to draw inferences regarding how individuals process information. This has important implications for other communication strategies. Indeed, the conclusions and evocations of consumers in relation to organic products lead researchers to suspect the absence of a complex analysis process. Models like the Heuristic-Systematic Model – HSM– (Chaiken 1980) or the Elaboration Likelihood Model –ELM– (Petty and Cacioppo 1986) can serve as guides to understanding how information is processed and what recommendations should be made.

Motives for Eating Organic Foods

The reasons why people buy or would buy organic foods have been studied extensively around the world. Although many motives have been reported, they are not all as important or of equal priority for consumers.

A wide-ranging review of the literature on the subject (Table 1, see Appendix) indicates that the main motives for buying this type of food can be classed into two groups. The first is **egoistic motives**, which center on the individual's health and food safety and on hedonistic aspects such as quality, nutrition or flavor. The second is **altruistic motives**, related to protecting the environment, animal welfare and rural development. In general, consumers are more motivated by egoistic factors as not only do studies that encounter this type of motivation abound, but where altruistic motives appear they are usually in the background or considered less important. In other words, concern for the environment, animal welfare and local and rural development usually come after health, food safety, quality, etc. in the hierarchy of motives for consuming organic products. The results of Pearson et al. (2011) also point in the same direction.

As well as the above motives, which might be termed more intrinsic to the individual and can be related to personal values, others that have been reported –such as disposable income or food-related scandals– have more to do with the situation or the background and can, in turn, precede the intrinsic motives. Both these motives (income levels and the distrust of conventional foods generated by food scares such as bovine spongiform encephalopathy [BSE], foot and mouth disease, bird flu, etc.) have encouraged the appearance of new life styles with new values and new consumption orientations, increasing the consumers' awareness of food integrity and security (Yeung and Morris 2006).

Although most of the studies show that the main reasons for buying and consuming organic food are the perceived health benefits, food safety, quality and taste (Pearson et al. 2011; Basirir and Gheblawi 2012; Sangkumchaliang and Huang 2012; Justin and Jyoti 2012; Aygen 2012), what truly increases their value is their greater respect for the environment. The main characteristic of these foods which is supported by empirical evidence is that their production methods protect the environment or conserve natural resources better (Mäder et al. 2002; Fuller et al. 2005). Moreover, the characteristics associated with greater healthiness, safety, quality or flavor have

not been scientifically proved (Brennan et al. 2003; Burton 2006; Benbrook et al. 2008), they are only consumer perceptions.

The review by Pearson et al. (2011) has already shown a certain divergence between consumer perceptions concerning the greater healthiness of organic foods and the scientific evidence. The present paper is based on this divergence between the main motives of consumers and what their motives should be, given the nature of the organic foods themselves and the scientific proof. A possible explanation for the divergence could be that the term 'organic' plays an important role as a heuristic cue, evoking attributes related to the consumers' motives. Nevertheless, this requires empirical verification.

Hypotheses

Assuming the role of the term 'organic' as a heuristic cue, it is worth noting that according to multilevel hierarchy persuasive models such as HSM (Chaiken 1980) or the ELM (Petty and Cacioppo 1986), heuristic cues are commonly used to process information about something (in this case, organic food) when a heuristic or peripheral route is used. This is the case when information processing is weak, characterized by little effort to judge the validity of the message and the absence of comprehensive thinking about the contents. This is a fast, superficial and automatic processing method that attaches importance to the external elements of a message, such as the attractiveness of the source or striking images. This type of processing typically occurs when people do not have sufficient motivation (involvement, interest, relevance or importance of the subject) or capacity (knowledge about the topic) for a complex evaluation of the message.

Within this framework, assuming that information processing is weak, two results can be expected: first, that consumers of organic foods will have very little knowledge about them and second, that their involvement with or interest in them will be very low. Thus:

H₁: Consumers have very little knowledge about organic food.

H₂: The level of consumer involvement with organic food is low.

Consequently, as the literature shows, consumers will use heuristic cues. As a result, organic foods could be expected to be valued more highly than their conventional counterparts for a variety of reasons, including safety, quality, taste, smell or the environment. Thus:

H₃: Organic food will generally be valued more than its conventional counterparts.

Moreover, given the nature of heuristics (replacement or absence of complex cognitive mental processes), one would expect greater value to be placed not only on the aspects of organic products which have been proven to be superior (related to conserving the environment), but also on aspects whose superiority is more controversial. From this perspective:

H₄: Organic food is valued more than its conventional counterparts even in aspects that have not been scientifically proven to be superior.

Finally, considering that heuristics replace in-depth, intensive, detailed information processing, in other words, when detail is replaced by overall assessments, it can also be assumed that the use of heuristics will generally involve a reduction of dimensionality in people's individual assessments. This would indicate strong internal correlation between the descriptors used and the absence of some independent macro-dimensions, so:

H₅: There is minimal dimensionality in perceptions and an important general dimension.

Materials and Methods

Research Design and Data Collection

This study compares an organic food to a conventional one. Extra virgin olive oil is widely known and familiar to Spanish consumers. This product is a staple of the Spanish diet and Spain is the largest producer of olive oil in the world (International Olive Council 2012).

The target population for this study was urban buyers of olive oils, over 25 years old and living in Spain. Urban consumers are the segment most likely to purchase organic food, as shown by Von Alvensleben and Altmann (1986), Aguirre et al. (2003), Radman (2005) and Wier et al. (2008). Furthermore, in Spanish cities there are few young people under the age of 25 who are responsible for food purchasing decisions. Any buyer who purchased olive oil in the past year was considered an olive oil consumer.

In addition, the sampling quotas set were based on education level, gender and age, given the likely influence of these variables on behavior towards organic food. The quota of women in the overall composition of the sample was 60%, given their greater role in buying household products (Luque 1998; Martínez 1996). A quota of 50% for university-educated buyers was also established, due to their greater willingness to purchase organic food. Finally, half of the interviews were conducted with people aged 35 and under, given the increased consumption of organic food in this age group. The literature provides abundant empirical evidence on the influence of these three variables on purchasing behavior and the consumption of organic food (Cicia et al. 2002; Briz and Al-Hajj 2003; Storstad and Bjorkhaug 2003; Lockie et al. 2004; Radman 2005; Rimal et al. 2005; Muñoz et al. 2006; Onyango et al. 2007; Aguirre 2007; Bellows et al. 2008; Ureña et al. 2008; Wier et al. 2008; Tsakiridou et al. 2008; Roitner-Schobesberger et al. 2008; Díaz et al. 2009). Consequently, the sample comprises an informed public, more prone to organic food consumption than the Spanish average.

Personal interviews were conducted with the aid of a personal digital assistant (PDA) and included questions related to different experimental objectives that are not addressed in this paper. They numbered 800 and took place in six different cities: Madrid, Barcelona, Seville, Salamanca, Oviedo and Valencia. The main reason for this choice of cities was their geographical dispersion.

Fieldwork began simultaneously in all the cities on November 13, 2009, and ended on November 25, 2009. A company which designs and conducts market research and opinion campaigns was responsible for carrying out the survey. This company has its own field network and was

responsible for programming the PDAs, randomly selecting the respondents, conducting the interviews and processing the data files, under the supervision of the authors. The entire sampling process is summarized below (Table 2).

Table 2. Sample

Scope	National, Spain
Target	Urban buyers of olive oil, aged 25-65
Type of Interview	Personal interview, in the street, with a PDA, using a structured questionnaire, with experimental manipulation of some variables
Sample Size	800 valid cases
Type of Sample	Random. Restricted by age, gender and education level
Sample Error	For global data the sample error is $\pm 3.5\%$ ($p=q=0.5$, $k=1.96$)
Study timeframe	13-25 November 2009

Questionnaire Structure

This paper reports on part of a much larger study with a complex questionnaire composed of various multi-item scales. The questionnaire begins by introducing the interviewer and recording the necessary variables for the sample quotas (age, education and gender). It then measures the following aspects, essentially: (1) general food-related values, (2) motivation or involvement in different food products, (3) comparative perceptions and beliefs concerning conventional and organic olive oil, (4) trust in different aspects of agriculture, control and organic products, (5) perceived behavioral control, (6) subjective norm, (7) level of consumption of different organic foods, (8) predisposition to buy organic olive oil and (9) level of knowledge about organic foods and about olive oils. It ends with questions on socio-demographic variables (income, occupation, household composition, etc.). Half-way through the questionnaire, some of the respondents were shown a message about organic olive oil. Others (the control group) were not shown any message. Using a PDA made it possible to change the order of items in some questions randomly in each interview. The items in the questions used in this part of the study (level of knowledge, comparative perceptions and involvement) are shown in the tables in the Results section.

Measurement

A six-item true/false scale (Table 3) was used to measure the individuals' degree of knowledge about organic production in general and the production of olive oils in particular. The individuals had to decide which statements regarding organic food and olive oils were true and which were false. The general items relating to organic food were inspired by the scale used by Roitner-Schobesberger et al. (2008) and by the definitions, principles, practices and regulations of relevant agencies in this area. These include the Spanish Ministry of Agriculture, Food and the Environment, the European Commission, IFOAM, Codex Alimentarius, the Spanish Organic Agriculture Society, Council Regulation (EEC) No 2092/91 (24-June 1991) on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs and Council Regulation (EC) No 834/2007 (28 June 2007) on organic production and labeling of organic products and repealing regulation (EEC) No 2092/91. For the items relating to olive oils, including organic olive oil, Council Regulation (EC) No 865/2004 (29-April 2004)

on the common organization of the olive oil and table olive market as amended by regulation (EEC) No 827/68 was also taken into account.

To measure the consumers' motivation or consumer involvement, they had to assess to what extent a range of foods, including virgin olive oils and organic food, were important, necessary, or of interest or concern to them on a five point Likert scale (Table 4). This scale was based on the original and revised Personal Involvement Inventory (PII) scales of involvement in products proposed by Zaichkowsky (1985 and 1994, respectively). McQuarrie and Munson's (1987 and 1992) criticisms of the latter scale with respect to the confusion that sometimes exists between this construct and attitude were also taken into account. The scale reflects only one facet of involvement: importance.

The measurement of beliefs or perceptions concerning organic extra virgin olive oil in comparison to conventional, non-organic extra virgin olive oil, again using a five point Likert scale, asked which oil the individuals identified with a series of statements. The answers ranged from 1: Clearly the conventional one to 5: Clearly the organic one (Table 5). Two items measured the consumers' general attitude directly, using the scale from Mitchell and Olson (1981) as a reference. Their general attitude was measured indirectly through 24 items based on the general beliefs discussed in the literature about organic food (as previously noted) and on the information obtained from four discussion groups that focused on perceptions of organic foods and olive oils (see Vega et al. 2010), which are therefore reflective in nature. Using both direct and indirect measurement made it possible to assess the convergent validity of the scale.

Data Analysis

The data were analyzed with SPSS version 15.0 and EQS version 6.1 statistical software. The number of correct answers (which varied between 0 and 6) indicated the degree of knowledge. The first hypothesis (H_1) was tested by calculating the confidence interval of the mean number of correct answers.

Analysis of the marginal distributions of frequencies on the scale of importance and interest of the two types of products and the joint distribution of the two variables showed the number of consumers involved with organic products and olive oils (H_2).

The average score of all the items related to comparative perceptions, beliefs and attitudes towards the two oils indicated whether organic olive oil was more highly appreciated than the conventional olive oil (H_3). Subsequent partial evaluations were calculated by dividing the items into two groups (H_4). In both cases, the hypothesis that the value of the mean differed by three was tested by a T-test. A score of three is the median of the scale and indicates that both oils are perceived as similar. These two hypotheses were tested through analyses of the control group alone because the message could have influenced the perceptions and beliefs of the respondents who had seen it.

Finally, the dimensionality of perceptions (H_5) was studied through confirmatory factor analysis of the data concerning beliefs, perceptions and attitudes towards organic olive oil compared to the conventional olive oil. The items used were those that measure this construct indirectly (a total of 24), which refer to the different dimensions of the product (environment, health, social,

quality, authenticity, etc.). The Robust Maximum Likelihood method (Satorra 2002) was employed because the data did not fulfill the assumption of multivariate normal distribution. The Satorra-Bentler χ^2 -value, as well as other indices, including the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the incremental fit index (IFI), the non-normed fit index (NNFI) were used to assess the model fit. Values below 0.08 for RMSEA (Browne and Cudeck 1993) and above 0.90 for CFI, IFI and NNFI (Bollen 1989; Bentler 1990; Bentler and Bonett 1980; Del Barrio and Luque 2000; Lévy et al. 2006) indicate an acceptable model fit.

Results and Discussion

The consumers' general knowledge about organic food and olive oils was low (Table 3), since the confidence interval of the mean (2.720, 3.007), with a level of significance of 99.9%, includes the scale average. The expected score for the hypothesis of random response was 3 and almost 70% of respondents answered fewer than 4 questions correctly, although 86.5% of the sample were olive oil or organic food consumers, which supports these results.

Table 3. Degree of knowledge: answers for each item (%) and overall mean of correct answers.

Item	Right answers (%)	Wrong answers (%)
Normally, organic production uses synthetic pesticides and fertilizers, but much less than other production methods	49.9	50.1
Organic foods are natural foods that people have not handled, processed or manipulated	38.1	61.9
Olive oil is a mixture of refined and virgin olive oils	29.8	70.2
The greener and more bitter the oil, the greater its quality	36.4	63.6
Olive oil from the first pressing is organic	42.9	57.1
Organic olive oil is produced without using synthetic pesticides or herbicides	89.4	10.6

Note. Overall mean correct answers per person: 2.8638 (minimum 0, maximum 6); SD 1.22865

Studies like those of the Spanish Ministry of Agriculture, Food and the Environment (2007), Stobbelaar et al. (2007), Fuentes and López (2008) and Roitner-Schobesberger et al. (2008) also reflect a lack of consumer knowledge about organic food and the effect this has on demand. Some authors consider this lack of knowledge an obstacle to consumption (Briz and Al-Hajj 2003; Padel and Foster 2005; Alonso 2005; Soares et al. 2008; Martínez-Carrasco et al. 2009; Chamorro et al. 2009; Sangkumchaliang and Huang 2012). Therefore, these results are consistent with the related literature, and confirm hypothesis H₁.

Furthermore, it is worth noting that, in general, the subjects' degree of interest in organic products was very low although over half of them seemed to have an interest in virgin olive oils (for practical purposes, subjects with scores of 4 or 5 on the scale were considered 'involved'). Considering both products together, just under a third of the sample (30.38%) indicated that organic olive oil was important or of interest to them but only 11.6% showed strong interest (scores of 5 on both scales). Consequently, it can be assumed that their level of involvement in the market is low (H₂), (Table 4).

Table 4. Distribution of consumers by degree of involvement with virgin olive oils and organic food (total percentages) (n=800).

Involvement or interest in	Organic Food					Total
	1 (none)	2	3	4	5 (a lot)	
1 (none)	0.3	0.5	0.1	0.0	0.1	1.0
2	1.5	1.0	0.4	0.4	0.0	3.3
Virgin Olive Oil	3	3.0	3.8	5.4	1.0	13.4
4	3.4	6.5	10.8	8.3	1.9	30.8
5 (a lot)	7.5	9.6	14.3	8.6	11.6	51.6
Total	15.6	21.4	30.9	18.3	13.9	100.0

Calculating the perceived superiority of organic olive oil compared to conventional extra virgin olive oil from the mean scores for all the items (Table 5), organic olive oil was generally perceived as better (Table 6).

Table 5. Items used to measure comparative perceptions or beliefs concerning organic extra virgin olive oil and conventional olive oil (scale from 1 to 5)*

Variable**	Item and Description
	1. If you have tried both kinds of oil, which do you like most?
	2. Which is the better quality oil?
V1	3. It is healthier
V2	4. It is more flavorful
V3	5. It poses fewer risks and is safer for consumers
V4	6. It has better sensory appeal (smells better, has a better texture, better color...)
V5	7. It is more respectful to the environment
V6	8. It is more nutritious (contains more minerals and vitamins)
V7	9. It is more natural, less processed
V8	10. It has less chemical residues (fertilizers, pesticides)
V9	11. It expires sooner (shorter shelf life)
V10	12. It is more artisanal
V11	13. It is more authentic
V12	14. It doesn't contain additives (preservatives or artificial colors)
V13	15. It has more curative properties
V14	16. It is better in most respects
V15	17. It generates more wealth for farmers
V16	18. It encourages rural development
V17	19. Its production leaves a smaller chemical footprint
V18	20. It uses fewer natural resources (water, etc.)
V19	21. It is more expensive
V20	22. It is a more gourmet product
V21	23. It is more appropriate for special occasions
V22	24. It has better packaging (container, labels and size)
V23	25. It is more traditional
V24	26. It generates more rural employment

* 1: Clearly the conventional one; 2: The conventional one somewhat more; 3: They are the same; 4: The organic one somewhat more; 5: Clearly the organic one

** Variables used in the confirmatory factor analysis

Table 6. Overall assessment of organic extra virgin olive oil compared to conventional extra virgin olive oil (mean of all items) and T-test.

Mean	T-Test. H_0 : Mean = 3				
	T	df	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
3.6351	6.308	79	0.000	0.4347	0.8355

Variable: 1: Clearly the conventional one; 2: The conventional one somewhat more; 3: They are the same; 4: The organic one somewhat more; 5: Clearly the organic one

Note. This analysis used the control group data exclusively (n=80) since all other groups had been exposed to a message about organic olive oil prior to this question

The results below (Table 7) replicate the above analysis, excluding items in which there was certainty that extra virgin organic olive oil was, or should be, better than conventional olive oil. This includes items related to environmental impact and the use of certain products and substances (Items 7, 14 and 19). The results are similar to the previous data.

Table 7. Overall assessment of organic extra virgin olive oil compared to conventional extra virgin olive oil (mean of items in which it is not clear that the organic olive oil is better) and T-test.

Mean	T-Test. H_0 : Mean = 3				
	T	df	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
3.5345	5.433	79	0.000	0.3387	0.7304

Variable: 1: Clearly the conventional one; 2: The conventional one somewhat more; 3: They are the same; 4: The organic one somewhat more; 5: Clearly the organic one

Note. This analysis used the control group data exclusively (n=80) since all other groups had been exposed to a message about organic olive oil prior to this question

Therefore, organic extra virgin olive oil was more highly valued than its conventional counterpart even when measuring aspects where it is not clear that organic is better. This is consistent with previous literature that shows that consumers have certain beliefs about the superiority of organic food that are not scientifically proven (Brennan et al. 2003).

The disaggregated list shows the average score of all items (Table 8). It should be pointed out that the average score was greater than three in all items except one. Therefore, the perceived superiority of the organic olive oil was evident in virtually all the aspects the consumers were questioned about and was not the result of overall compensation between some items and others. Accordingly, these results support hypotheses H_3 and H_4 .

Table 8. Average score on comparing organic extra virgin olive oil with conventional extra virgin olive oil.

Item	Statements*	Average
1	If you have tried both kinds of oil, which do you like most?	3.29
2	Which is the better quality oil?	3.90
3	Which oil is healthier?	3.91
4	Which oil has a better flavor?	3.23
5	Which oil is safer (poses fewer risks) for consumers?	3.64
6	Which oil appeals more to your senses (smells better, has a better texture and color)?	3.41
7	Which oil is more respectful to the environment?	4.31
8	Which olive is more nutritious (contains more minerals and vitamins, etc.)?	3.70
9	Which oil is more natural, less processed and manipulated?	4.15
10	Which oil has less chemical residues (fertilizers or pesticides)?	4.16
11	Which oil expires sooner (has a shorter shelf-life)?	3.60
12	Which oil is more artisan?	4.05
13	Which oil is more authentic?	3.83
14	Which oil does not contain preservatives, artificial coloring or other additives?	4.13
15	Which oil has better curative properties?	3.61
16	Which oil is better in most respects?	3.69
17	Which oil generates more wealth for farmers?	3.16
18	Which oil favors rural development more?	3.39
19	Which oil produces less chemical residues?	4.06
20	Which oil uses fewer natural resources in its production (water, etc.)?	3.63
21	Which oil is more expensive?	4.59
22	Which oil is more gourmet?	3.84
23	Which oil is more appropriate for special occasions?	3.44
24	Which oil has better packaging (container, labels and size)?	3.13
25	Which oil is more traditional?	2.86
26	Which oil generates more rural employment?	3.11

*We would like to know your opinion and beliefs about organic extra virgin olive oil compared to conventional extra virgin olive oil.

Variable: 1: Clearly the conventional one; 2: The conventional one somewhat more 3: They are the same; 4: The organic one somewhat more 5: Clearly the organic one.

Note. This analysis used the control group data exclusively (n=80) since all other groups had been exposed to a message about organic olive oil prior to this question.

Confirmatory factor analysis of the 24 items that indirectly measure the perceptions or beliefs about organic olive oil compared to conventional olive oil (Table 5) and testing the unidimensionality of these perceptions or beliefs showed that some of the indicators or adjustment measures did not reach the recommended values mentioned in the *Data Analysis* section. The Wald test, the test of significance of parameters and the normalized residual matrix (Rial et al. 2006) eliminated six of the 24 initial variables (V8, V15, V16, V17, V19, and V24). However, this amendment did not change the primary structure of the model, preserving the initial theoretical stance concerning the trend towards one-dimensionality of the perceptions compared.

The estimation of the model after the modification (Figure 1) shows a marked improvement in the goodness of fit. As a result, most of the measures of fit show that the model is adequate (Table 9). The exception is the significance of the chi-squared test, probably due to the size of

the sample. This test is sensitive to sample size (Schumacker and Lomas 1998; Hair et al. 1999; Del Barrio and Luque 2000) and multivariate normality (Rial et al. 2006).

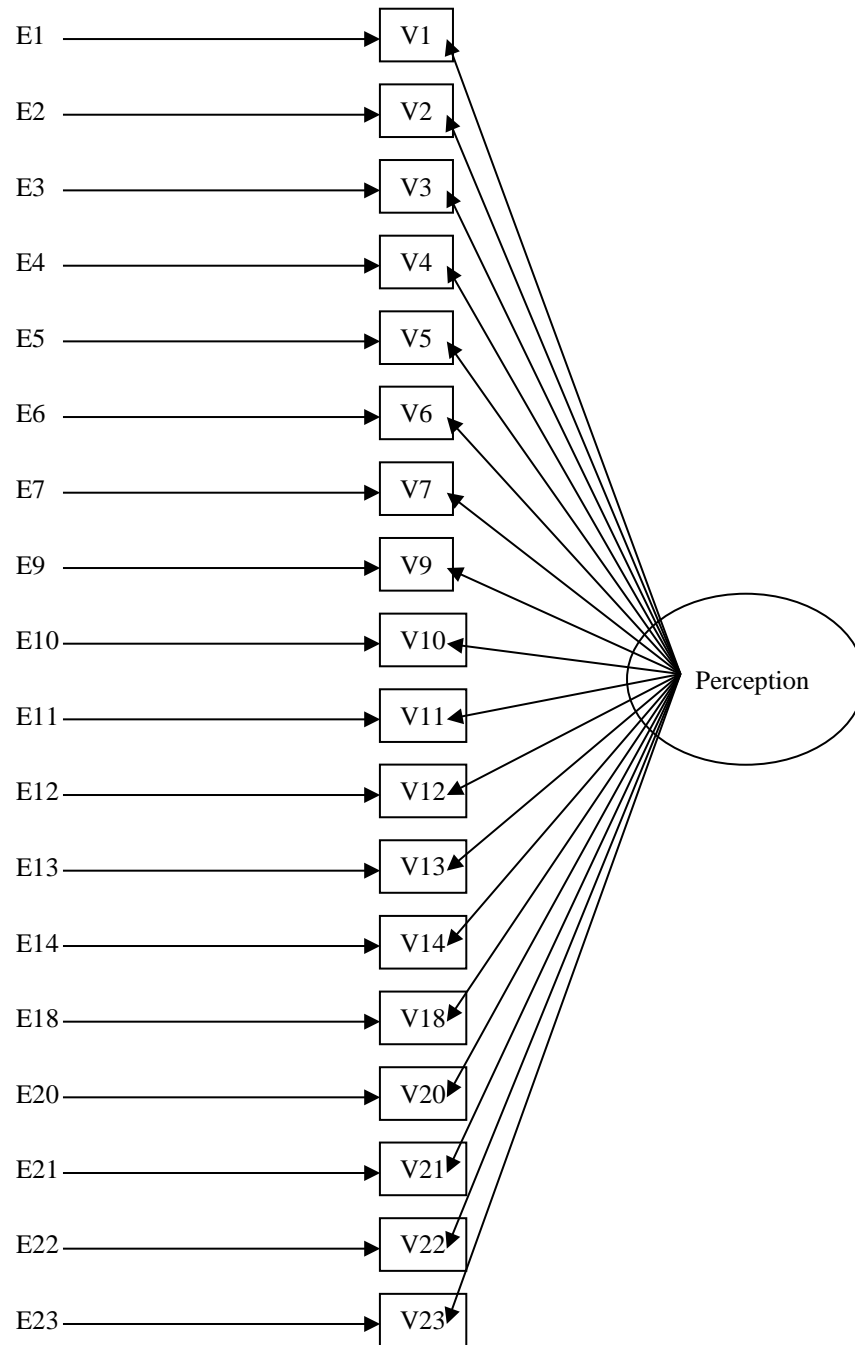


Figure 1. Confirmatory factor model of the unidimensional perception of organic olive oil.

Table 9. Indicators of overall goodness of fit of the model.

Measure	Value
Satorra-Bentler chi-squared	355.4067 (gl. 133; p=0)
RMSEA	0.061
CFI	0.920
IFI	0.920
NNFI	0.908

Furthermore, after a more detailed diagnosis with reference to the measurement model, the statistical significance of all the parameters was noteworthy: all the λ coefficients (which measure the relationship between latent and observable variables) were significant at a 95% confidence interval and all were positive, so they contributed positively to the perception of quality (Table 10). The validity of the construct can therefore be accepted. Furthermore, it is noteworthy that the values for Cronbach's alpha and the composite reliability index (rho) were high (0.925 and 0.928 respectively), so it may be assumed that the scale is a reliable measure of the construct (Nunnally 1978; George and Mallery 1995; Bentler 2006), although these figures could also be due to the number of items.

Table 10. Statistical significance of the parameters.

Variable	Standard Error	Test Statistic
V1	0.042	16.151*
V2	0.051	14.084*
V3	0.052	13.915*
V4	0.058	13.676*
V5	0.045	12.593*
V6	0.045	15.336*
V7	0.046	15.161*
V9	0.053	7.299*
V10	0.050	14.443*
V11	0.048	16.491*
V12	0.049	14.261*
V13	0.066	9.919*
V14	0.039	19.473*
V18	0.045	11.634*
V20	0.048	14.761*
V21	0.049	13.760*
V22	0.051	6.496*
V23	0.059	8.166*

* Statistics significant at the 5% level.

Since the goodness of fit indices are acceptable, the existence, in general, of a one-dimensional structure of differential perceptions or beliefs between the two products is understandable. It can be inferred that there is a strong factor that unites most global perceptions of organic olive oil compared to conventional olive oil.

The unidimensionality of consumer perceptions could explain that despite a lack of knowledge about the properties of organic food and organic olive oil, the consumers considered organic olive oil to be of higher quality and/or superior to conventional olive oil in almost all the items. Consequently, 'organic' is a simple means of assessing product quality without complex processing or knowledge related to the differential characteristics of organic olive oil and its relationship to health, the environment, or its manufacturing process. In short, the term 'organic' can be viewed as a heuristic cue, a key to quality or superiority that allows any product information to be included in the general assessment. Presumably, the term alone evokes inferences of superiority compared to conventional products.

Conclusions

In view of the results, it can be concluded that the term 'organic' plays an important role as a heuristic cue to superiority and that organic foods are purchased by consumers who value health, safety, quality, authenticity and naturalness in food. Thus, conserving the environment is not an end but a mediating factor. In this context, it is noteworthy that the clear, objective relationship between organic food and environmental conservation has been the springboard for consumers to develop other connections between the term 'organic' and important consumer values with regard to food. These connections are made by consumers who have reinterpreted the meaning of 'organic' to suit their consumption behavior. As a result, the term 'organic' has become a highly evocative word, a key heuristic trigger or a set of meanings developed and inferred by consumers. Therefore, the mere use of the word 'organic' evokes powerful connotations about a product that undoubtedly increase its value to consumers. Organic means better, not because the manufacturer communicates it but because the consumer thinks so.

The development of this market behavior could be explained by its advantages to consumers. Besides the obvious simplification of the purchasing process, the establishment of these meanings (the organic-value relationship) removes the need for consumers to analyze such abstract or difficult-to-evaluate features as health or safety, which are nonetheless important to them.

From an academic perspective, this study highlights the relationship between the choice of terms and the meanings understood by consumers. This field of study is of undoubted interest, especially for products with low involvement, in relation to two fundamental questions: how does the construction of meaning develop in the market through the use of a specific term and what features should those terms possess to generate higher perceived value to the consumer? The study of these issues can provide valuable information for businesses and academics, increasing their knowledge of consumer behavior. Thus, a direct application of these studies could be to choose words to identify, position and market products (generic designations, labeling or advertising campaigns).

Furthermore, in conjunction with the theoretical models used as references (the HSM and ELM), these results provide some suggestions for marketing organic products. Simply using the term 'organic' in product communication evokes superiority, creating a favorable attitude towards organic products. This is partly due to weak consumer information processing that ignores the rest of the message's content. Similarly, emotional messages should be more persuasive than

rational ones and the use of attractive and credible sources is more persuasive than the message content. In this case, the context of the message and the peripheral elements are more important than the message itself, which only needs to contain the term organic. A future study along these lines could identify which combinations of experimental elements (message sources, amount of information, form of presentation) would be most effective in developing or increasing the demand for these products.

Finally, the present study has some limitations. The first is that this paper focuses on the specific case of a single product, organic olive oil. It would be interesting to replicate the study to include more foods with varying degrees of familiarity and cultural connotations.

Additionally, this research focuses on Spain, where the market penetration of organic food and retail development is lower than in other countries (Padel and Midmore 2005; Schmid et al. 2007). The assumption of environmental values and their impact on consumer behavior might be greater in more mature markets (Switzerland, Denmark, Austria, etc.).

Acknowledgements

This research is part of the 'Marketing Strategies of Organic Olive Oil in the Spanish Market' project. The authors wish to thank the Department of Organic Farming of the Andalusian Regional Government (Spain) for funding this project and Mary Georgina Hardinge for her assistance in translating and revising the English manuscript.

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Appendix

Table 1. Factors that motivate the demand for organic foods.

Factors	References
Increasing consumer concern for the environment	Davies et al. (1995), Sánchez et al. (1997), Sánchez, Gil and Gracia (1998), Zotos et al. (1999), Worner and Meier-Ploeger (1999), Gil et al. (2000), Sánchez et al. (2001), Squires et al. (2001), Makatouni (2002), Arcas et al. (2002), Verdume et al. (2002), Padel and Foster (2005), Lea and Worsley (2005), Durham and Andrade (2005), Honkanen et al. (2006), Gracia and Magistris (2007), Schmid et al. (2007), Aguirre (2007), Stobbelaar et al. (2007), Tsakiridou et al. (2008), Chamorro et al. (2009), Basir and Gheblawi (2012), Sangkumchaliang and Huang (2012), Krivvy and Mecking (2012), Pino et al. (2012), Oliveira et al. (2012), Padilla et al. (2013).
Greater interest in animal welfare among some consumers	Makatouni (2002), Padel and Foster (2005), Honkanen et al. (2006), Stobbelaar et al. (2007), Schmid et al. (2007).
Support for local farming development (consequently benefiting farmers)	Worner and Meier-Ploeger (1999), Padel and Foster (2005), Chamorro et al. (2009).
Increasing consumer concern for health (seeking healthier, more natural food)	Byrne et al. (1992), Tregear et al. (1994), Davies et al. (1995), Huang (1996), Wandel and Bugge (1997), Hutchins and Greenhalg (1997), Sánchez et al. (1997), Schifferstein and Oude Ophuis (1998), Sánchez, Gil and Gracia (1998), Worner and Meier-Ploeger (1999), Zotos et al. (1999), Gil et al. (2000), Squires et al. (2001), Torjusen et al. (2001), Sánchez et al. (2001), Magnusson et al. (2001), Arcas et al. (2002), Lockie et al. (2002), Lubieniechi (2002), O'Donovan and McCarthy (2002), Zanolli and Naspèti (2002), Harper and Makatouni (2002), Chinnici et al. (2002), Makatouni (2002), Verdume et al. (2002), Magnusson et al. (2003), Rivera and Brugarolas (2003), Millock et al. (2004), Chrysoschoidis and Krystallis (2005), Radman (2005), Padel and Foster (2005), Lea and Worsley (2005), Botonaki et al. (2006), Rodriguez (2006), Schmid et al. (2007), Aguirre (2007), Chen (2007), Chen and Li (2007), Gracia and Magistris (2007), Stobbelaar et al. (2007), Oryango et al. (2007), Tsakiridou et al. (2008), Magistris and Gracia (2008), Roitner-Schobesberger et al. (2008), Gracia and Magistris (2008), Hamzaoui and Zahaf (2008), Chen (2009), Haghir et al. (2009), Chamorro et al. (2009), Basir and Gheblawi (2012), Sangkumchaliang and Huang (2012), Krivvy and Mecking (2012), Oliveira et al. (2012), Aygen (2012), Justin and Jyoti (2012).
Greater consumer concern for food safety and security (no chemical residues, no additives)	Byrne et al. (1992), Wilkins and Hillers (1994), Hutchins and Greenhalg (1997), Harper and Makatouni (2002), Lubieniechi (2002), Rimal et al. (2005), Gifford and Bernard (2006), Pino et al. (2012).
Greater consumer interest in buying better quality, more nutritious food	Sánchez et al. (1997), Lubieniechi (2002), Radman (2005), Rodriguez (2006), Chen (2007), Chen and Li (2007), Magistris and Gracia (2008), Basir and Gheblawi (2012).
Better flavor	Byrne et al. (1992), Davies et al. (1995), Zotos et al. (1999), Worner and Meier-Ploeger (1999), Verdume et al. (2002), Millock et al. (2004), Chrysoschoidis and Krystallis (2005), Radman (2005), Lea and Worsley (2005), Rodriguez (2006), Schmid et al. (2007), Roitner-Schobesberger et al. (2008), Chamorro et al. (2009).
Fresher	Byrne et al. (1992), Millock et al. (2004).
Curiosity	Roitner-Schobesberger et al. (2008).
Higher disposable income	Munuera and Pemartin (2005).
Food scores	Lampkin and Padel (1994), Alonso (2001), Arcas et al. (2002), Fotopoulos and Krystallis (2002a and b), Verdume et al. (2002), Vicente and Aguirre (2003), Briz and Al-Hajj (2003), Munuera and Pemartin (2005), Oryango et al. (2007), Schmid et al. (2007), Kalogeras et al. (2009).



International Food and Agribusiness Management Review
Volume 16, Issue 4, 2013

Opportunities and Constraints for Small Agricultural Exporters in Egypt

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Abstract

This study analyzed specialist small- and medium-sized agricultural export firms in Egypt in order to identify perceived opportunities and barriers regarding present and future export activities. The results indicate that these firms have to deal with stiff foreign competition in terms of price and quality criteria, while lacking relevant knowledge and information on how to deal with these challenges. The firms that perceived most future opportunities from exports were identified as using e.g. digital information sources and were able to source products from export-committed domestic farmers.

Keywords: agricultural exports, Egypt, non-tariff barriers, ordered probit model

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Introduction

The rising number of globally operating multinational firms in agribusiness should not be allowed to mask the fact that Small and Medium-sized Firms¹ (SMFs) are still of great importance to both developed and developing economies (Tambunan 2009). In Egypt, SMFs represent at least 90 per cent of total enterprises and constitute more than 99 per cent of all non-agricultural private enterprises (El-Hawary 2010). The contribution by SMFs to Egyptian exports has doubled during the past decade (CAPMAS, 2013); however, the total contribution is still no higher than 10%.

Agriculture in Egypt currently makes up 14 per cent of GDP and 55 per cent of national income (CAPMAS, 2012). Agricultural exports accounted for more than 60 per cent of Egypt's total exports until the 1980s (Hassanain 2004), but have been declining ever since. In the year 2010, SMFs in Egypt accounted for about 15-20% of all Egyptian exports of agricultural products (EDSEB, 2010).

Clearly, in the presence of increasing returns to scale, the role of SMFs must be viewed critically with respect to Egypt's international competitiveness. Rutherford (2008) indicates that Egypt's private sector is dominated by only a few large firms, with close ties to the state. In other words, when comparing the export performance of small and large firms in Egypt, it has to be carefully determined why an exporting firm is large in the first place and if this is the outcome of scale economies or due to other factors.

In this context, a number of studies demonstrate that on average, firm size is not a barrier to export, which implies that scale effects do not play a major role (Zucchella 2001, Moen 1999, Bonaccorsi 1992). Fliess and Busquets (2006) and Langes and Montgomery (2005) point out that the increase in global trade along with a removal of trade barriers, a fall in transportation and information costs and the emergence of new markets in developing countries have all contributed to increased opportunities for SMFs to export. Based on this evidence, SMFs can play a significant role in the export process, provided that they are placed in an enabling environment and are provided with proper incentive schemes (MoF, 2005). The Egyptian government has implemented a number of strategies to promote and develop agricultural export activities, with special attention to the role of SMFs. These strategies include the Strategy for Agricultural Development till 2017 and the Strategy for Sustainable Agricultural Development towards 2030. With respect to SMFs, the strategies highlight the importance of supporting small farmers' associations, particularly in the field of agricultural marketing, promoting agricultural small- and medium-size processing and exporting firms, and increasing the abilities of SMFs to participate in the processing and exportation of their products.

However, despite these attempts to promote both SMFs and agricultural exports, Egyptian SMFs are generally viewed as underperforming in (agricultural) exporting (MoF, 2004). Furthermore, Hamdy (2009) shows that agricultural exports by SMFs in particular have been characterized by fluctuations in quantity and value over time. Elasrag (2012) argues that the political development

¹ The Egyptian Ministry of Trade and Industry uses the EU definition according to which an SMF has up to 50 employees. This definition is also used in this study.

initiatives are unlikely to motivate more agricultural firms to export, since many SMFs would effectively be unable to benefit from them. Said (2006) found that agricultural SMFs in Egypt perceive profits from exporting to be lower and exporting to be more complicated and more risky than is reported by larger firms. Abu Hatab et al. (2007) found that the majority of agricultural SMFs, when confronted with the decision to export, often decide not to do so. Lall (2002) identified three sets of competitive challenges that SMFs face: 1) Being small imposes disadvantages in activities where the risks are high and technology is fast-paced and relies on enormous investments; 2) large firms are generally favoured with access to inputs including credit, labour, infrastructure and technology and market information, where SMFs face segmented factor markets; and 3) policies and institutions can be biased against SMEs, since large firms with resources and connections can manipulate bureaucrats to exploit the system (Syed and Abdullah 2009; Lall *ibid*).

Several studies have focused on export barriers faced by firms in different sectors and countries (Haahti et al. 2005, Sousa et al. 2008). However, empirical research specifically investigating export barriers faced by firms in developing countries is less common (Tesform and Lutz 2006, Al-Hazaimeh et al. 2011). Moreover, most of these studies focus on non-agricultural exporting firms, with little attention given to firms mainly exporting primary agricultural commodities (Kazem and Heijden 2006).

In summary, the existing evidence suggests that SMFs play an important role for the Egyptian economy, but that their potential to engage in export activities may partly suffer from dominance by large firms. In addition, the export performance of SMFs may be hindered by the presence of various structural barriers. The aim of the present study was therefore to determine whether, and under what conditions, small and medium- sized agricultural export firms (SMAEFs) in Egypt are prepared to capture potential export opportunities, and to identify what they perceive to be the main obstacles to success at present. In investigating this research question, we adopted two novel approaches. First, unlike the bulk of the relevant literature, we focused specifically on SMFs operating within the agricultural export sector in Egypt and sought to identify major constraints currently encountered by these firms. Second, we analysed how these constraints influence export growth and profit opportunities for Egyptian SMAEFs in the agricultural sector.

We based our analysis on a recent survey that we conducted with specialist SMAEFs in Egypt. This paper is organized as follows: in the next section, we review the literature on export constraints relevant for SMFs in developing countries, which allowed us to formulate relevant survey questions and hypotheses for our analysis. The following section introduces the survey design, the sample of specialist exporters and the data collection process. The results section provides a descriptive analysis using the dataset collected and the determinants of export growth and profitability in Egyptian SMAEFs are then determined according to an ordered probit regression approach. The final section discusses the findings of our study.

Export Constraints for SMFs in Developing Countries: A Review of Literature

Exports play a fundamental role for economic growth because they stimulate domestic production and increase the supply of foreign exchange (Koksal 2008). At the individual firm level, exports are vital for business development, competitiveness and increased market share.

Given these evident contributing factors, a large body of economic literature has attempted to formulate a model for firms' export behaviour (e.g. Abby and Slater, 1989). Issues addressed in these studies have been reviewed e.g. by Sousa et al. (2008). Table 1 synthesizes the findings reported in this literature, based on which we identified the main reasons why SMFs in developing countries refrain from export activities.

Table 1. Major barriers to export by SMEs in developing countries according to the literature

Barrier to Export	Examples	Sources
Competition in International Markets	<ul style="list-style-type: none"> • Competition between different exporters, mainly in terms of prices, product quality and standards, and promotional efforts. • Liquidity constraints at the firm level. 	<p>Naidu and Rao (1993); Wolff and Timothy (2000); Mittlstaedt, Harben and Ward (2003).</p> <p>Holtz-Eakin, Joulfaian and Rosen (1994); Blanchflower and Oswald (1998).</p>
Financial and Macroeconomic Constraints	<ul style="list-style-type: none"> • Inability to obtain financial services for export deals. • Inability to access hedging instruments or options and insurance markets. • Impact of high interest rates, as well as exchange rate fluctuations. 	<p>Fraser (2005); Irwin and Scott (2010).</p> <p>Cressy and Toivanen (2001); Tesfom and Lutz (2006).</p> <p>Doroodian (1999); Dekle and Heajin (2007); Briggs (2007).</p>
Administrative Barriers and Foreign Standards	<ul style="list-style-type: none"> • Legislative and regulatory variables and standard specifications. • High export taxes, bureaucratic documentation requirements and a multiplicity of points and authorities for export inspection and supervision. • Stringent standards in import markets and requirements for market access. • Preferential treatment and discrimination against some exporters due to Regional Trade Agreements. 	<p>Swinnen and Vandemoortele (2011);</p> <p>Crick and Czinkota (1995); Lee and Griffith (2004).</p> <p>Arteaga-Ortiz and Fernández-Ortiz (2010); Koksai and Kettaneh (2011).</p> <p>Julian (2003); Martina and Martin (2008).</p>
Domestic Institutional Constraints	<ul style="list-style-type: none"> • Absence of comprehensive databases on export procedures and regulations. • Lack of information on foreign market demands. • Poor institutional capacity to foster the organisation and networking of farmers and related export firms. 	<p>Li (2004).</p> <p>Christos et al (2008); Okpara and Kumbiadis (2008).</p> <p>Burgess and Oldenboom (1997); Hotniar et al. (2009).</p>
Lack of Human Resources	<ul style="list-style-type: none"> • Perception of exporting by managers as 'risky' due to the high transaction cost of selling abroad, and due to risks of payment default. • Lack of skilled labour and inefficient personnel for technical export operations. • Lack of commitment by local suppliers and insufficient production capabilities. 	<p>Bonaccorsi (1992); Christos, Konstadinos and George (2008).</p> <p>Javalgi et al. (2000); Mittelstaedt et al. (2003).</p> <p>Hult et al. (2003); Ibeh (2004).</p>
Physical Infrastructure	<ul style="list-style-type: none"> • Transportation costs, unavailability of equipped transportation means, internet and telecommunication availability, and inadequate storage facilities for perishable agricultural products. 	<p>Kaleka and Katsikeas (1995); Morgan (1997).</p>

Source. Authors' presentation based on the literature review.

In summary, the literature provides ample evidence as to how export barriers prevent SMFs from capturing export opportunities. With respect to Egyptian SMFs engaged in agricultural exports, it

is not clear how important these constraints appear relative to each other, so a specific objective of our survey was to identify these barriers precisely.

Survey Design and Method of Analysis

A questionnaire² was developed in order to survey the export behaviour of SMAEFs in Egypt. The sample of firms surveyed consisted of all specialist firms registered in Egypt for export of agricultural products. We focused only on those firms that definitely consider exporting to be their core activity. By not including SMFs with a focus on domestic marketing, we avoided the potentially confounding effect of heterogeneous firm strategies. Furthermore, as explained in the previous section, the institutional environment in Egypt did not allow us to conclude that large firms are more successful exporters *per se* due to economic scale effects (e.g. Rutherford 2008). Therefore, we excluded large firms from the survey so that we could measure the opportunities and constraints perceived by firms committed to exports, but not likely to be benefiting from specific institutional advantages.

Thus, our sample is defined as the 181 firms officially registered in Egypt as SMFs (with less than 50 employees) and specialist export firms, i.e. they were officially licensed as export-orientated firms and their main occupation are exports of agricultural products.

In the survey, the export managers, founders of the firms and individuals who make decisions or play a leading role regarding export decisions were asked to complete the questionnaire, as they were expected to have the experience and perspectives necessary to provide practical information about their firm's exports of agricultural commodities. The questionnaire included structured and open-ended questions as the instrument for collecting information from the respondents. Compared with our previous experience in the field, gathering data on profits, revenue, income and other related data has proved to be a very challenging endeavour in Egypt. For prevailing political and cultural reasons, the respondents tended to have doubts about the interviewer's true identity and hidden intentions, regardless of the fact that the objectives of the study were clearly explained. Therefore, questions regarding export quantities or profits from exports could only be recorded as a set of categorical variables.

The overall objective of the interviews was to obtain the following specific information: 1) Characteristics of the firms and their experience and specialisation in the export business, 2) export volumes and the main destinations of their commodities, 3) the criteria used for selecting import markets, 4) sources on which firms rely to access information on export opportunities, 5) major perceived obstacles and problems encountered in foreign import markets, 6) the support provided by the Egyptian export authorities to cope with these constraints and promote firms' export and marketing abilities, and 7) the interviewees' views on how to develop the agricultural export sector and promote an export-friendly environment for SMAEFs in Egypt.

A pre-test was conducted and the final version of the questionnaire was sent out in March 2011. The firms' representatives were first telephoned to inform them about the survey and to request

² The questionnaire is available upon request from the corresponding author.

their participation. The objectives of the study and the ethical rules were explained at this time. Upon receiving consent, the questionnaire was mailed to the appropriate individual, who was also requested to sign a consent form. Due to the low efficiency of the mail service in Egypt, some questionnaires were not successfully delivered to the firms. Some participants asked for fax copies during the telephone conversation and, upon request, the authors also delivered forms in person. After two weeks, a follow-up phone call was made. After four weeks, the questionnaires were collected in person. Of the 181 registered firms contacted, 87 firm owners and export representatives agreed to participate. The 94 non-responding firms included those downsizing or retiring and firms with which contact could not be established.

Of the 87 SMAEFs that agreed to participate, 41 did not return the questionnaire, provided incomplete answers or did not respond to all sections of the questionnaire. We have no evidence of systematic effects behind this but do not consider it unusual, given that even some of the firms that returned the questionnaire mentioned difficulties in handling export-related paperwork, so for some firms the questionnaire may just have added to the paperwork burden. However, we cannot rule out the possibility that the failure to complete the questionnaire was simply a random omission for various internal company reasons.

In total, 46 questionnaires were completed correctly and returned. Thus, our sample corresponded to approx. 25 per cent of the total population of target firms in Egypt. A common problem encountered in surveys of small business owners is the low response rate to mail surveys (Dennis 2003). In fact, our response rate can be considered satisfactory when compared with that in similar studies of smaller-sized firms. For instance, the response rate was 20.5 per cent in Fletcher (2001), 24 per cent in Pope (2002), 30% in Maria et al. (2007), and 17% in Koksall and Kettaneh (2011).

Descriptive Survey Results

Profile of the Responding Firms

Within our sample of SMAEFs in Egypt, 59 per cent of the firms had export experience exceeding 10 years, but only 13 per cent had exported for more than 20 years (Figure 1). About 41 per cent of the sample comprised firms that were relatively new to the export business, with less than 10 years in export activities.

The size distribution of firms in the sample, expressed in terms of number of employees, is summarized in Figure 2. One fifth of the firms were characterized by a relatively small number of employees (less than 20). However, almost all firms rely on other, smaller firms and agencies to which they outsource or subcontract specific services, or from where temporary workers are employed during peak export seasons. These temporary employees ended up being reported in the survey but the firms in the largest size category in Figure 2 (more than 50 employees) are still officially classed as SMFs by the Egyptian authorities (with up to 50 employees and therefore were included in our survey) because some of their workers are temporary.

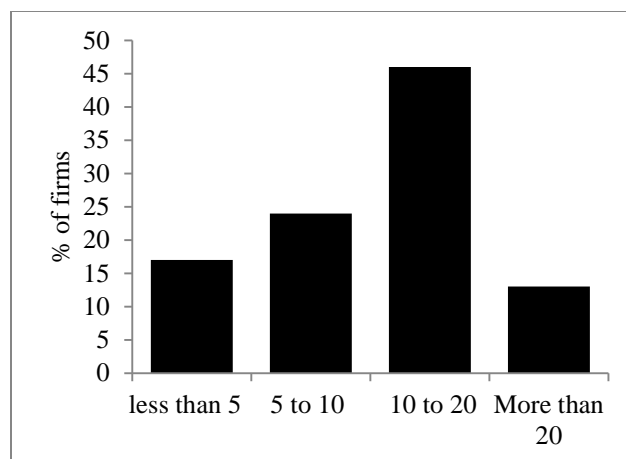


Figure 1. Firms' experience (years) in the agricultural export business.

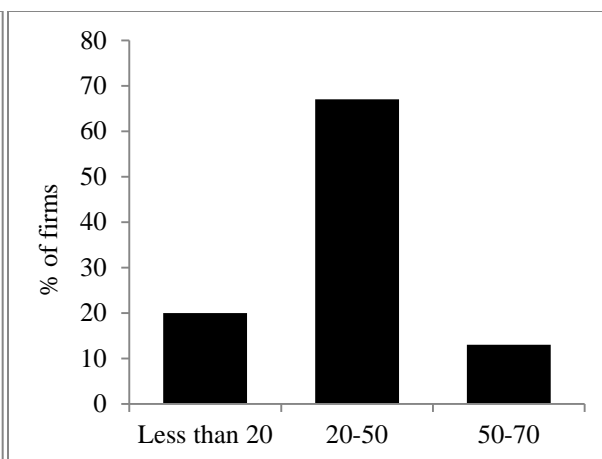


Figure 2. Number of employees in the companies according to survey results.

Structure of Exports

Around half the firms surveyed reported moderate or high export growth and gains over the previous five-year period, while the other half reported low rates of export growth and revenue from their export business (Figure 3). In terms of annual sales to foreign markets, the study failed to obtain reliable information from the respondents, who in most cases did not give an answer at all or indicated that it is difficult to provide specific values or figures on sales. In addition, the majority of respondents mentioned that their exports fluctuate to a great degree from year to year, and sometimes decline from a peak in one year to almost zero in the next. The respondents attributed this to changes in domestic agricultural production and in demand at the export destinations. Some respondents also stated that their export patterns shifted from a certain commodity to another based on the available opportunities, the export prices and the expected revenue. According to the respondents, these factors are very volatile and their agricultural exports respond accordingly to the ensuing trends. Furthermore, some exporting companies considered such information confidential, or the person who completed the questionnaire was not allowed to provide information on export values.

The agricultural products exported most frequently by the firms surveyed are shown in Figure 4. This figure shows that exports were dominated by horticultural products: 66% of the firms in the sample stated to export potatoes, followed by oranges (62%), onions (59%), green beans (55%), garlic (48%), strawberries (41%), and fresh grapes (34%). Around 31 per cent of the firms were involved in exporting rice, while only 15 per cent had experience of exporting cotton. Thus the exports of SMAEFs surveyed are mainly primary commodities, mostly exported as fresh unprocessed products.

Furthermore, our survey revealed that the Arabian market was the most popular destination for the firms surveyed, absorbing in total about half the total exports by those firms. This can be explained by the historical, cultural and economic ties between Egypt and other Arab states and their geographical proximity.

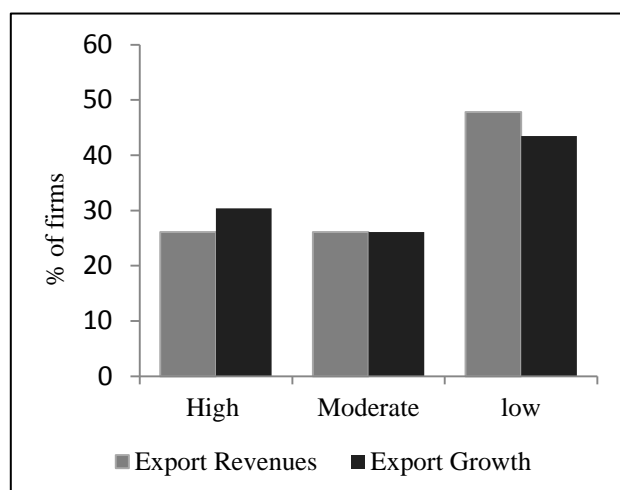


Figure 3. Firms' perceived growth & revenue from agricultural export

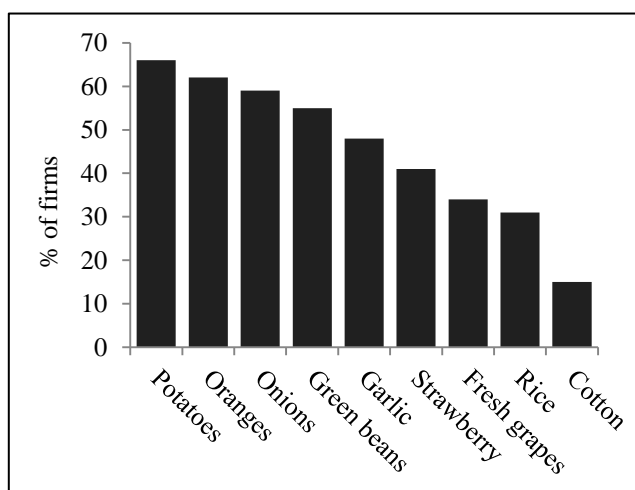


Figure 4. Major agricultural exports of the firms within the survey

European markets ranked second for agricultural exports from the firms surveyed, with about 39.4 per cent. Within this region, Italy, Greece, Spain, the UK, Germany and France are key partners. The remaining 10 per cent of exports were divided equally between the Asian and North American markets, while other regions of the world together accounted for only a minor proportion. Markets in sub-Saharan Africa played only a marginal role as regards agricultural exports by the firms surveyed. These results indicate a notable degree of concentration on rather few markets.

Factors Influencing SMAEFs' Selection of Export Destinations

The criteria on which firms in the survey rely when selecting their foreign target markets are shown in Figure 5. Survey respondents were asked to rank the seven criteria "profitability", "size of the destination market", "previous experience of that market", "level of quality standards", "geographical location", "political stability" and "existence of Regional Trade Agreements (RTAs)" according to their perceived importance.

The relative frequency (vertical axis in Figure 5) of the ratings given by the respondents to each of the seven criteria indicated that: About 35 per cent of respondents ranked profitability measures as the most important criterion when selecting an export market, 30 per cent ranked it as the second most important and 10 per cent as the third most important criterion.

Thus, for 75 per cent of respondents in the sample, profitability measures were one of the three most important criteria for selecting an export market.

These results are in line with El-Miniawy and Gouell (1994), who showed that Egyptian exporters seem to focus mainly on profit maximisation and pay less attention to maintaining their position and the stability of their products on the import markets.

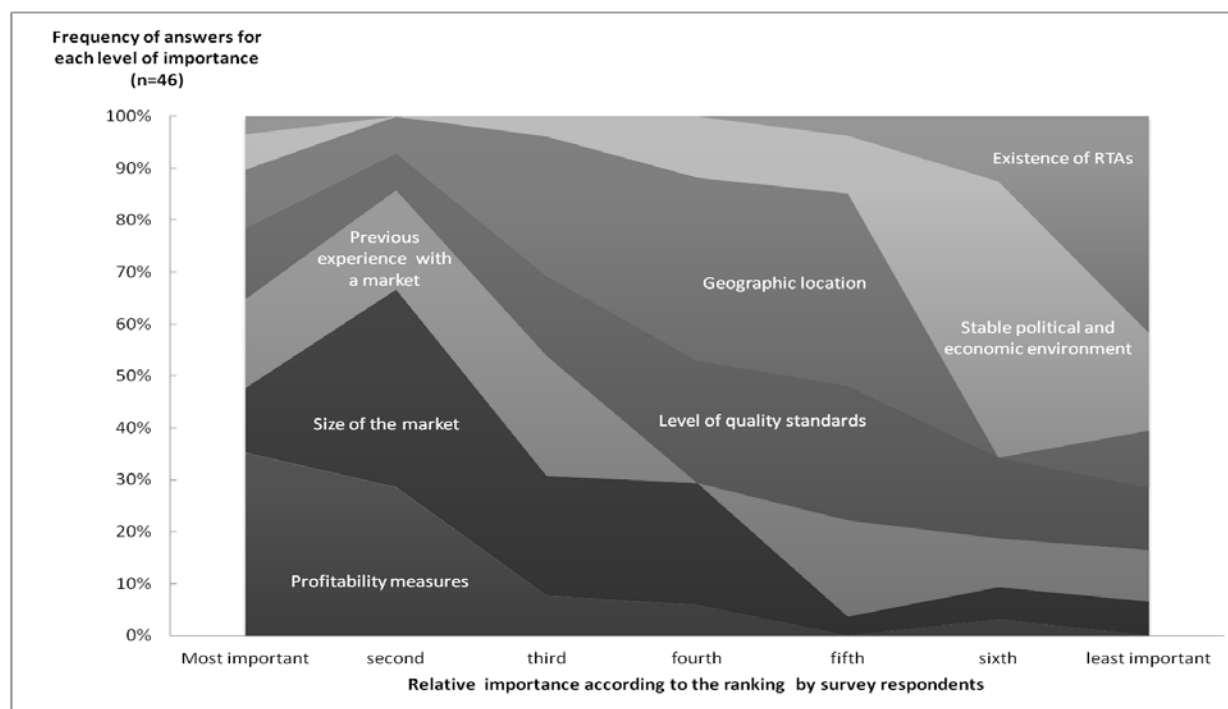


Figure 5. Factors influencing the selection of export destination markets, according to the respondents.

Size of the import market (having a well-established market and a large population familiar with Egyptian agricultural products) was the next most important criterion. Previous experience of the import market came third but with a much more even distribution, indicating that this criterion is only important to some exporters. The relatively high ranking given to this criterion by some firms is explained by the geographical distribution of Egyptian agricultural exports, as prolonged experience among Egyptian exporters of the Arabian market (as a result of cultural and historical ties) and the European market (as a result of past colonial ties and strong political and economic relations) have led to concentration of Egypt's agricultural exports in these two regions (Abu Hatab 2011).

Geographical location, as a proxy for transportation costs, was a criterion of secondary importance. It was certainly relevant, but not as frequently mentioned among the top three as the criteria listed above. The level of quality standards was most important for some firms, but of moderate importance for most. Finally, economic and political stability and the existence of an RTA between Egypt and the importing country were identified as rather less important by almost all respondents (Figure 5).

Major Sources of Information about the Export Opportunities in the Foreign Markets

The sources of information that the surveyed firms rely on to learn about export opportunities in foreign markets are listed in Table 2. Surprisingly, no firm mentioned the role of the Egyptian Commercial Services (commercial offices as part of Egyptian embassies abroad) and the Export Development Centre in this respect. One firm's representative indicated that the government

used to provide promotional and export assistance schemes in the past, but that these efforts had recently declined. According to statements by survey respondents, these programmes have been ineffective overall with respect to the promotion of exports. However, many companies believe that the help of export authorities is important, especially during the first steps into the export business.

As Table 2 suggests, the firms surveyed rely heavily on their individual capabilities and past experiences, as well as on announcements by importers about actual demand (62.1 per cent). Participation in fairs and exhibitions also seemed to be important (48.3 per cent) as were trade visits (44.8 per cent). Export associations also provide exporters with important information about the demand on foreign markets, with more than half the firms investigated citing UPEHC as a source of information.

Table 2. Sources of information about the export opportunities on foreign markets, according to respondents

Sources of Information	% of Firms
Announcements and calls by importers	62.1
Participation in fairs and exhibitions	48.3
Union of Producers and Exporters of Horticultural Crops (UPEHC)	55.2
Business trips and visits	44.8
Foreign trade points	37.9
Internet (e-commerce)	17.2
General Organisation for International Exhibitions and Fairs	6.9
Egyptian Commercial Services	0
Export Development Centre	0
Supreme Council for Export	0
Other government agencies	0

Source: Own presentation based on survey results.

Modern means of trade and e-commerce do not seem to be recognized or adopted by Egyptian agricultural exporters, while only 17.2 per cent of the firms employed the internet in seeking export opportunities for their agricultural commodities.

Perceived Obstacles and Constraints to Agricultural Exports

A total of 54 potential export constraints were presented to respondents as part of the survey³. Their responses to these 54 potential constraints were then grouped into the categories portrayed in Figure 6; these categories had been developed based on the literature review (compare Table 1). The vertical axis in Figure 6 displays the frequency with which the individual problems in each category were mentioned by the respondents, as a proportion of the sum of all problems mentioned. Perceived constraints are summarized below under the corresponding groupings:

³ A complete list is available from the authors upon request.

i) Perceived Competition within International Export Markets

Most respondents agreed that the international market for agricultural products is highly competitive and that Egypt's agricultural commodities face strong competition, especially from Middle Eastern and North Africa exporters. They also believe that in order to cope with this competition, products have to be introduced at lower prices and better quality, and Egyptian agricultural products often lack both. Moreover, 62 per cent believed there was preferential treatment for other competitors in the importing markets, due to the existence of regional trade agreements. Accordingly, 79 per cent of the firms considered lack of competitive prices in comparison to competitors as the greatest challenge to access foreign markets. Better packaging and labelling by other competitors was also perceived as an important barrier to exports, with 76 per cent of the firms agreeing that packaging and labels perform an important role in international marketing communications. The firms surveyed mentioned two main challenges they face when dealing with the domestic agricultural sector. The first is inefficient production capabilities (mentioned by 62 per cent), reflecting existing agricultural production techniques and the importance of modernisation of agricultural systems in order to increase production and improve productivity. The second issue is the lack of commitment by local suppliers to their obligations to deliver the contracted quantities (mentioned by 59 per cent), which was explained by instability in agricultural production and the growing domestic demand.

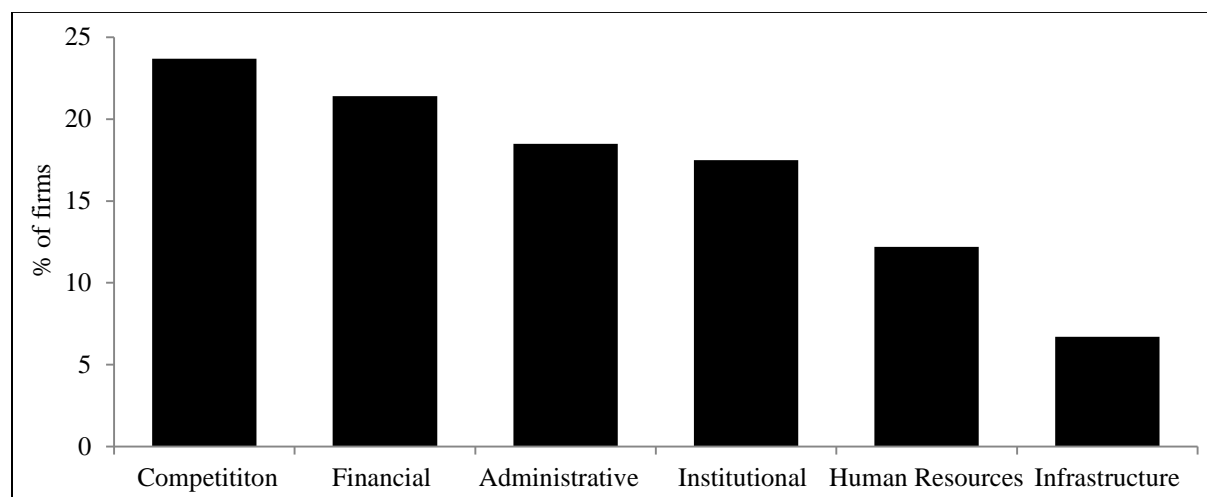


Figure 6. Relative perceived importance of the main categories of export barriers, according to the respondents.

ii) Perceived Financial Constraints

The SMAEFs in the sample operated with relatively small amounts of liquidity, which made it difficult for them to fund unexpected costs of exportation, e.g. fines for breaking export rules (this is very common due to information scarcity or lack of consultation) and exchange rate disparities. Specifically, 85 per cent of firms indicated that the difficulty in expanding their export business is due to a lack of capital, whereas 81 per cent of companies blamed the high cost of access to credit and export loans and the unwillingness of banks to serve SMFs. These financial problems were compounded by perceived inefficient performance of banks and other

loan-giving institutions, with 79 per cent of the firms surveyed referring to the inability of local banks to cope with international business and 84 per cent describing export credit schemes as poorly operated or underfunded. In all, 69 per cent of the sample firms perceived exporting as appealing, but also a high-risk activity compared with domestic sales, whereas 74 per cent had concerns about customers defaulting on payment when selling abroad.

iii) Administrative Barriers and Foreign Standards

Apparently confusing regulations and import procedures in the target market were viewed by 59 per cent of the respondents as a major barrier. These included unnecessary export documentation requirements (mentioned by 77 per cent), the enforcement of high export taxes (82 per cent), the inefficient export risk guarantee schemes (74 per cent), and the lack of attractive export incentives and subsidy programmes (78 per cent). Furthermore, 86 per cent of firms agreed that the involvement of many different ministries and the multiplicity of export inspection and supervision authorities represented a fundamental obstacle to agricultural exports from Egypt. The departments involved have often failed to harmonize their actions with stakeholders and exporting firms, which has created contradictions. For instance, some outdated export laws and regulations are not in accordance with current domestic and international practice (according to 65 per cent of respondents). Restrictive standards within the import markets, especially in the EU, along with high import tariffs and Egyptian export fees were considered to be problematic by 66 and 52 per cent of the respondents, respectively.

iv) Institutional Constraints

The survey responses reflected firms' unfamiliarity with export assistance schemes introduced by government institutions (69 per cent of respondents). Export expansion and training services seem to be ineffective or unrecognized by exporters, as 59 per cent of the SMAEFs surveyed lacked familiarity in legal matters related to export procedures and regulations. For the majority of exporters (82 per cent), the absence of a comprehensive database on export procedures and regulations is an essential barrier to expanding their business, while 65 per cent indicated a lack of knowledge regarding demands by foreign markets. Poor institutional capacity to foster the organisation of farmers and exporters and corruption and red tape in export authorities were mentioned as critical barriers by more than 70 per cent of the firms investigated.

v) Human Resources Constraints: Know-how, Commitment and Information Management

Human resources seem to be another major constraint on agricultural exports in Egypt, with 72 per cent of firms mentioning lack of skilled labour for export, technical activities and, more specifically, post-harvest operations. More than two-thirds of the firms investigated stressed the difficulty in finding trained personnel to manage international trade activities.

vi) Physical Infrastructure

Inadequate storage space and lack of refrigerated areas for perishable goods were perceived as important problems by 68 per cent of the agricultural exporters who completed the survey.

Moreover, high transportation and shipping costs and the unavailability of equipped transportation were mentioned as major infrastructural barriers.

Determinants of Export Growth and Profitability

Descriptive analysis of the survey results showed the absolute and relative importance of export constraints as perceived by SMAEFs in Egypt. The results obtained are broadly in line with the literature on SMF export performance in developing countries in general. We now turn to the analysis of perceived opportunities from exporting, as stated by the respondents to our survey. Rather than asking hypothetical questions about the future, we assumed that the stated level of each firm's export growth and export profitability during the past five years gave an indication of the relative magnitude and direction of opportunities from exporting.

Table 3. Descriptive Statistics on the Dependent Variables

Dependent Variable	Mean	STD	Max.	Min.	Mode
Export growth over the last five years	2.833	1.239	5	1	3
Profits from export activity	2.741	1.206	5	1	2

Source. Authors' own calculations.

Each dependent variable was measured according to a five-point Likert scale (Table 3). In this part of the empirical analysis, we examined how the previously discussed constraints to exports affected the stated level of these dependent variables.

Given the confidentiality that the firms assigned to information about economic performance (see description of survey design), the five-point Likert scale can be viewed as an approximation of the 'true' underlying, yet unobservable, continuous distribution of these variables. Therefore, our method of analysis had to account for the fact that the 'true' value of each of the two dependent variables remained unobserved, but was approximated through the observed categorical responses on the Likert scale. Hence, we employed an ordered probit model and used the previously discussed constraints as sets of explanatory variables. Using an ordered probit model (along with ordered logit models) is a well-established estimation approach if the dependent variable y is discrete while the order of discrete categories has a meaningful interpretation such as "increasing order of answers" or, in our case, Likert categories 1 to 5 implying subsequently higher levels of recent export growth or profits from exports.

Our regression model thus took the general form, with x representing explanatory variables, β the corresponding estimated coefficients and ε a stochastic error term: $y^* = x'\beta + \varepsilon$. However, the variable y_i^* represents only the 'true' level of profit from exports and export growth as could be found e.g. in each firm's accounts, while owing to the confidentiality issue this information unfortunately remained unobservable for the $i=1, \dots, n$ observations. Instead, our observed counterpart of y_i^* was a corresponding discrete variable, y_i , which is based on the Likert-scale answers.

In general, the ordered probit model applies to surveys in which the dependent variable represents an ordinal ranking (as in our case: $y = \text{Likert category 1} < y = \text{Likert category 2}$), while

the multinomial probit does not restrict the discrete outcomes to be ordered (e.g. $y = \text{“wheat”}$ versus $y = \text{“maize”}$, etc. would be sufficient for a multi-nominal but not for an ordered approach). The ordered probit model can thus be viewed as a more restrictive multinomial model that better exploits the information contained in an ordered categorical dependent variable than the conventional multi-nominal model would do. Ordered probit models can either be estimated based on Maximum Likelihood, as used here, or through Bayesian methods. The probabilities, which enter the log likelihood function, can be stated as follows (Greene and Hensher 2008):

$$P(y_i=j) = P(y_i^* \text{ falls within the } j^{\text{th}} \text{ category of } y_i)$$

The ordered probit approach estimates the empirical effect of each explanatory variable on the probability of a firm's export growth (or profit) falling into one of the observed $j=1, \dots, 5$ (Likert) categories of the observed dependent variable y (which is used as an approximation of the unobserved 'true' y^*). A disadvantage of the ordered probit approach is that marginal effects on y of a 1-unit change in x are not directly given by the estimated coefficients. Therefore, neither the sign nor the magnitude of the estimated β receives a direct interpretation. Instead, marginal (also known as “partial”) effects have to be calculated separately for each of the j categories (Greene and Hensher, 2008) according to the first-order partial derivatives:

$$\frac{\partial P(y_i=j/x)}{\partial x}$$

Tables 4a and Table 5a present the estimates from our ordered probit models after elimination of non-significant variables; all these explanatory variables have been formed based on answers to questions in our survey. The corresponding calculated marginal effects are presented in Tables 4b and 5b. These marginal effects state that a 1-unit change in each explanatory variable will determine the change in the probability of the unobserved y_i^* falling within any of the j categories of each of the two dependent variables y . In our case, $j=1, \dots, 5$ represented the five categories of the Likert scale used in the questionnaire (first row of Tables 4b and 5b). Furthermore, the estimated cut-off points (μ) and the intercept represented the four estimated breaks of the 'true' but unobserved variables y_i^* between the five categories. Intuitively, these cut-off points can be viewed as an empirical indication of the extent to which the Likert scale failed to reflect existing but unobserved clusters in the underlying variable y_i^* . However, according to Greene and Hensher (2008, section 5.5.3), the estimated cut-off points in ordered probit models should not be interpreted too strictly.

All three model selection criteria (last row of Tables 4a and 5a) indicated that “Profits from exports” were slightly better explained by the explanatory variables than “Export growth over the last five years”. However, our focus was not primarily on explaining all variability in the dependent variables, but rather on identification of those explanatory variables that had a statistically different from zero effect on each respective y . Given the difficulties in data collection we experienced and the likely presence of heterogeneity in the data for which we were unable to control, we considered McFadden Pseudo R-squared values of 0.39 and 0.33 as rather satisfactory fits of the ordered probit models to our data.

Table 4a. Ordered Probit Model y ="Profits from export activities"

	Coeff.	Std. error	b/St.Er 	P[Z >z] 	Mean (x)
Constant	8.086	2.484	3.255	0.0011	
Lack of attractive export incentives and subsidy schemes	-0.257	0.136	-1.880	0.0600	3.847
Risk of default on payment	0.252	0.178	1.412	0.1581	3.913
Difficulty in handling export documentation	-0.330	0.194	-1.700	0.0891	3.782
Absence of comprehensive database on export procedures/regulations	-0.325	0.147	-2.201	0.0277	3.543
Insufficient service from trades union and export associations	-0.366	0.175	-2.085	0.0371	3.717
Unwillingness of banks to serve SMFs	-0.649	0.229	-2.832	0.0046	4.043
Differences in product specifications on foreign markets	-0.324	0.170	-1.910	0.0561	3.652
Stringent standards & requirements for access to import markets	-0.269	0.159	-1.688	0.0914	3.826
Years involved in export activity	1.042	0.238	4.372	0.0000	2.543
$\mu(1)$	1.811	0.297	6.083	0.0000	
$\mu(2)$	3.454	0.314	10.98	0.0000	
$\mu(3)$	4.855	0.452	10.71	0.0000	

Finite Sample AIC: 2.680; Restricted log likelihood: -70.38; McFadden Pseudo R-squared: 0.39

Table 4b. Marginal effects (dy/dx) in each category of y ="Profits from export activities"

Likert category j from the answering scale:	1 (low)	2	3	4	5 (high)
Lack of attractive export incentives and subsidy schemes	0.010	0.086	-0.054	-0.040	-0.002
Risk of default on payment	-0.010	-0.085	0.053	0.039	0.002
Difficulty in handling export documentation	0.013	0.111	-0.070	-0.051	-0.003
Absence of comprehensive database on export procedures/ regulations	0.013	0.109	-0.069	-0.050	-0.003
Insufficient service from trades union and export associations	0.015	0.123	-0.078	-0.057	-0.003
Unwillingness of banks to serve SMFs	0.026	0.219	-0.138	-0.101	-0.006
Differences in product specifications on foreign markets	0.013	0.109	-0.069	-0.050	-0.003
Stringent standards and requirements for access to import markets	0.011	0.091	-0.057	-0.042	-0.002
Years involved in export activity	-0.042	-0.352	0.222	0.163	0.010

Source. Own calculations based on the ordered probit model results.

The results showed that in case of the dependent variable "Profits from export activities" (ordered model in Table 4a), almost all explanatory variables were statistically significant at the 90% level or better. Regarding the dependent variable "Export growth over the past five years", an only slightly different set of explanatory variables was identified as having most explanatory power, and all these variables were statistically significant at the 95% level or better.

Concerning the "Profits from export activities" (Table 4a), the estimated cut-off points μ and the intercept were all statistically significant and showed that y takes the Likert category 1 ($y_{i,j=1}$) if $0 < y_i^* \leq 1.811$ (consequently for all y_{ij}). Interestingly, the estimated intercept indicated that the highest category $y_{i,j=5}$ corresponded to an estimated 'true' $y_i^* > 8.086$. Thus, the underlying distribution of y^* was estimated to spread over a much wider range than the five-point Likert scale that respondents were allowed to use.

Calculated marginal effects based on the estimated coefficients in Table 4b should be interpreted as follows: a 1-unit change in "Lack of attractive export incentives and subsidy schemes" increased the probability of being in category $y_{i,j=1}$ (which corresponds to a low stated level of profits from exports) by 1.06%, while the perceived lack of attractive export incentives increased the probability of a firm being within the category of only moderately low export profits ($y_{i,j=2}$)

by 8.6%. Consequently, a lack of attractive export incentives lowered the probability of being in the category of firms with medium or high profits from exports. In this context, the number of years that a firm had already engaged in export activities significantly increased the probability of performing either at medium or moderate export profitability. However, changes in this variable did not seem to substantially affect the probability of being among the firms with the highest profits from exports (marginal effect only 0.01 for $y_{i,j=5}$).

Table 5a. Ordered Probit Model y ="Export growth over last five years"

	Coeff.	Std. Error	b/St.Er.	P[Z >z]	Mean
Constant	11.516	1.488	7.737	0.0000	
Inefficient export risk guarantee programmes	-0.694	0.195	-3.558	0.0004	2.957
Lack of commitment by local suppliers of produce	-0.337	0.149	-2.254	0.0242	2.022
Lack of familiarity of legal matters and export payment terms	-0.512	0.148	-3.453	0.0006	2.543
Absence of comprehensive database on export procedures/regulations	-0.301	0.134	-2.242	0.0249	2.543
Insufficient service from trades union and export associations	-0.400	0.174	-2.302	0.0213	2.717
Unwillingness of banks to serve SMFs	-0.565	0.209	-2.706	0.0068	3.043
Differences in product specifications on foreign markets	-0.429	0.166	-2.588	0.0097	2.652
Stringent standards and requirements on access to import markets	-0.308	0.159	-1.927	0.0539	2.826
$\mu(1)$	1.410	0.260	5.413	0.0000	
$\mu(2)$	2.827	0.275	10.274	0.0000	
$\mu(3)$	3.970	0.386	10.288	0.0000	

Finite Sample AIC:2.81061; Restricted log likelihood: -71.4355; McFadden Pseudo R-squared: 0.33

Table 5b. Marginal effects (dy/dx) in each category of y ="Export growth over last five years"

Likert category j from the answering scale:	1 (low)	2	3	4	5 (high)
Inefficient export risk guarantee programmes	0.047	0.201	-0.069	-0.147	-0.032
Lack of commitment by local suppliers of produce	0.023	0.098	-0.034	-0.071	-0.015
Lack of familiarity in legal matters and export payment terms	0.034	0.148	-0.051	-0.108	-0.023
Absence of comprehensive database on export procedures/regulations	0.020	0.087	-0.030	-0.064	-0.014
Insufficient service from trades union and export associations	0.027	0.116	-0.040	-0.085	-0.018
Unwillingness of banks to serve SMFs	0.038	0.163	-0.056	-0.119	-0.026
Differences in product specifications on foreign markets	0.029	0.124	-0.043	-0.091	-0.020
Stringent standards and requirements for access to import markets	0.021	0.089	-0.031	-0.065	-0.014

Source. Own calculations based on the ordered probit model results.

As regards the risk of default payment, we observed the opposite. Clearly, firms that export more should experience a higher default payment risk and therefore, the probability change to be within the category of high export profits was positive. Furthermore, if the risk of default payment is perceived to be higher, the exporting firm most likely experiences a medium level of export profits. This finding can be an indication that some firms certainly engage in export activities but, due to this risk, do not make use of the full market potential that is available to them. Alternatively, this group of firms may have trading partners with low financial reliability and, *ceteris paribus*, export profits are lower as well. Interestingly, all further determinants of

profits from exports basically determined the placement of the firms into two groups⁴: On the one hand, firms with rather low (Likert category 1 or 2) profits from exports were most likely to have difficulties in handling export regulations and the related paperwork. Moreover, those firms that lack sufficient access to the related information databases often have difficulties in coping with product standards and quality restrictions in foreign markets, and do not enjoy sufficient access to capital through local banks. On the other hand, all firms with medium or high export profitability apparently are more likely to cope with these challenges, as indicated by the negative signs that we found on these marginal effects (= negative effect on the probability to have stated answers in the highest categories).

Table 5a shows explanatory factors that determine the extent to which exports had grown during the past five years, as perceived by the person who completed the questionnaire. Again, precise interpretation of the significant constant and cut-off points is not recommended (Greene and Hensher 2008, section 5.5.3). The calculated marginal effects (Table 5b) based on the estimated probabilities and cut-off points from the ordered probit model in Table 5a revealed that firms could basically be distinguished into two categories: 1) The probability of having experienced low or limited export growth in the past was more likely if the respondent agreed with the corresponding explanatory variables (positive sign on the marginal effects for categories $y_{i,j=1}$ and $y_{i,j=2}$, respectively). 2) Respondents whose firms experienced moderate or strong export growth in the past were much more likely to either cope with the set of explanatory variables, or for unobserved reasons, did not seem to be constrained by them.

It is noteworthy that (in contrast to “Profits from export activities”) the lack of commitment by local agricultural product suppliers turned out to be a distinct determinant of export growth in the past years. While this was apparently less important as a determinant for total profitability of exports, the option to source agricultural goods from suppliers with some commitment towards exporting had been a crucial determinant for recent growth.

Discussion

The aim of this study was to investigate whether and to what extent a sample of specialist small- and medium-sized agricultural export firms (SMAEFs) in Egypt feel ready to capture export opportunities, and the barriers they perceive when doing so.

Our results confirm previous findings by Ghoneim (2000) that SMF exporters in Egypt mainly depend on personal contacts and international trade exhibitions. The SMFs in our sample largely relied on traditional and informal ways of establishing export contacts and when acquiring related market information. Furthermore, the low awareness among our survey respondents about the existence and role of the recently created RTAs points to the lack of knowledge among agricultural exporters about the export opportunities that these agreements may provide. It also indicates that there is potential miscommunication between the government agencies which signed these agreements and the exporters who are intended to benefit from them. However, our

⁴ Note that similar conclusions would likely have been reached through e.g. a Principal Components Analysis. However, the sensitivity of such methods to small sample sizes constitutes an additional reason why we used the ordered probit approach.

survey also revealed that the institutional environment is not the only source of perceived barriers among small agricultural exporters in Egypt. Perceived barriers with respect to competition on foreign markets indicate several structural weaknesses among the agribusiness and the export-orientated SMAEFs in Egypt. These weaknesses can be summarized as: i) a limited ability to match quality criteria in foreign markets, ii) limited diversification of export destinations and therefore potential economic vulnerability to demand, price or exchange rate fluctuations, iii) lack of qualified personnel that can deal with new export opportunities, and iv) the failure of Egyptian growers to produce exportable quantities of the desired quality. In addition, v) most firms included in our survey seem to be relying on outdated communication techniques.

These results call for networking among Egyptian agricultural research institutions and among agricultural advisory services and farmers' associations to improve and support domestic vertical chain integration and to extend export-relevant information to agricultural producers and not only to export firms. Furthermore, some of our findings about perceived barriers still confirm findings reported in earlier studies: Inadequate post-harvest services, including poor packaging, were among the problems identified already about fifteen years ago by a World Bank (1995) study. In addition, failure to achieve the required high standards for products and to keep track of consumer needs was identified as impeding the ability of Egyptian exporters to enter foreign markets (World Bank, 1995). Siam (2002) pointed out the problem of Egyptian agricultural exports being concentrated in very few destination markets. This creates vulnerability to changes in demand for Egyptian agricultural exports and also leaves exporters vulnerable in the case of rapid changes in the political or economic situations of their key importing markets (Abu Hatab et al. 2010). Dogruel and Tekce (2010) investigated the export diversification in Egypt and selected MENA countries and concluded that a continuing focus on exporting primary agricultural products would lead to deteriorating terms of trade, rising income volatility and decreasing growth rates. Thus, our findings support these arguments that call for a diversification of export destinations.

The results from our ordered probit models suggest that the firms included in our sample will most likely be able to increase their profits from exports in the future if they are able to overcome the constraints described in the analysis and to handle the quality restrictions placed e.g. by the EU food quality and safety standards. A possible limitation of our study is that we did not include large exporting firms in the dataset and empirically test for differences regarding perceived export opportunities and constraints.

Based on our results, we concluded that small- and medium-sized agricultural export firms in Egypt could better utilize existing access to foreign markets. The creation of a comprehensive database on export procedures and regulations has in this context repeatedly been mentioned by our respondents and turned out in our ordered probit models to be a significant explanatory variable of export performance. Increased efficiency of agricultural exporters and producers could in turn improve and maintain Egypt's long-term position on global agricultural markets and perhaps directly contribute to poverty alleviation in rural areas where a large proportion of the workforce is employed in agriculture.

Conclusions

There is ample evidence that small- and medium-sized agricultural export firms could play an important role for Egypt's agricultural exports. The sample of specialist SMF agricultural exporters surveyed here reported barriers to exports that have partly already been present for years, if not decades. Yet, the firms surveyed that are successfully dealing with these barriers and could potentially be successful agricultural exporters in the future report an additional problem of a domestic agricultural supply sector that is partly incapable of complying with foreign quality standards at competitive prices. Therefore, one option for small and medium-sized agricultural export firms in Egypt would be to develop closer links and collaborations with farms and firms that supply them with export-quality agricultural products. An important component of such collaborations would be for the exporters to collect available digital information about prices and quality regulations in foreign markets more efficiently, and to share this information with producers.

Acknowledgements

We are grateful to Editors, Nicola Shadbolt, Peter Goldsmith and two anonymous referees for their comments and suggestions. In addition, we would like to thank Mary McAfee for editing our manuscript.

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International Food and Agribusiness Management Review
Volume 16, Special Issue 4, 2013

The Evaluation of Brazilian Beef in Europe: Consumers, Importers and Exporters' Perspectives

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Abstract

This research analyzes the Brazilian beef image in Europe from three different perspectives: consumers, importers and exporters by means of quantitative and qualitative methods. The main hypothesis tested whether consumer perceptions concerning the quality of Brazilian beef in Europe is dependent on the country's image. It was found that the image of Brazilian beef is considered positive overseas, but it would benefit from greater advertising in Europe and improved outlet infrastructure. Therefore, one important action to be taken in order to improve the Brazilian beef image overseas concerns communication and logistic strategies.

Keywords: country image, country of origin effect, European market, Brazilian beef.

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Introduction

Agricultural trade liberalization is a priority for the Brazilian government and private sector, whether on a multilateral, regional or bilateral basis. Investments in research and development made since 1970 and the deregulation of the agricultural markets in the beginning of the 1990's awakened the competitiveness of the Brazilian agribusiness, diversifying and increasing its presence in the international market. The increase in the commodities produced in Brazil and other developing countries now depends on a greater opening of international market and less subsidies to agriculture (Jank 2011).

The economic globalization has enabled consumers to have access to a large number of products made in different parts of the world and countries have been increasingly facing an international competitiveness regarding their food products. Some companies have decided to use their product's country of origin as a differentiation strategy (Skaggs et al. 1996). For example, Switzerland has great experience with cheese and chocolate productions and this fact ends up influencing the opinion of foreign consumers about other Swiss products as a whole.

The world's new dynamics have affected production chains of agriculture and livestock. A great movement proposed by civil society institutions and international organizations, such as United Nations, have started to discuss in the last three decades the environmental and social impacts of development, and have also proposed to society ways to mitigate these impacts. Cultural interchanges, improved transportation and communication, higher income levels, increased number of women in the labor market are all factors that have influenced consumers to become more concerned about the environmental and social consequences of consuming a product, specially products from agriculture and livestock, including animal sanitation issues, and slaughtering procedures (Barcellos et al. 2009).

Considering the influence of country image on products evaluation, several studies on the subject have been conducted since the 1960's. In general, they point to the idea that consumers have very distinct but "generalized" perceptions of products from other countries. These perceptions of a country (or country image) have a significant effect on the consumer attitudes regarding brands of products made in certain countries (Balabanis et al. 2002; Han 1989). Several authors call this phenomenon "country-of-origin effect" (Han 1989; Jaffe and Nebenzhal 2001; Martin and Eroglu 1993; Pappu et al. 2007). For some authors, the image of a country can be influenced by exogenous factors such as economic development level, national identity, its people, political scenario as well as cultural environment and personal values (Balabanis et al. 2002; Jaffe and Nebenzhal 2001).

This study has sought to identify the influence of Brazil's image on the Brazilian beef trade in the European market, in a holistic research based on the views of consumers, European importers and Brazilian exporters. By means of a survey involving respondents living in England, Ireland, France and Germany, it was possible to identify how they evaluate the image of Brazil and which attitudes they have towards the Brazilian beef, thus enabling the identification of how the country image can influence the consumption of such a product. This influence was statistically evaluated, by employing the multiple regression technique, which had the attitude towards Brazilian beef as the dependent variable and some dimensions of Brazil's image as independent

variables. Furthermore, it was also identified how Brazil image has been affecting the trading of this product, according to importers and exporters.

Considering the theory of the country of origin effect, the main hypothesis to be tested in this research is “Consumers’ perception about the quality of Brazilian beef in Europe is dependent on the country image”. In order to check this hypothesis, the answers to the following questions are pursuit: (1) How important is the country of origin image in selling beef? (2) How good is the image of Brazil in Europe? (3) What is the image of Brazilian beef among European consumers? The Brazilian beef was selected as the product in analysis because Brazil has assumed, since the last decade, the first position in the ranking of global beef exporters. Brazil has the largest cattle herd on the planet (200 million heads) and one of the lowest production costs in the world, which brings great competitive advantage. Beef cattle represents the largest share of the Brazilian agribusiness, yielding R\$ 50 billion yearly and employing approximately 7.5 million people (The Brazilian Association of Beef Exporter Industries - ABIEC, 2010). Only behind U.S.A., Brazil is the world’s second producer and the world’s first beef exporter and it has become one of the major players in the international market of beef. The main importers of Brazilian beef is Russia (228.822 tons/ US\$ 1.013.691), European Union (approximately 100.000 tons / US\$ 478.800), North of Africa, specially Egypt (approximately 100.000 tons/ US\$ 413.586), Hong Kong (approximately 200.000 tons/ US\$ 701.000) and Iran (130.649/ US\$ 688.804).

The results of this study will support not only the Brazil’s beef exporter sector, but also the Brazilian exporters in general and those using marketing strategies involving the country of origin. This work was aimed to identify ways to strengthen the Brazil’s image, as well as the Brazilian brands overseas, mainly in the European market – the second largest consumer of Brazilian beef in the world, with a total consumption of 8,249 million tons (carcass equivalent) in 2010. The USA is the first consumer of Brazilian beef despite importing only industrialized meat rather than in natura (ABIEC 2010). Table 1 lists countries of the European Union that import Brazilian bovine meat.

Considering that there are a few Brazilian studies assessing the image of Brazil overseas, one can also highlight the innovative aspect of the present work, in which the effect of country image on the trade of a specific Brazilian product in other countries is demonstrated.

Table 1. EU member countries that import Brazilian beef

Country	2010 US\$ (000)	2010 Ton	2009 US\$ (000)	2009 Ton	2008 US\$(000)	2008 Ton
UK	168,178	44,377	168,163	48,009	220,785	56,023
Italy	189,180	29,693	157,010	26,917	145,712	23,565
The Netherlands	130,225	16,539	129,002	19,718	169,848	27,613
Germany	61,414	8,800	51,005	8,736	53,268	8,245
Spain	28,021	4,846	23,242	5,248	18,020	4,160
Sweden	25,212	3,795	17,539	3,499	24,035	3,952
Belgium	17,334	4,133	16,039	4,017	19,117	3,678
France	16,301	3,520	17,216	4,150	16,628	3,619
Portugal	7,706	1,244	5,477	1,094	7,172	1,392
Ireland	4,808	911	10,782	2,108	9,477	1,635

Source. ABIEC (2010)

Country of Origin Effect

The first empirical test of the country-of-origin effect on acceptance and success of a product was conducted by Schooler (1965). The author found significant differences in product evaluations, which were identical in terms of attributes except for the country shown on the “made-in” label. Nagashima (1970) was the first author to define the concept of country image in terms of origin of products, that is, as being the representation, reputation, stereotype businessmen and consumers give to the products of a country.

Two traditional models have been used to explain how countries stereotypes affect the consumer behavior. On the one hand, country image can serve as a halo by which consumers can assess the quality of an unknown foreign product. On the other hand, consumers do not mind about the country of origin when they are familiarized with the product (Ahmed and D’Astous 1996; Han 1989). In the model establishing country image as a summary construct, well-known brands or more affordable prices can minimize the impact on the attitude of consumers that purchase products made in countries whose image is negative or even inexistent (Han 1989).

Studies on the country-of-origin effect are based on the notion that individuals have stereotyped perception of other people and countries and that country image has a significant impact on the judgment of the quality of the products and consumer attitude towards them. The relevance of this theme is demonstrated by Usunier (2006), who reported that about 1,000 studies on country-of-origin effect have been conducted in the last years, with 400 being published in major academic journals. The huge scientific production indicates that the origin of the product acts like a sign of quality, thus affecting the consumer’s purchase intentions (Han 1989; Roth and Diamantopoulos 2009).

Studies performed by Balabanis et al. (2002), Papadopoulos and Heslop (2002), Orbaiz and Papadopoulos (2003) and Verlegh et al. (2005) showed that consumers evaluate identical products differently regarding all aspects, except the country of origin. Such results suggest that product evaluation (quality, value, production etc.) is strongly affected by the knowledge of the country of origin. Therefore, the positive image of a country can influence the consumers’ evaluation of the products as well as their purchase intention. Other studies have reported that people also evaluate brands depending on their country of origin and on what this country internationally represents (Lin and Kao 2004; Samiee et al. 2005).

By analyzing the research on country image and its relevance in a period in which global brands are already consolidated (i.e. since the 2000’s), Pharr (2005) reports that one conclusion is unequivocally drawn: origin of the product continues to influence the consumer’s evaluation about the product. Hsieh et al., (2004) also believe that companies acting in several markets should identify the national characteristics which can affect the success of strategies related to the image of their brand or product. In this sense, by knowing the influence of the country image on one or more products, the managers of private institutions, like the export companies, may or may not use the country of origin emphatically as a communication strategy. They can also alter the product price to increase competitiveness and minimize the negative effects of the country’s bad image among the consumers (Han 1989; Jaffe and Nebenzhal 2001).

Some categories of products are intrinsically identified with some countries. For example, French perfumes, English porcelains, Germany machines and Italian fashion. Another example illustrating how some products are intrinsically identified with certain countries was reported by Davidson et al. (2003). The authors demonstrated that Scottish consumers believe that the beef produced in Scotland and products labeled “Scotch Beef” are safer, superior in quality and more expensive than the equivalent produced in England. However, such preference that Scottish consumers show towards products locally produced in regards to those from England could also be influenced by their beliefs about England.

Umberger and Calkins (2008) have also studied the country of origin influence on the choice of beef. Their research sought to determine which factors (such as price, quality attributes and socio-demographic and psychographic characteristics) would explain Korean consumers’ willingness to purchase U.S. versus domestic or Australian beef. The authors have employed both consumer focus groups and online surveys using choice sets. Results indicated that consumers had higher positive perceptions of Australian beef than of U.S. beef, particularly in the area of environmentally friendly, cleanliness, standards and credibility; and thus Korean consumers discount Australian beef less than U.S. beef relative to domestic beef.

Agrawal and Kamakura (1999) point out that country of origin is more influential on the purchase of agricultural products than manufactured products because of the lesser involvement with the latter. These findings demonstrate the complexity involved in the evaluation of beliefs on country of origin and its impact on the consumer attitude towards the product within a multidimensional context (Bhaskaran and Sukumaran 2007), and consequently, the complexity in measuring the country-of-origin effect. Because of this complexity, this paper has employed a holistic perspective of the theme, considering the viewpoints of consumers, exporters and importers of Brazilian beef.

The Image of Brazil and Brazilian Beef

Few studies on Brazil’s image have applied a multidimensional perspective of evaluation, such as: Almeida and Drouvot (2009), Anholt (2007), Giraldi (2010) and Giraldi et al. (2011). Almeida and Drouvot (2009) have used Nagashima’s scale (1970) and found that French and Brazilian consumers perceived Brazilian products as being very inferior to those made in developed countries in terms of image and quality. Giraldi (2010) aimed at investigating the country-of-origin effect on high and low-involvement products by means of a survey with Dutch students, which were interviewed because Netherlands is an important access way for Brazilian products in Europe, with Rotterdam’s harbor as the main outpost for Brazilian exportations.

Anholt (2007) measured the brand power of 35 countries, through the nation’s brands index (NBI), showing that Brazil is a poor-selling brand overseas and it is little recognized among potential consumers. Brazil has an overall positive image which, however, is almost useless, little productive, and poorly explored by the country. In addition, the country sells soybean and meats as well as shoes and fashion but fails to aggregate all these products and tailor the image of a country where its products are of quality and may serve as reference for certain consumer segments, such as young people, and people from the fashion and tourism industries.

Giraldi et al. (2011) aimed to analyze Brazil's image in light of the Social Representations theory, considering the objectivation process, and have found categories of country image, with their respective subcategories/dimensions: Population, Politics, Nature, Sports and Economy.

Since 2010, two Brazilian government initiatives have systematically monitored the evolution of Brazil's image in foreign institutions, companies, newspapers and governments. One of them is a survey in which indicators are obtained by means of a 15-item questionnaire and updated every three months. This questionnaire is answered by 170 entities in Brazil, including embassies and trade chambers (Antunes 2010). The answers revealed a "moderately favorable perception" of the country in the majority of the items, but far from the "very optimistic" level. Violence was the issue receiving the lowest score, whereas expected GNP growth and economic policy were highly scored. The other government initiative is a daily analysis of international news on Brazil published by 48 newspapers from North America, Latin America, Europe and Asia. The objective is to establish public relations with foreign opinion formers, mainly journalists, so that the image of Brazil overseas can be strengthened (Antunes 2010). Despite the initiatives taken by the Brazilian government in recent years to evaluate the country image, there are still few actions aimed at internationally promoting the image of Brazil, and few studies have been conducted with foreign consumers to identify how the country is evaluated as the origin of products, investment and tourism destination.

In reviewing studies which evaluate perspectives on Brazilian beef, the following studies can be cited: Barcellos et al. (2009) and Banovic et al. (2010). It should be noted that the Australian and Brazilian consumers' attitudes towards bovine meat were studied on bovine meat produced in their own country, which is a different perspective than the one attempted in this paper. In their comparison of Australian and Brazilian consumers' attitudes towards bovine meat, Barcellos et al. (2009) have found similarities between the two groups. Consumers from Porto Alegre (Brazil) and Sydney (Australia) were found to be the most dedicated beef lovers, considering the strong relationship between their culture and bovine meat. In Brazil, consumers indicated that they perceived no consistency in meat quality, suggesting that quality guarantee systems should be implemented there. On the other hand, Australians were found to be less worried about this issue. In fact, the Meat Standard Australia (MSA) seems to ensure the meat quality expected by Australian consumers. MSA began in 1996 as an industry program following detailed consumer research investigating the continuing decline in beef consumption. It is a voluntary cooperative program requiring coordination and rewarding best practice across all Australian industry sectors (MSA, 2012).

A study of Portuguese consumers was conducted to determine quality perception towards two Portuguese brands (Carnalentejana and National) and a Brazilian meat brand ("Brazilian Beef" brand) by Banovic et al. (2010). The Portuguese brand Carnalentejana was identified by the consumers as having the best quality. This brand was chosen because it provided clear information on animal care, type of feed, fat content and origin. The preference for the Carnalentejana brand was made clear, even after a single-blind test in which consumers attempted to differentiate it from the other two meat brands based on sensory qualities such as taste, softness and succulence. According to Banovic et al. (2010), because the "Brazilian Beef" brand does not have an effective communication strategy, the Portuguese brands become more familiar as they invest more in advertisement. According to the above mentioned studies, the

characteristics considered important for bovine meat during its purchase seem to be the way cattle are raised (i.e., favorable or non-favorable conditions, feeding, sanitation, well-being), as well as meat texture, cattle breed and country of origin.

Methods

Quantitative and qualitative methods were used in this study. In the first step, a survey with 380 consumers living in four European countries (France, England, Ireland and Germany) was carried out. In the second step, primary data on Brazilian exporters and a Dutch importer were collected with in-depth interviews. These interviews were aimed at complementing the results analysis from the first step.

Since the European Union is the second largest consumer of beef in the world and it is the first importer of beef *in natura*, this study has chosen to be centered in the countries mentioned above. It was also decided to carry out a survey with countries members of the EU because of their traditional protectionist position regarding agriculture products (Jank 2011). The choice of the four countries was due to the fact that England, France and Germany are the most populated ones in European Union. The Netherlands was not selected for this survey because of its role as a distributor of products to other European countries, due to the world's second largest port in Rotterdam. Italy is also considered an important purchaser, but it was not included in the field research because most of the beef imported from Brazil serves as raw material for manufacturing *bresaola*, a typical food very appreciated by Italian people. Ireland, in turn, was chosen because of its position in the EU as one of the ten major importers of Brazilian beef as well as the largest meat producer in Europe. Therefore, the choice of the four countries was based on the fact that their inhabitants are important consumers of *in natura* bovine meat, including the Brazilian meat, in addition to having a protectionist position regarding products of animal origin.

The population of the quantitative research consisted of under and post-graduate students and staff of business and economics schools in Dublin (Ireland), Paris (France), Munster (Germany), and Canterbury (England), with age ranging from 18 and 65 years old. Considering the four institutions, the entire population had approximately 4,000 people. This group of individuals was chosen because they are a segment of interest for companies as they are potential buyers of foreign products and meat. Considering other empirical studies on country image, many of them used students as the population of interest, such as: Martin and Eroglu, 1993, Pereira et al. (2005) and Brijs (2006). In addition, as shown by Verlegh and Steenkamp (1999), the magnitude of the country-of-origin effect does not differ between studies using samples of students and those using samples of consumers. However, the choice of this population may have brought some bias to the results of the evaluation of Brazil's image, as the sample includes individuals with higher levels of education than the general population. This element is one of the limitations of the research.

Non-probabilistic samples were used for the majority of the studies on country image, according to Roth and Diamantopoulos (2009). This was the choice in this study, with the sample being chosen according to the convenience criteria, as follows: 40 from French institutions, 111 from German institutions, 115 from English institutions, and 114 from Irish institutions. The respondents were asked how they evaluate the image of Brazil and its products, particularly

bovine meat. Because the sample elements were not randomly selected, it was not possible to objectively assess the sampling error (Churchill 1998). Statistical tests of significance were not performed and results from the sample cannot be generalized and applied to the entire study population, which is a limitation of this research.

The quantitative research had two main concepts: 1) the image foreign consumers have of Brazil and 2) their attitudes towards the Brazilian beef. The former is the independent variable and the latter is the dependent one. For the operationalization of the variables in each concept, a seven-point Likert scale was used (1= totally agree and 7 = totally disagree). This measurement was based on Parameswaran and Pisharodi (1994), Pisharodi and Parameswaran (2002) and Banovic et al. (2010), as explained below.

To analyze Europeans' attitudes towards Brazilian beef, it is necessary to empirically measure this concept. Fishbein and Ajzen (1975) define attitude as a "learned" predisposition to respond to an object stimulus. On the one hand, according to the original view of attitudes, its formation requires direct or indirect experience with the object, and responses to this object can be classified into three categories: cognitive (perception and verbal manifestations of beliefs), affective (neuro-sympathetic responses and verbal manifestations of affection), and behavioral (actions and verbal manifestations). Thus, attitudes do not consist of cognitive aspects only, but also include affective (i.e., specific feelings or emotions) and conative (i.e., intended behavior) facets (Fishbein and Ajzen, 1975).

On the other hand, newer studies describe attitudes either along a two-component view (Engel et al. 1995) or a hierarchy-of-effects (or ABC) sequence (Ajzen and Fishbein 1980) which assume that self-reported behavior and stated intentions to respond are treated as dependent effects of affective and/or cognitive variables. However, since it is not the objective of this paper to evaluate the level of dependence among the attitude components, the concept is measured according to the original view of attitudes, and it is operationalized by using 14 sentences aimed at evaluating cognitive, affective and conative components of the attitude towards the product being studied (see Table 2).

The affective component of attitude was measured through the question "How much do you like Brazilian beef?", because according to Fishbein and Ajzen (1975) this component represents feelings and emotions towards the object. This sentence refers to an overall evaluation of the feelings towards Brazilian beef. General attitudes towards Brazilian beef were then represented by the average scores attributed to the sentences and this composite score was considered the dependent variable in the multiple regression analysis.

The scales used to measure the independent variable (the image foreign consumers have of Brazil) were based on the study developed by Pisharodi and Parameswaran (1992), which was tested in 1994 and improved in 2002. The sentences are shown in Table 3.

In the quantitative step, the following statistical analyses were applied according to Giraldi's methodology (2010): exploratory factor analysis for identifying the dimensions of Brazil's image, and multiple regression analysis to know the impact of this image on consumers' attitude towards the Brazilian beef (the COO effect). According to Malhotra (2010) the multiple

regression can be used to evaluate the strength of a relationship between a dependent variable and a set of independent variables, which is the main purpose of this paper. In the qualitative step, in-depth interviews with a European beef importer and Brazilian beef exporters (represented by one major Brazilian company and representatives of the Brazilian Association of Beef Exporter Industries) were conducted.

Table 2. Scales used for measuring consumers' attitude towards the Brazilian beef

Cognitive component of attitude (General product image)							
	I fully agree						I fully disagree
Brazilian beef is of good quality	1	2	3	4	5	6	7
Brazilian beef is easily found	1	2	3	4	5	6	7
Brazilian beef has an attractive image	1	2	3	4	5	6	7
Brazilian beef is cheap	1	2	3	4	5	6	7
Brazilian beef is sold in several European countries	1	2	3	4	5	6	7
Brazilian beef has a positive image	1	2	3	4	5	6	7
Product communication should be strengthened in the European market	1	2	3	4	5	6	7
Brazilian beef has a good texture	1	2	3	4	5	6	7
Brazilian beef is tasty	1	2	3	4	5	6	7
Brazilian beef is tender	1	2	3	4	5	6	7
Brazilian beef is adequately packaged	1	2	3	4	5	6	7
I consider the cattle-raising methods in Brazil adequate and sustainable	1	2	3	4	5	6	7
Affective component of attitude							
	I liked very much				I did not like so much		
How much do you like Brazilian beef?	1	2	3	4	5	6	7
Conative component of attitude							
Would you buy this product?							
I would definitely buy it							I definitely wouldn't buy it
1	2	3	4	5	6	7	

Sources. Adapted from Assael (1995) and Banovic et al. (2010).

Results and Discussion of the Quantitative Step

A total of 380 questionnaires were completed and validated. Most of the questionnaires were applied individually to the sample between September and November 2010, in the form of live interviews. Overall, the results showed that 60% of the sample had low levels of knowledge about Brazil and 40% knew the country reasonably or fairly well.

The exploratory factor analysis was aimed at creating a set of new variables to replace the existing ones. The Bartlett's sphericity test assessed the statistical probability of existing significant correlations and the Kaiser Meyer Olkin test presented a value of 0,816. According to Hair et al. (2009), this result can be considered a very good one.

Analysis of variables communalities was performed. When communalities are lower than 0.5, it is recommended to exclude the variable (Hair et al. 2009). In this sense, those variables with communalities lower than 0.5 were excluded from analyses. The criterion for choosing the number of factors was the eigenvalues greater than 1, which resulted in seven factors, explaining 61.045% of the total variance. As suggested by Hair et al. (2009), rotation of the factors for questions on Brazil's image was performed by using the VARIMAX method. Hair et al. (2009) indicate that it is necessary to verify the practical significance of the factors; they should be at least 0.50 to be considered significant. In this sense, virtually all factor loads resulting from analysis have values greater than 0.50, except for the correlation between "Brazilian products are well-finished" and factor 5. Therefore, this sentence was excluded from analysis. Internal consistency was assessed by the Cronbach's alpha. Table 3 presents the rotated component matrix, factor labels (given after literature suggestions), factor loads and Cronbach's alphas.

Table 3. Rotated component matrix, factors labels and Cronbach's alphas

Factor Label	Cronbach's Alpha	Sentences on the Questionnaire	Factor Loads
Factor 1- Face of the Brazilian People	0.749	Brazilian people are hard working	0.769
		Brazilian people are well-educated	0.732
		Brazilian people have technical skills	0.679
		Brazilian people reached high standard of living	0.644
Factor 2 - General Image of the Brazilian products	0.707	Brazilian products are long-lasting	0.801
		Brazilian products have a good value	0.731
		Brazilian products have a wide range of models	0.601
Factor3 Communication, Distribution and Differentiation of Brazilian Products	0.728	Brazilian products are easily available	0.740
		Brazilian products are prestigious	0.668
		Brazil is well known for producing mainly industrial products	0.618
		Brazilian products have high technology	0.523
		Brazilian products are intensively advertised	0.515
Factor 4- Perceived Similarity	0.720	Brazil is economically similar to my country	0.791
		Brazil has similar culture comparing to my country	0.770
		Brazil has similar political view comparing to my country	0.639
Factor 5- Internationalization of Brazil	0.507	Brazilian products are sold in many countries	0.688
		Brazil participates in international affairs	0.680
Factor 6 - Beliefs about Brazilian Arts and Sympathy for Brazil	0.697	Brazilian people are creative and artistic	0.864
		Brazil is friendly and likeable internationally	0.843
Factor 7- Negative Aspects of Brazilian Products	0.429	Brazilian products are imitations	0.723
		Brazilian products need frequent repair	0.721
		Brazilian products are not attractive	0.488

Factor 5 has a Cronbach's alpha equals to 0.507, indicating that it would not be acceptable. However, according to Cortina (1993), the value of Cronbach's alpha decreases as the number of variables of in a factor also decreases, since its calculation is directly proportional to this number (N). Therefore, because Factor 5 has only two variables, such a low Cronbach's alpha is the result of the small number of variables in the factor, and it was kept in the analysis. However, factor 7 had an alpha value much smaller than 0.5, and it was not kept.

The attitude towards Brazilian beef, the dependent variable, was represented by the mean score attributed to the variables that measured the cognitive, affective and conative (behavior) aspects of attitude (following the original view of attitude formation), because it was not the objective of this paper to evaluate the level of dependence among the attitude components. Moreover, the problem of multicollinearity among the attitude dimensions of Brazilian beef could be avoided by using this summated score. As it was used a 7 point scale, mean scores lower than 4 meant a positive attitude towards the Brazilian beef; scores equal to 4 meant a neutral attitude; and scores greater than 4 meant a negative attitude. In general, the respondents' attitude towards the Brazilian beef had a mean score of 3.93, that is, close to a neutral assessment.

Concerning the differences among countries (see Table 4), among the French and English respondents, the attitude towards Brazilian beef was found to be less favorable, when compared to Irish and German counterparts. However, the worst mean score was given by French respondents, despite being considered somehow a neutral evaluation. This can be explained by the fact that France is one of the most protectionist countries in the world in relation to its products, especially those produced in the agriculture and livestock sectors. In addition, both French and English consumers, and even German ones, indicated in the questionnaires that they have a vegetarian habit.

Table 4. Differences in attitude towards Brazilian beef according to country of residence

Country	N	Mean	Standard Deviation
France	40	4.0821	0.89060
England	115	3.9652	0.92361
Germany	111	3.9575	0.68107
Ireland	114	3.8330	0.83797

Six factors were used to represent the independent variable (Brazil image) with regards to the multiple regression analysis performed to identify the country of origin effect. Table 5 shows the summary of the estimated regression model for assessing the influence of Brazil's image on the respondent's attitudes towards the Brazilian bovine meat, as well as the model components. The R^2 is the measure of the magnitude of the country-of-origin effect, as in Giraldi's (2010) work. Because R^2 measures the percentage of total variation in the dependent variable, one can observe that the relationship between the variables is not strong ($R^2 = 0.137$). For all the respondents, the Brazil's image did not influence significantly their attitudes towards the Brazilian beef, that is, the country-of-origin effect is not strong.

However, it must be mentioned that, in the Social Sciences field of research, it is not uncommon to have low R^2 values, especially in cross-sectional studies (Wooldridge 2009), because of the

complexity of the phenomenon under study. These research results can be considered relevant, since part of the variability in the attitudes towards Brazilian beef can be explained by the country image.

Since this research has used a non-probabilistic sample, the elements of the sample were not chosen randomly, and it was not possible to objectively evaluate the sampling error (Churchill, 1998). Thus, no generalizations can be made regarding the results obtained from this sample for the entire survey population, since the key characteristic of a sample allowing generalization is its probabilistic versus non-probabilistic nature (Mazzocchi 2008). Therefore, the t-test to check the statistical significance of differences was not employed. Although statistical tests were not employed since the sample was not probabilistic, the residual normality was verified in order to apply the multiple regression analysis. It was observed that residuals follow a normal distribution (this was observed through both Kolmogorov-Smirnov test and histogram analysis).

Table 5. Summary and coefficients of the regression model for all the respondents

Summary				
R	R²	Adjusted R²	Estimated Standard Error	
0.370	0.137	0.123	0.77674	
Components	B	Standard Deviation	B	Tolerance
Constant	2.134	0.276		0.000
Face of the Brazilian people	0.026	0.053	0.027	0.628
General image of the Brazilian products	0.013	0.060	0.012	0.835
Communication, distribution and differentiation of Brazilian products	0.118	0.054	0.127	0.030
Perceived similarity	0.089	0.037	0.128	0.018
Internationalization of Brazil	0.040	0.038	0.056	0.289
Beliefs about Brazilian arts and sympathy for Brazil	0.196	0.039	0.252	0.000

In this case, we found it was more effective to assess and compare both the magnitude and valence of the regression coefficients, rather than the R^2 values in the estimated model, in order to better understand the influence of the Brazilian image on attitudes towards Brazilian beef. By analyzing the non-standardized regression coefficients (Table 5), one will observe that the dimensions of the Brazil image which have higher values are *Beliefs about Brazilian arts and sympathy for Brazil*, followed by *Communication, distribution and differentiation of Brazilian products*.

Although both were the most influential dimensions regarding the respondent's attitude towards the Brazilian beef, the former had a more positive influence and the latter a more negative influence. Aspects related to communication, distribution and differentiation of the Brazilian products were negatively evaluated (mean score above 4.5) by the total of respondents. Because the highest coefficient was that for the dimension *Beliefs about Brazilian arts and sympathy for*

Brazil, one can conclude that the country-of-origin effect was positive for all the respondents, despite not being strong.

This finding is corroborated by other authors, who found that consumers evaluate identical products differently regarding all aspects, except country of origin (Orbaiz and Papadopoulos 2003; Verlegh et al. 2005). Such evaluations (quality, value, labor etc.) are strongly affected by the knowledge about the place where the product is made, that is, the country of origin (Ahmed and D'Astous 1996; D'Astous and Ahmed 1999; Han 1989; Papadopoulos 1993). The positive image of a country can influence the attitude of the consumers towards its products as well as their purchase intention (Balabanis et al. 2002; Papadopoulos and Heslop 2002). Umberger and Calkins (2008) have also shown that the country of origin is one important attribute that Korean consumers evaluate when searching for "high quality beef" at the supermarket, after cut of meat, being chilled, grade, price and color.

Results and Discussion of the Qualitative Step

A qualitative study with representatives of the Brazilian beef exporters and one European importer was conducted in order to identify how Brazil image has been affecting the market access and bovine meat trade, thus complementing the results from the quantitative step. The way how exporters and importers have been highlighting the origin of the product was also addressed, including how the Brazilian beef is positioned in the European market.

The Brazilian exporting company interviewed has a high rate of internationalization, almost twice the general rate for the food sector. The Brazilian Association of Beef Exporter Industries (ABIEC) was also chosen for the qualitative research because it is a class entity representing the major exports of beef in Brazil. The importer company is a Dutch one, which was chosen because it is one of the major beef importers in Europe, having storage capacity of 30 thousand tons of meat. Supermarkets, retail networks, industries, food manufacturers, and restaurant chains are among its main clients in Europe. The bovine meat imported by this company comes from Brazil, Argentina, Uruguay, Paraguay, USA, New Zealand, Botswana, and Namibia.

The interviews scripts were built based on the literature. The method employed was in-depth interviews, and the content was analyzed according to Bardin (2007) procedures. Based on the interviews conducted with representatives of the Brazilian meat export sector, it was seen that they have highlighted the product's origin since 2005, when the Brazilian Beef brand (sectorial brand which explores the image of Brazil) was reformulated. Even slaughterhouses which are not ABIEC members use the Brazilian Beef brand to strengthen the image of their products. According to the Dutch meat importer, both meat's origin and Brazilian Beef brand are also highlighted by the importers while the exporters are encouraged to use the brand in marketing campaigns.

However, the Brazilian exporter has pointed out that it is not always possible to control the type of highlight importers give to the bovine meat in Europe. The origin of meat cuts to be used as raw material for manufacture of other products, such as the Italian bresaola, is less stressed. He has also informed that European importers usually buy fore-quarters and hind-quarters of the animal and then they chop them into smaller pieces. Although importers or retailers buying

bovine meat are obliged to clearly inform the origin of it, even in case of meat cuts, the exporters have no control on how this is done. On the other hand, the meat cut in Brazil is directly sold to European countries, with tenderloin and top sirloin beefs being highlighted as Brazilian products. In addition, these noble meat cuts are divulged by importers and retailers through marketing campaigns in Europe.

Both exporters and importers somehow highlight the Brazilian bovine meat origin depending on the region of Europe and meat cut being traded. In fact, the Brazilian top-sirloin has a positive image in virtually all European countries. However, considering the differences in cultural patterns and diet habits, there are regions where Brazilian beef is more positively evaluated than in others.

According to both Brazilian exporters and the importer, the image of Brazilian beef is considered positive overseas. The import company pointed out that Brazilian beef has always been competitive in Europe thanks to its price, especially between 2005 and 2008, as well as to its quality and supply. However, the importer believes that the Brazilian beef still needs to be more advertised in Europe. "There is always negative news suggesting that the production of bovine meat and other commodities in Brazil has been causing the destruction of Amazonia forest".

By analyzing the economic advances reached by Brazil in the last couple of years, the importer also said that the product became scarce in the European market as a result of the improved purchasing power of the Brazilian people, who have been consuming more meat thanks to the economic boost and income transfer programs implemented by the Brazilian government. For the importer, the outlet logistics for the Brazilian beef is badly regarded, which has contributed to the product's loss of competitiveness. Because of the delayed arrival of the product in Europe (up to 45 days), much of the imported meat can only be sold to the so-called wholesale markets, whose main clients are the large retail networks supplying hotels and restaurants. The direct sale of the product to retail groups becomes more difficult because of such a delay, since the bovine meat loses its original tonal qualities when sliced after 25 days of the slaughtering of the animal. At that moment, the importer was selling American, Uruguayan and Argentine meat to European supermarkets, because the product takes about 20 days to be transported from one continent to another, thus making the meat from these countries more competitive.

These results can be compared to the ones obtained by Umberger and Calkins (2008), which have shown that, for Korean consumers, the beef freshness (not frozen) appears to be very desirable. Although it may be expensive, the importance of freshness may indicate the need for U.S. beef exporters in the case of Umberger and Calkins (2008) study (and also Brazilian in this research) to further explore transportation and shipping methods which allow more beef to arrive and to be sold as chilled (not frozen) meat in the supermarkets abroad.

Despite the social, infrastructure and logistics problems, the exporters believe Brazil has a much better image than 10 years ago. With regard to the bovine meat, the product is more positively regarded in some markets like Middle East and Russia, whereas its image varies among the EU countries. For example, the Brazilian beef's image is extremely negative in Ireland, whose economy depends on the bovine meat production, and in France, whose people are very nationalist and tend to consume national products. In the Netherlands, the Brazilian beef has an

extremely positive image in view of the large number of foreign products. Thus, residence country and culture may contribute to a more or less favorable image of the Brazilian meat.

According to the Brazilian exporting company, inadequate logistics and poor infrastructure are domestic problems which affect negatively the exports. In addition, the private sector assumes many responsibilities of the public sector. For example, the cattle-tracking system should be applied throughout the country by force of law, and not only to farms which export to European markets. This would strengthen the image and credibility of the sector by allowing consumers from all countries to obtain information on birth place and how animals are raised and slaughtered.

The significant differences in cultural patterns and consumption habits among European consumers, which mostly determine their preference for a type of meat instead of another was also mentioned. For instance, both Portuguese and Swedish consumers have a very positive image of the Brazilian beef, the former thanks to their proximity of Brazil and the latter thanks to low-fat content in the product. The preference for this type of meat is due to the fact that Swedish soldiers during the World War II had to eat pure fat stored in cans because of the lack of food. As a result, a collective aversion to high-fat content products in Sweden developed since then.

German and Irish consumers prefer meat from Argentina, Uruguay, USA, and Ireland, which contains a high content of fat. France is also considered a peculiar market as the country is considered an important meat producer while foreign meat is not easily found in French supermarkets. However, because of the great number of tourists visiting the country every year, restaurants and hotels have to import the product from other countries. Despite being an important meat producer in Europe, England has a large number of industries acquiring pre-cooked meat from Brazil for industrialization and distribution in English market.

The interviewees stated that little effort has been made to promote the Brazilian bovine meat among the end consumers, which can partially explain the results seen in the quantitative step of this research (low level of knowledge about Brazil and Brazilian beef). Although ABIEC marketing measures have been heavily directed to European meat importers, it would be necessary to advance and reach directly the networks of restaurants and retailers prior to the end consumers. The next step would be to increase the number of distribution platforms in the consumer markets, thus enabling advertising campaigns to be performed for end consumers. Otherwise, it would be risky to do so without the guarantees that the product will be on the shelves of the supermarkets. Furthermore, investments by the Brazilian government are needed to improve the outlet infrastructure so that the Brazilian products can be more competitive overseas.

Attempts by the Brazilian government are also necessary to reduce the *ad valorem* taxes imposed by EU, which means three euros charged for each one-fifth of meat. It was suggested that a group of entrepreneurs and government agents be formed in order to negotiate with the European Commission a reduction of *ad valorem* taxes, as well as to establish strategies for entering new markets, as did Japan, South Korea and other countries.

Conclusions

The paper analyzed the influence of Brazilian image on the trade of Brazilian beef in Europe. It has assessed how different dimensions related to the Brazil's image are viewed by a group of European consumers and how their attitudes towards Brazilian beef are influenced by these dimensions. Moreover, a qualitative research step has sought to investigate Brazilian beef image and promotion strategies in other perspectives: importers and exporters'.

This study's main hypothesis was *Consumers' perception about the quality of Brazilian beef in Europe is dependent on the country image*. In order to check this hypothesis, the answers to the following questions were obtained: (1) How important is the country of origin image in selling beef? (2) How good is the image of Brazil in Europe? (3) What is the image of Brazilian beef among European consumers?

The first and the second questions were answered by the quantitative study, indicating that the influence of Brazil's image on the consumer attitude towards the Brazilian beef, that is, the country-of-origin effect, was not considered so significant. However, this research results can be considered relevant, since part of the variability in the attitudes towards Brazilian beef can be explained by the country image. The dimensions of Brazil image that had the higher influence on the attitude towards Brazilian beef were *Beliefs about Brazilian arts and sympathy for Brazil* (a positive influence), and *Communication, distribution and differentiation of Brazilian products* (a negative influence).

Both quantitative and qualitative studies helped to answer the third question. The qualitative study has shown that to both Brazilian exporters and the importer, the image of Brazilian beef is considered positive overseas. It was seen that the importer believes that the Brazilian beef still needs to be more widely advertised in Europe and that the outlet logistics for the Brazilian beef is badly regarded. These elements were also poorly evaluated by consumers in the quantitative study. Therefore, one important action to be taken needed to improve the image of Brazilian beef overseas refers to the communication and logistics strategies.

We also found that the image of Brazil has been explored by both exporters and importers more or less intensively, depending on the market to be served. Brazilian bovine meat is more or less accepted in some European countries, depending on the consumers' dietary habits, since Brazilian beef is viewed as having a lower fat content compared to the meat from Uruguay, Argentina and the USA.

Brazil tends to keep its position as the world's leading exporter of bovine meat and other cattle products, thus diversifying its trade partners, mainly in Asia, and is increasing exports of beef to this continent. Therefore, it is essential to strengthen the image of Brazil and its bovine meat as they are not well known. Actions should be coordinated, developed, and implemented by the government and bovine meat exports and the production sectors, including those involving other cattle products, in order to improve the image of Brazilian products overseas.

For instance, both private sector and government need to invest more in measures aimed at advertising and differentiating the Brazilian products overseas. Public managers could launch

campaigns aimed to minimize the negative image of the country overseas, thus increasing the chance that the products will be consumed worldwide with a higher aggregate value. Projects should be also implemented in order to improve airport, port, and road infrastructures for enhancing export logistics, besides offering higher fiscal incentives to exporters.

Meanwhile, investment should be increased not only to guarantee adequate conditions for raising the cattle, but also to comply with the environmental and labor laws, implement cattle-tracking systems, and develop technologies aimed at increasing productivity and reducing the use of natural pastures in the country. On the part of the government, the outlet infrastructure for export products should be improved through investments to increase the capacity of the ports and construct more railways and motorways, including hydro-ways.

Despite the initiatives already taken, such as the creation of the Brazilian Beef brand, it is essential that the sector considers the viability of developing additional or complementary brands for markets, mainly European countries, associating the Brazilian beef with different regions of Brazil, such as Cerrado, Pampas and others where meat production is traditionally practiced. Associating the Brazilian cattle with Brazil has been a challenge because of the concerns raised by the international community regarding the Amazon forest and its preservation. The export sector should, still, be aware of the specificities of each market and how different types of consumers respond to the marketing stimuli.

Regarding the methodological limitations of this research, we highlight the defined target population for the quantitative part of this study, which did not cover other important markets with which Brazil maintains trade relations, such as other European and Asian countries, the United States, or even other European consumer segments, such as professionals and affluent consumers. This can be considered a limitation of this research, since they may not represent the opinions of all European consumers or even of consumers from the countries analyzed. Additionally, a non-probabilistic sample was used, and thus the statistical tests of significance were not performed.

Despite the limitations mentioned above, this study has contributed to the understanding of how the country-of-origin effect can influence the consumer's perception in a food market context and whether the country of origin can be used as a marketing tool. Considering that there are few Brazilian studies assessing the image of Brazil and Brazilian products overseas, the innovative aspect of this paper can also be highlighted.

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International Food and Agribusiness Management Review
Volume 16, Special Issue 4, 2013

U.S. Agribusiness Companies and Product Innovation: Insights from a Choice Experiment Conducted with Agribusiness Executives

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Abstract

Product innovation generates short and long-term growth by attracting new customers while satisfying existing customers. This paper identifies factors influencing the selection of innovation projects and quantifies the tradeoffs which agribusiness managers make when selecting product innovations. A choice experiment approach is used to provide insight into agribusiness executive behavior. Our results indicate that executives prefer (in decreasing order of importance) projects with low risk of technical/regulatory failure, low relative market risk, short-term to market, in-house capability, and high sunk costs. Our results suggest that policy makers could stimulate open innovation with programs such as government sponsored research and cost-sharing.

Keywords: innovation, agribusiness, executive behavior, willingness-to-trade

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Introduction

Innovation generates short and long-term growth by attracting new customers while continuously satisfying current customers. “Innovation is critical to the success of a firm as well as the economic health of an industry and the overall economy” (Roucan-Kane, Gray and Boehlje; p.52). Various researchers have developed frameworks which stimulate, measure and determine governance structures that enhance innovation ideas (Roth and Sneader 2006; Brown 2005; Barsh et al. 2008; Huurinainen 2007; Christensen and Raynor 2003; Christensen et al. 2004; Dacin et al. 2007; Sampson 2007; Ahuja and Katila 2001). Companies are faced with many potential innovation projects to choose from and must allocate a limited research and development (R&D) budget to selected projects. “The selection of the right innovation project is the main challenge facing companies in today’s dynamic business environment” (Roucan-Kane, Gray and Boehlje; p.52). Several frameworks and criteria have been developed to assist companies with this difficult task (Day 2007; Graves, Ringuest, and Case 2000).

Various studies have been conducted to identify important project attributes that are considered when making innovation project investments. A review of the literature revealed that companies focus primarily on financial criteria such as project net present value, internal rate of return, and return on investment when selecting innovation projects. Additional research has found that companies that also incorporate qualitative criteria into their decision-making are the most successful innovators (Cooper et al. 1999; Coldrick et al. 2005). A summary of the criteria that have been proposed in the literature are provided in Table 1 (see Appendix).

The goal of this paper is to identify factors influencing the selection of innovation projects, quantify the tradeoffs which agribusiness managers make when selecting product innovations, and address the difficulties companies face in making these decisions. Several attributes have been highlighted by previous research as important for project selection. However, the preferences by agribusinesses for projects with bundles of these various attributes, especially when compared across multiple projects, are largely unknown. This research fills a gap in the empirical literature by providing insight into agribusiness executive behavior using a choice experiment (CE) approach. This framework enables the identification of preferences for project attributes by agribusiness companies and allows for the estimation of tradeoffs between the various innovation projects’ characteristics.

Methods

To complement the findings from the prior literature, semi-structured phone interviews were conducted with executives from eight diverse food and agriculture companies. Phone interviews were conducted to identify important project attributes to be evaluated in the CE. The detailed structure and process used to conduct the interviews is discussed in Roucan-Kane (2010). The objective of the interviews was to obtain direct information from decision makers regarding project characteristics that they take into account when choosing their company’s innovation portfolio (Roucan-Kane 2010). All of the criteria from the literature in Table 1 (see Appendix) were mentioned by at least one of the respondents.

It was found that financial return, time to market, risk, strategic fit, access to capability and competitive advantage considerations were particularly important. In the interviews, respondents mentioned that other qualitative criteria were usually considered as being embedded in financial return, particularly as more information was gathered about the project through time. As such, return to research, product demand, competition and market share were included in their financial calculations.

Various types of risk were identified by respondents, specifically regulatory, technical and market risk. Regulatory risk refers to the uncertainty associated with the regulatory approval process and whether the project will receive some kind of intellectual property rights protection (patent, copyright, etc.). Technical risk originates primarily from a lack of information from a technology standpoint (McGrath and MacMillan 2000). This type of risk was particularly important for technology intensive companies such as those in the seed sub-industry compared to companies in the food sub-industry. Market risk refers to the lack of certainty about consumer demand. It was found that firms usually take this into account by conducting sensitivity analysis on their financial return given various market assumptions.

In addition to risk, several respondents discussed governance structure and their search for partners to obtain knowledge in basic research as a factor in their decision making. Previous commitment (Hammond 1999) was a factor not widely covered in the literature but raised in the phone interviews. One respondent indicated that earlier investments in a project biased the “go/kill” decision in subsequent stages.

Econometric Modeling

Food and agribusiness executive behavior is analyzed using a choice experiment based on random utility theory. Random utility theory assumes individuals seek to maximize their expected utility subject to the choice set that they are given. This individual's utility is considered a random variable because the researcher has incomplete information (Manski 1977). Let utility be the sum of observable and unobservable components:

$$(1) \quad U_{jt} = V_{jt} + \varepsilon_{jt}$$

where U_{jt} is the latent, unobservable utility for the j^{th} alternative in choice set t ; V_{jt} is the observable, systematic portion of utility determined by the attributes; and ε_{jt} is the random component of utility, independently and identically distributed over all alternatives and choice scenarios. The probability that alternative j will be selected is the probability that the added utility from this selection is greater than choosing another alternative presented in the choice experiment:

$$(2) \quad (V_j - V_k) > (\varepsilon_k - \varepsilon_j) \forall j \neq k, j \in N$$

where N is the total set of alternatives available to the respondent (Boxall and Adamowicz 2002; Adamowicz et al. 1998) and choice set subscripts t are suppressed for simplicity. We cannot

observe $(\varepsilon_k - \varepsilon_j)$, so the relationship in equation 2 cannot be determined exactly. But one can make statements about choice outcomes up to a probability of occurrence by calculating the probability that $(\varepsilon_k - \varepsilon_j)$ will be less than $(V_j - V_k)$. Therefore, the probability that an individual will choose alternative j is given by (Louviere, Hensher, and Swait 2000):

$$(3) \quad P_j = P[(\varepsilon_k - \varepsilon_j) < (V_j - V_k)] \forall j \neq k, j \in N.$$

Assuming the ε terms are distributed according to the extreme value (type 1) distribution enables statistical estimation of the model parameters by maximum likelihood and yields the multinomial logit (MNL) or conditional logit model (McFadden 1974) for discrete choice modeling. The probability of choosing alternative j can then be expressed as:

$$(4) \quad P_j = \frac{e^{\beta \mathbf{X}_j}}{\sum_{k \in N} e^{\beta \mathbf{X}_k}}$$

where β is a vector of parameters that relate the vector \mathbf{X} of attributes to the utility of the j^{th} alternative (Boxall and Adamowicz 2002; Adamowicz et al. 1998) and V_j is assumed to be linear in parameters according to:

$$(5) \quad V_j = \beta \mathbf{X}_j = \beta_1 x_{j1} + \beta_2 x_{j2} + \dots + \beta_n x_{jn}$$

where x_{jn} is the n^{th} attribute for alternative j , and β_n is the parameter associated with the n^{th} attribute of the j^{th} alternative. An alternative to the MNL model that allows the coefficient associated with each observed variable to vary randomly from one individual to another is the mixed logit (also called random-parameters logit). This model introduces individual decision maker preference heterogeneity that is not captured by the multinomial logit model, which assumes homogeneous preferences for the attributes contained in the CE. The mixed logit model also relaxes the independence from irrelevant alternatives assumption, and allows efficient estimation when the same individual makes repeated choices, as is the case in this study (Revelt and Train 1998).

The utility of attribute j for individual i in choice set t in the mixed logit model is distinct from equation (1) and is generally presented as (Tonsor et al. 2005):

$$(6) \quad U_{ijt} = V_{ijt} + (u_{ij} + \varepsilon_{ijt})$$

where V_{ijt} is the systematic portion of the utility function, u_{ij} is an error term normally distributed over individuals and alternatives (but not over t , the choice sets), and ε_{ijt} is the stochastic error, independently and identically distributed over all individuals, attributes and choice sets. In a mixed-logit model, the probability of individual i choosing alternative j in choice set t is $P_{ijt}(U_{ijt} \geq U_{ikt})$ over all possible k attributes. Assuming V_{ijt} is linear in parameters, as in equation (5), the utility function can be expressed as

$$(7) \quad U_{ijt} = \beta_{ijt} \mathbf{X}_{ijt} + (u_{ij} + \varepsilon_{ijt})$$

where \mathbf{X}_{ijt} is a vector of individual-specific and alternative-specific attributes for choice set t , and β_{ijt} is a vector of preference parameters that is randomly distributed across individuals (Alfnes 2004; Tonsor et al. 2005).

The Choice Experiment

Choice experiments allow for the evaluation of trade-offs between attributes or characteristics pertinent to a specific decision. We use this approach to examine how agribusiness decision-makers choose among innovation projects. CEs differ from conjoint analysis of stated preferences which typically ask respondents to rate or rank alternatives, by having decision makers choose a single preferred alternative from a choice set made of various attributes and levels (Adamowicz et al. 1998).

Careful analysis of the findings from the literature review and interviews generated five project characteristics to be evaluated: risk of technical/regulatory failure, time to market, access to capabilities, probability of potential return and costs already incurred. These innovation project characteristics were broken down into attributes with varying levels. Table 2 (see Appendix) provides detailed descriptions of each attribute and their corresponding levels. Attributes were standardized to make them comparable across various agricultural sub-industries. For example, no specific length of time was assigned to the levels associated with the attribute “time to market” (*Mkt*) due to various differences in firms’ planning horizons given the sub-industry in which they operate. As such, the level ‘short-term to market’ refers to innovations that could be developed, manufactured, marketed and commercialized in the “short-term”, while “long-term” to market refers to innovations that would reach the market over a longer time frame.

The *Return (above average, average, below average)* attributes represent a project’s distribution of potential return. For example, Return 50, 25,25, represents an innovation project with a 50% probability of generating an above average rate of return, 25% probability that the project will generate the average rate of return and a 25% probability that the rate of return will be lower than average.

In designing choice sets, it is important that every alternative represents a realistic combination of attributes and levels that characterize an innovation project. It is important for companies to select innovation projects that fit the firms’ strategic direction and have potential for competitive advantage. Each choice set, comprised of three alternatives, was framed so that it included plausible choices. An example choice set is presented in Figure 1.

A project/alternative with no potential competitive advantage or strategic fit would never be chosen by the company. Therefore, respondents were asked to make their selection “assuming that all projects fit your organization’s mission, strategic focus and have potential for competitive advantage.”

Among the following three innovation projects, which would your organization be most likely to choose?									
Characteristics	Project 1			Project 2			Project 3		
Risk of technical/regulatory failure	low			Low			high		
Time to market	long-term			long-term			short-term		
Access to capabilities	in-house			partner			in-house		
Probability of potential return	Above 25%	Near 50%	Below 25%	Above 50%	Near 25%	Below 25%	Above 50%	Near 0%	Below 50%
Costs already incurred	high proportion			low proportion			low proportion		

Figure 1. Example of a Choices Set Question Used in the Research

Experimental Design

An optimal fractional factorial experimental design was generated using the experimental design and choice modeling macro in SAS 9.2 (SAS 2008) that uses the PROC OPTEX procedure (Kuhfeld 2009). The experimental design constructed was made up of 20 choice sets (unique attribute-level combinations) which were split into two randomly assigned blocks to reduce response fatigue. Thus, each survey respondent was asked to complete a total of 10 choice sets. Following Kuhfeld (2009, 2005) and Pardoe (2006), the experimental design was evaluated with an artificial set of data and found to be amenable to analysis using the workhorse conditional logit model. The order of the attributes presented was randomized to control for order effects. Because innovation projects depicted by the CE are assumed to fit the company's mission and strategic focus and because executive decisions about innovation projects tend to be pre-screened by lower-level management, executives are presented only with the choice of which project in the choice set is best. At this point in a typical stage-gate process all purely dominated strategies have already been eliminated from a firm's choice set. Thus, an "opt-out" alternative was not included in the experimental design.

Data

The data for this study was collected using a survey of agribusiness executives (Roucan-Kane 2010). The survey was pre-tested with individuals in academia and industry, including six executives of food and agribusiness companies. Using a contact database provided by the Purdue Center for Food and Agricultural Business and the Purdue Department of Food Science, the survey was sent to a convenience sample of 849 executives in December 2009. The use of recruitment emails, referral to the correct respondent within a business, financial incentives, and an appealing survey interface were used to increase response rate, consistent with the procedures recommended by Dillman, Smith, and Christian (2009). A response rate cannot be calculated directly because of the inability to know which of the initial contacts were sent directly to a member of the target population and how many referrals to the correct person within each business occurred after recruitment emails were sent to the entire sample frame.

The survey was composed of three sections that included questions on company characteristics (2008 fiscal revenue, scope, and governance structure), respondent characteristics (company position, education, experience selecting innovation projects, etc.) and the choice experiment. The data revealed that all of the respondents were involved in the selection of product innovations with 58% involved at the corporate level and 42% involved at the division or strategic business unit level. Thirty-seven percent of the respondents indicated they were executives, 21% had primarily marketing responsibility, 22% were involved in R&D, 7% had primarily sales management responsibility, and 13% indicated other responsibilities. The sample is fairly diversified across agricultural sub-industries with 25% of the respondents belonging to the food sector, 20% to animal nutrition, 17% to crop protection, 12% to seed companies, 9% to capital equipment, 7% to animal health, 1% to biotechnology, 1% to fertilizer, and 8% to other: grain handling, additives to seed, etc. Data on executives' firm revenue is shown in Figure 2.

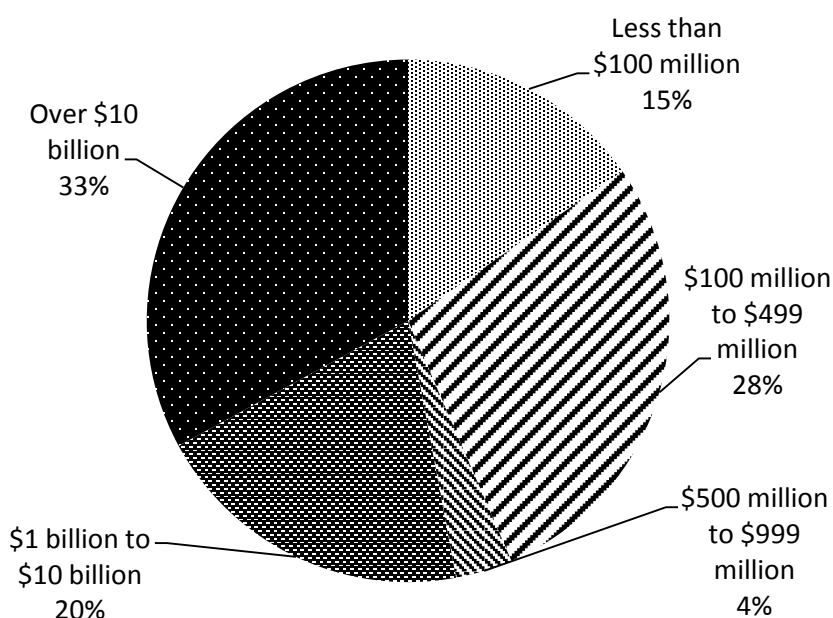


Figure 2. Distribution of Firm Revenue in the Sample

Estimation

The econometric model estimated specifies the observable, systematic portion of utility as:

$$\begin{aligned}
 V_i = & \beta_1(\text{Cost}) + \beta_2(\text{Mkt}) + \beta_3(\text{Technical failure}) + \beta_4(\text{Capability}) + \\
 (8) \quad & \beta_5(\text{Return } 50, 25, 25) + \beta_6(\text{Return } 25, 50, 25) \\
 & + \beta_7(\text{Return } 50, 0, 50) + \beta_8(\text{Return } 60, 25, 15)
 \end{aligned}$$

where all variables are dummy variables representing attribute-level combinations in the CE (Table 2, see Appendix). The variable *Cost* represents the level of costs already incurred in a

given project (either high or low); *Mkt* is a variable capturing the time for the innovation project to reach the market and generate revenue; *Technical Failure* represents the risk of technical/regulatory failure; and *Capability* captures the origin of needed capabilities for the project. The *Return (above average, average, below average)* variables represent a project's distribution of potential return; the reference level for all of the return variables is a 33%, 34%, 33% distribution of returns.

A mixed logit model with the aforementioned utility function specification was estimated using the software NLOGIT 4.0. One thousand Halton draws were used for the simulation and all random variables were specified to vary according to a normal distribution. This variable specification allows for parameters to reflect both positive and negative utility associated with a project attribute.

Results

The mixed logit model estimation results are presented in Table 3. The overall model is highly significant ($\chi^2 < 0.001$). We find that companies are more likely to choose a project with a high proportion of costs already incurred. It is important to note that the coefficient associated with the variable *cost* is small and is only marginally significant, indicating that previous commitments have a limited practical effect on the decision. *Cost* has the smallest significant coefficient relative to the other parameters, indicating that the other attributes will have a stronger absolute effect on the investment decision.

Table 3. Effect of Project Characteristics on the Choice of Innovation Project

Variable/Attribute	Mixed Logit Model		
	Mean Coefficient		Std. Deviation
Cost	0.24 (0.13)	*	0.26 (0.50)
Market (<i>Mkt</i>)	-0.99 (0.23)	***	0.98 (0.60)
Technical failure	-2.33 (0.44)	***	1.50 (0.52)
Access to capability	-0.47 (0.16)	***	1.56 (0.60)
Return 50, 25, 25	1.14 (0.31)	***	
Return 25, 50, 25	0.18 (0.21)		
Return 50, 0, 50	-0.52 (0.26)	**	
Return 60, 25, 15	1.63 (0.34)	***	
Goodness of fit			
Prob>chi-square	< 0.001	***	
Number of Simulations	1000		
N	85		

Note: Standard errors in parentheses. *, **, and *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

Model results indicate that executives prefer projects with a shorter time to market, low risk of technical failure, and in-house capability. The coefficients on these attributes are highly significant, indicating a strong effect on the selection of innovation projects.

Using the return distribution 33%-34%-33% as the reference level, all but one of the return distributions (*Return 25, 50, 25*) were found to have a significant effect on the choice of innovation projects. The lack of significance of *Return 25, 50, 25* suggests that the preference for this return distribution is not significantly different from the 33%-34%-33% return distribution in terms of market risk. *Return 50, 0, 50* represents the greatest downside risk and, as would be expected at this point in a firm's decision making process, is the only return distribution that is less preferred than the reference level.

Results from the mixed logit allow for examination of the distribution of preferences. Significant standard deviation coefficients around the mean of the variables *Technical failure* and *Capability* provide statistical evidence of preference heterogeneity around those attributes. As such, the mean coefficients of these variables are not representative of the overall sample. One can delve deeper into the analysis of heterogeneity among respondents by studying the magnitude of the standard deviations. The magnitudes of the standard deviations relative to the mean coefficients indicate that 94% prefer projects with low risk of technical/regulatory failure, and 62% prefer projects that require only in-house capability¹.

Respondents' Willingness to Trade-Off between Attributes

The coefficients estimated from a random utility model have little economic interpretation because of the non-cardinal nature of utility. These coefficients are typically used to calculate respondents' willingness to tradeoff (WTT) between attributes allowing for additional insights into executives' preferences. The WTT between two attributes (attribute 1 and attribute 2) is calculated as the total derivative of the systematic portion of the utility function with respect to changes in attributes 1 and 2, $dV_i = \beta_1 dx_1 + \beta_2 dx_2$, setting the result equal to zero, and solving for dx_2/dx_1 . This yields the change in attribute 2 that keeps utility constant given a change in attribute 1. The result is the willingness to trade attribute 1 for an incremental increase in attribute 2, and is given by:

$$(9) \quad WTT_{1,2} = \frac{dx_2}{dx_1} = -\frac{\beta_1}{\beta_2}.$$

This ratio is most commonly reported as a willingness to pay measure where x_2 is a cost variable in the marketing literature (Hole 2007b). In the present context, WTT is a non-monetary measure of the willingness to tradeoff one attribute of an innovation project for another attribute.

When the standard deviation coefficients of the attributes are not statistically different from zero in the mixed logit model, the estimated mean WTT can be interpreted as being representative for the entire sample. Where evidence of preference heterogeneity exists (i.e., if the estimated standard deviations are statistically significant), the mean WTT estimates are not representative of the entire sample. Given that WTT is derived as the ratio of two random variables, a method

¹ These figures are given by $100 * \Phi(-\hat{\beta}_k / \hat{S}_k)$, where Φ is the cumulative standard normal distribution function and $\hat{\beta}_k$ and \hat{S}_k are the mean and standard deviation, respectively, of the k th coefficient (Hole 2007a).

capable of calculating the variance of a non-linear function of two or more random variables is needed to evaluate the significance of the WTT measures. A variety of methods exist to determine confidence intervals on the WTT estimates, including the delta, Fieller, Krinsky-Robb, and bootstrap methods; these four methods have all previously been found to be reasonably accurate and yield similar results to one another (Hole 2007b). The delta method was implemented to calculate these variances by a first-order Taylor series expansion around the mean value of the random variables following Hole (2007b):

$$(10) \quad \text{var}(\widehat{WTT}_1) = \left((-1/\hat{\beta}_2)^2 \text{var}(\hat{\beta}_1) + (\hat{\beta}_1/\hat{\beta}_2^2)^2 \text{var}(\hat{\beta}_2) + 2(-1/\hat{\beta}_2)(\hat{\beta}_1/\hat{\beta}_2^2) \text{covar}(\hat{\beta}_1, \hat{\beta}_2) \right)$$

Using the delta method estimate of the variance, a confidence interval can then be constructed to evaluate the significance of the WTT measures as $\widehat{WTT}_1 \pm z_{\alpha/2} \sqrt{\text{var}(\widehat{WTT}_1)}$. For 99%, 95%, and 90% confidence intervals, $z_{\alpha/2}$ equals 2.576, 1.96, and 1.645, respectively. The WTT measures are statistically significant for a given confidence interval if the confidence interval does not include zero and the coefficient is contained within the range of the confidence interval.

Table 4 reports the WTT measures and their statistical significance based on the confidence intervals calculated by the delta method. A positive WTT measure indicates respondents' WTT between two attributes, while a negative WTT signifies respondents' unwillingness to tradeoff between two attributes. Using time to market as the reference, the positive figure 0.25 indicates that the respondents are willing to take on a project where more of the costs have already been incurred (so with more previous commitments) by giving up short-term to market and taking on a longer-term project. A negative willingness to trade measure indicates that respondents are not willing to trade or must be compensated in the form of another attribute to take on more of an attribute. For example, the figure -0.47 in the first row of Table 4 can be interpreted as follows: respondents are willing to forgo a project that requires only in-house capability in exchange for a project that will require partnering, if in return they are given a shorter term to market for the project. The figure -2.35 suggests that respondents will take-on more risk of technical/regulatory failure in exchange for a shorter-term project.

The magnitude of the significant WTT figures can be compared across a single row of Table 4 to determine respondents' relative preference for each attribute. When the tradeoffs are estimated with (time to) Market as the reference, respondents' preferences for the attribute risk of technical failure is more than three times greater in absolute value than the next largest WTT estimate. The signs of the WTT measures indicate the individual attribute levels the respondents prefer. For example, if one continues to use time to market as a reference, the negative WTT for capability and risk of technical failure indicate that respondents prefer in-house capability and low risk of technical failure. Similarly, looking at the magnitude of these WTT measures for the reference Capability, one can rank respondents' preferences as follows: low risk of technical/regulatory failure is preferred to the return distribution (60%, 25%, 15%), which is preferred to the return distribution (50%, 25%, 25%), which is preferred to short-term to market, which is preferred to the return distribution (50%, 0%, 50%), which is preferred to low costs already incurred. Alternatively, the magnitude of the tradeoffs for the reference Technical Failure leads to the following descending ranking of preferences: the return distribution (60%, 25%, 15%), return

distribution (50%, 25%, 25%), short-term to market, in-house capability, and low costs already incurred.

Table 4. Derived Willingness to Tradeoff (WTT) Measures

Cost	Capability	Market	Technical Failure	Return 50, 25, 25	Return 25, 50, 25	Return 50, 0, 50	Return 60, 25, 15
Willingness to tradeoff column attribute x with (time to) Market							
0.25**	-0.47***	na	-2.35***	0.49**	0.08	-0.22	0.70**
Willingness to tradeoff column attribute x with Capability							
0.54**	na	-2.13***	-5.01***	2.54***	0.4	-1.11*	3.50***
Willingness to tradeoff column attribute x with Technical Failure							
0.11**	-0.20***	-0.43***	na	0.49***	0.08	-0.22**	0.70***
Willingness to tradeoff column attribute x with Cost (already incurred)							
na	1.87**	3.99**	9.35**	-4.58*	-0.74	2.08	-6.54**

Notes. *, **, and *** indicate the WTT estimate falls within the 90%, 95%, or 99% confidence interval, respectively. All confidence intervals calculated by the delta method following Hole (2007b) are available from authors upon request.

Conclusion

In today's business environment, innovation is critical to firm success. Therefore, understanding and researching how companies select their innovation projects is critical to help develop benchmarks that can be used by companies. A choice experiment was conducted with 85 executives of U.S. food and agribusiness companies. Survey respondents' stated preferences for innovation projects were elicited based on five criteria: distribution of potential return (market risk), risk of technical/regulatory failure, time to market, capability, and costs already incurred.

The results indicate that the magnitude of these considerations vary with companies preferring (in decreasing order of importance) projects with low risk of technical/regulatory failure, low relative market risk, short-term to market, in-house capability, and high costs already incurred. It is surprising to see such a high influence of the risk of technical/regulatory failure and a relatively lower influence of market risk. A possible explanation is that technical/regulatory risk, as distinct from market risk inherent in any new innovation, may be viewed as avoidable and therefore not entirely beyond companies' control when selecting innovation projects.

Global demand for food is expected to increase for at least another 40 years, with continuing population and consumption growth expected (Godfray et al. 2010). Given the need to feed this growing population in the years to come, food and agricultural industries may be able to meet these demands by achieving breakthrough innovations in their supply chains. However, the results of this research suggest that firms avoid choosing projects with a high risk of technical/regulatory failure, likely limiting the probability of achieving breakthrough innovations. It is, therefore, critical for firms to consider strategies to manage the risk of technical/regulatory failure if they cannot avoid it. For example, firms need to make sure they invest enough time monitoring and attempting to influence the regulatory landscape, and should develop formal processes to increase the probability of obtaining regulatory approval.

From a policy standpoint, governments should consider ways to reduce the technical/regulatory risk facing agricultural companies by clearly communicating the requirements, procedures, expectations, and timelines for regulatory processes. More transparent regulatory processes can reduce uncertainty that may hinder the innovation process within the agricultural sector and may facilitate more open innovation. Policy makers could stimulate open innovation through government sponsored research and cost-sharing programs that require partners (public or private). To address the challenges of open innovation, such as Intellectual Property Rights appropriation, better guidelines could be developed for companies to be more willing to engage in innovation projects with other firms and public research institutions.

Despite the limitations of research based on a small convenience sample of agri-food executives, this study reports results from a population not often surveyed and opens up a wide area of future research to study the innovation selection process of companies. It would be interesting to follow up on this study with a choice experiment designed to characterize market risk in a different fashion that would allow the estimation of tradeoffs between different probabilities of market return outcomes. New respondent demographics that may have an effect on the decision could also be identified. To match the decision-making process with reality, the survey could be done by several respondents from one company discussing and completing the survey together. In addition, several studies dealing with choice experiments (e.g. Revelt and Train 1998) have compared the effect of attributes from both stated and revealed preference data. Although analyzing revealed preferences in the case of innovation projects is likely to be cumbersome and require intense collaboration with companies, the results of such a study could significantly increase our understanding of the innovation process.

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Appendix

Table 1. Criteria Considered by Firms when Making Product Innovation Selection Decisions

Criterion	Definition	Studies
<i>Project Attributes</i>		
Reasonable financial return	Estimation of a reasonable return (revenue minus cost)	DePiante Henriksen and Traynor (1999), Ringuest and Graves (1989)
Time to market	The project's length of time from ideation to product launch	Mikkola (2001), Farrukh et al. (2000), Cooper et al. (1999)
Risk	Scientific/ technical, market uncertainty; probability of failure or success	Bard et al. (1988), Day (2007)
<i>Organizational Attributes</i>		
Relevance	Degree to which the proposed project supports the organization's mission and strategic objectives, and satisfies customers' needs	DePiante Henriksen and Traynor (1999), Day (2007)
Capability and Competitive advantage	Company's capability to produce and market the product compared to competitors	Day (2007)
Return to research	The impact of the project on basic research, synergistic concurrent project(s), and development of new projects or second generation innovation	DePiante Henriksen and Traynor (1999)
Internal competition	Will the project cannibalize firm's current offerings?	Bard et al. (1988)
<i>Market Attributes</i>		
Product demand	Is there a market? Is it big enough?	Day (2007), Ringuest and Graves (1989), Bard et al. (1988)
Competition/ Market share	What will be the number of competitors? How aggressive will they be? How successful will their product be?	Day (2007), Ringuest and Graves (1989), Bard et al. (1988)
<i>Environmental Attributes</i>		
Intellectual Property Rights/ Protection	Ability to achieve sustainable competitive advantage via patents or proprietary knowledge	Cooper et al. (1999)

Table 2. Attributes and Levels in the Choice Experiment Design

Attribute	Description	Levels	Coding
Cost	Level of cost already incurred in the project	Low	0
		High	1
Time to Market (Mkt)	Time for the innovation project/alternative to reach the market and generate revenue	Short-term	0
		Long-term	1
Technical Failure	Level of risk of technical/regulatory failure, i.e., intensity of technical and/or regulatory hurdles	Low	0
		High	1
Capability	Origin of needed capabilities for the project/alternative	The capabilities are available or will be developed in-house	0
		The needed capabilities come from other companies through some form of governance structures	1
Return 33, 34, 33	The innovation project/alternative has a (33%, 34%, 33%) distribution of potential return	Reference level for distribution of return dummy variables	-
Return 50, 25, 25	The innovation project/alternative has a (50%, 25%, 25%) distribution of potential return	No	0
		Yes	1
Return 25, 50, 25	The innovation project/alternative has a (25%, 50%, 25%) distribution of potential return	No	0
		Yes	1
Return 50, 0, 50	The innovation project/alternative has a (50%, 0%, 50%) distribution of potential return	No	0
		Yes	1
Return 60, 25, 15	The innovation project/alternative has a (60%, 25%, 15%) distribution of potential return	No	0
		Yes	1



International Food and Agribusiness Management Review
Volume 16, Special Issue 4, 2013

Competitiveness of the Orange Juice Chain in Brazil

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Abstract

This paper provides a detailed look at the orange juice production chain in Brazil including, the recent downturn of orange juice consumption seen in the global markets. This study is intended to provide more transparency and serve as a basis for deeper analysis for researchers, citrus growers, entrepreneurs and other stakeholders in the citrus industry. Looking to the future, the paper suggests a list of actions which need to be taken in order to increase the chain competitiveness.

Keywords: orange juice, production chain, global market downturn, Brazil

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Introduction

The orange juice chain is a unique commodity, since only two regions in the world are responsible for around 80% of the production—the states of São Paulo in Brazil and Florida in the U.S. São Paulo has a weather advantage because it is a hurricane free area with minimal risks of frost and drought.

Weather problems were cited as the major driving forces of growth for the Brazilian citrus industry when a frost hit the orange groves of Florida (U.S.) in 1962, which until then was the largest producer of oranges and orange juice. Consolidation of the Brazilian orange industry occurred definitively after the frosts returned to castigate Florida in the 1970s and 1980s. The union of highly developed citrus growing techniques and a competitive industry led Brazil to become the world's largest producer of oranges in the 1980s, surpassing the United States not only in production but also in citrus technology. Since then, Brazilian production has nearly doubled, and the United States has remained the second largest producer of oranges. But the U.S. is losing production year-by-year, and it currently accounts for less than half of Brazil's orange production.

Oranges produced in Brazil compete with other fruits in the vast array of consumer choices. Domestic consumption of fresh oranges is increasing, as consumers demand regularly prepared fresh squeezed orange juice in their homes, bakeries and restaurants throughout the nation—as is pasteurized juice, which is produced at factories that operate regionally. The domestic market for fresh oranges has become a major consumer of Brazil's total production. More than 100 million boxes of oranges (40.8 kg) – equivalent to approximately 30% of Brazil's production are consumed by the Brazilian population.

The biggest challenge to the production chain is in exported juice—the destination of the other 70% of Brazil's orange harvest. Orange juice is losing ground as other juices and beverages are introduced to markets with increasing frequency and steadily gain market share as they offer consumers fewer calories, lower costs, or they offer higher profit margins to bottlers and wholesale/retail networks.

Theoretical Framework

Marion Harper Jr. (1961) wrote, “To manage a business well is to manage its future; and to manage the future is to manage information.” From this sentence, the author exposes the need for decision makers to be constantly subsidized with new information which can help them develop new strategies and solutions.

An organization is defined by Bateman and Snell (2006) as a set of interdependent subsystems that is managed to transform inputs into outputs. It is an open system that interacts with the environment to select inputs which result in production. For Luhmann (2009), a feature of open systems is the ability of the structure to be modified based on the stimuli from the environment, leading to the formation of new structures.

Zylbersztajn (1995) stresses the need for a systemic approach in agribusiness, since there is a dependency relationship between the chain links and this relationship cannot be ignored. This interdependence is present in the concept of the food supply chain proposed by Folkerts and Koehorst (1997). For them, the food supply chain is a set of interdependent companies that work closely together to manage the flow of goods and services along the value-added chain of agricultural and food products, in order to realize superior customer value at the lowest possible costs. The members of these supply chains have to deal with the question of how they can best satisfy the demands of the retailers' customers and final consumers.

Since the interdependencies is not only between activities, but also between actors and the resources they use, Gripsrud, Jahre and Persson (2006) advocate that to better understand the issues related to the overall organization, as well as the actors in a distribution system, and the roles of individual companies in that context, is necessary to study the distribution arrangements from the perspective of the individual actors and also from the perspective of the distribution system as a whole. A holistic perspective must be the starting point combining insights from marketing channels and business logistics research.

Complementing the notion of interdependence between links in the chain, emerged the concept network. Omta, Trienekens and Beers (2001) define networks as agents within an industry and/or between industries that are related and potentially can work jointly seeking to add value to consumers.

Stevens (2001)(as cited in Omta et al. 2001) argues that a system that integrates the raw material suppliers, factories, distribution services and consumers is seen as a supply chain. Moreover, it is a concept network, in which organizations are directly involved in different processes that add value in the development of products and services, according to Christopher (1988) (as cited in Omta et al. 2001).

According to Neves (2013) the focus of a production system is the vertical relationships between the agents, whereas the network concept encompasses the vertical, horizontal and lateral relationships between independents agents, and therefore, a more general concept. Ménard (2002) treats the network as a hybrid form of governance and the agro-industrial system as a special case of network.

In this context, Reardon et al. (2009) showed the rapid restructuring of the agrifood industry between 1980s–2000, which included a shift from public to private standards, a shift from spot market relations to vertical coordination of the supply chain using contracts and market inter-linkages, and a shift from local sourcing to sourcing via national, regional, and global networks. This modernization was adopted to reduce costs and increase quality in order to strategically position companies in a sharply competitive marketplace.

Similarly, Shepherd (2007) emphasized the rapid transformation occurring in marketing systems, as traditional marketing channels are being replaced by coordinated links between farmers, processors, retailers and others. Moreover, consumers are becoming more demanding in terms of quality and safety and demographic and income trends are leading to increased demand for convenience foods, together with assurances of product safety. Thus, the adoption of a systemic

approach in agribusiness requires knowledge of the internal dynamics of each agricultural sector together with knowing the business environment, organizational structure and institutional environments as well.

Sonka and Hudson (1989) argued that agribusiness differs from other industries in five ways: 1) the unique cultural, institutional, and political aspects of food, domestically and internationally; 2) the uncertainty arising from the underlying biological basis of crops and livestock production; 3) the alternative goals and forms of political intervention across subsectors and among nations in an increasingly global industry; 4) the institutional framework leading to significant portions of the technology development process being performed in the public sector; and 5) the variety of competitive structures existing within and among the subsectors of the food and agribusiness sector.

Folkerts and Koehorst (1997), suggest an analytical approach to chain management that focuses on improved governance of chain strategy and activities, in reply to the change of the consumer demands that exerts an intense influence over the way the chain is structured and operates.

Given that the orange juice chain extends from the fields of Brazil to the retail segments of the world, especially—Europe and United States, this paper aims to present a more detailed analysis of the complex nature of this juice chain by providing a greater understanding of the business, variables, trends and challenges. To achieve this, the analysis is done from the perspective of the distribution system as a whole. As Gripsrud, Jahre and Persson (2006) proposed, to better understand the issues related to the overall organization. Within this context, the paper examines the needs to improve governance as recommended by Shepherd (2007) and show the restructuring of the orange juice sector is needed to survive in a sharply competitive context as commented by Reardon et al. (2009) to the general agribusiness.

Our hope is that the information presented in this study, can be useful to agribusiness managers and/or management scholars in developing new strategies for a more competitive future in this chain.

Methods

This paper utilizes a qualitative research method approach because it analyzes data from fieldwork observations, in-depth, open-ended interviews, and written documents, as Patton (2002) featured this kind of research. According to King et al. (1994), qualitative research includes a wide range of approaches, however, by definition, none of which are based on numerical measurements. The authors state that qualitative research tends to be focused on a single or a small number of cases, which makes use of intensive interviews or in-depth analysis of historical material. Although the number of cases is limited, qualitative research produces a range of information, generating a thorough understanding of the details of events or objects analyzed. Denzin and Lincoln (2011) align with the above authors and argue that qualitative research can be conducted when a detailed understanding of a particular issue is required and the solution depends on direct interviews with the people involved. Kvale and Brinkmann (2009) state that the research interview is based on the conversation of daily life and is a professional conversation, is it an inter-view, where knowledge is constructed in the inter-action between the

interviewer and the interviewee. An interview is literally an “inter view”, an inter-change of views between two persons conversing about a theme of mutual interest.

Interviews were conducted with large, medium and small companies in the orange juice chain in order to collect data and information through discussions. Some of the interviews occurred with participants attending the World Juice Conference held in Madrid, Spain in October, 2011. Other interviews were conducted with European bottlers and industrials at ANUGA held in Cologne, Germany, in October, 2011. Members of the Brazilian Association of Citrus Exporters (CitrusBR) in Brazil were surveyed through four months of immersion, by collecting individual and compilations confidentially, resulting in averages of data relating to the purchase of oranges in Brazil and sale of From Concentrated Orange Juice (FCOJ) in Europe and North America—such as the average of the production costs of orange and costs of manufacturing and worldwide distribution of FCOJ and by-products. The individual information collected from the companies were later returned in strict confidence and only the industry averages were analyzed. In addition, Tetra Pak Worldwide Center for Research and Development and Business Intelligence, in Modena, Italy, offered an immersion into global data regarding fruit juices.

Results and Discussions

Analysis of Consumption

Orange flavor stands out as the most widely consumed product among the fruit-based beverages ready for consumption. Analyzing the data of TetraPak (2013) from 40 countries representing 99% of worldwide consumption of orange flavor, one can see that the global consumption of orange juice fell -12.3% in the period from 2003 to 2012 (Table 1).

Table 1. Consumption of orange juice in the 40 top markets, grouped by continent, in 1,000 tonnes, 2003 to 2012.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Variation 2003/2012
North America	1,117	1,147	1,118	1,033	987	927	957	914	900	815	-27%
Europe	903	878	876	899	882	889	870	857	837	801	-11%
Asia	212	211	212	219	220	216	220	240	248	246	16%
Central & South											
America	93	84	88	91	92	97	103	111	119	136	46%
Oceania	60	61	63	64	66	65	64	64	64	64	7%
Africa	20	21	23	24	25	26	27	31	32	33	65%
Middle East	20	21	22	23	24	25	27	29	32	32	60%
Total	2,425	2,423	2,402	2,353	2,296	2,245	2,268	2,246	2,232	2,127	-12.3%

Consumption shown in the table does not include orange juice used in carbonated soft drinks, estimated at 70,000 tonnes of FCOJ a year.

Source. Prepared based on data from Tetra Pak Compass.

Among the 10 largest consumers, the most significant drop was in Japan, at -35% followed by Germany at -34% and then by the U.S. – by far the largest consumer market – with a decrease of roughly -29% (Table 2). The combined downturn in consumption in this three countries corresponded to a decrease of -412,000 tonnes of FCOJ equivalent in annual sales.

Table 2. Consumption of orange juice highlighting the 10 top markets, in 1,000 tonnes, 2003 to 2012.

By Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Variation 2003/2012
United States	1,002	1,029	985	924	882	826	851	807	791	708	-29%
Germany	256	231	211	213	201	199	188	188	184	170	-34%
France	152	147	153	158	163	163	168	165	159	158	4%
United Kingdom	140	136	136	138	129	140	136	135	133	126	-10%
Canada	115	117	133	109	105	101	106	107	109	108	-6%
China	44	42	48	56	60	68	74	89	102	101	130%
Russia	51	59	63	74	79	78	73	64	63	68	33%
Japan	92	97	95	95	92	76	74	75	65	60	-35%
Australia	53	55	56	57	59	58	57	57	57	58	9%
Brazil	45	37	40	41	37	38	41	45	48	55	22%
Other 30 countries	475	470	482	486	490	499	503	514	521	516	9%
Total	2,425	2,423	2,402	2,353	2,296	2,245	2,268	2,246	2,232	2,127	-12.3%

Consumption shown in the table does not include orange juice used in carbonated soft drinks, estimated at 70,000 tonnes of FCOJ a year. Data from 2003 to 2011 were reviewed by Tetrapak.

Source. Prepared based on data from Tetra Pak Compass.

Despite the decline in these major consumer markets, new facts have appeared that may represent new opportunities. There has been an increase in emerging markets, which are still relatively small and there has been a recovery in some of the traditional European markets. However, the solution could still be a long way off, because in those countries – with lower per capita income – the categories of nectars and still drinks have the strongest presence on the market. The explanation is a more affordable price to the consumer, because of the low juice content in these beverages. Along with nectars and still drinks, there are the other fruit flavors and other beverage categories, such as sport drinks, teas, coffee-based drinks, flavored milk, and flavored waters, which have experienced higher growth rates in consumption.

In 2012, the CitrusBR ordered a survey to investigate the reasons behind the orange juice decline in the global market. The study was conducted in 10 countries - Japan, U.S., UK, France, Russia, Poland, Germany, China, Norway and Canada - in which 106 experts were interviewed over six months. One finding revealed that in countries where there is growth in consumption, juice is positioned as a liquid healthy-food, nutritious, tasty and fresh. The idea of health is very important because it comes from a long held belief that it's important to consume vitamins especially in the winter (Pinto and Maresca 2012).

Another finding from the study revealed that the nutritional benefits of orange juice are usually remembered by the elderly. Since they experienced periods of war with scarce of food, juice was considered at that time to possess a full glass of energy and vitamins. But awareness of this

benefit was lost in subsequent generations, which suggests that it is one of the reasons for the drop in consumption. Overall, the results of the survey showed that (Pinto and Maresca 2012):

- orange juice is losing market share compared to other drinks: water (plain and flavored), teas, juice blends and fruit-based drinks;
- the issue of obesity is very serious and juice is being positioned as one of the villains;
- government and experts such as nutritionists and doctors are now recommending that patients eat the whole fruit instead of just the juice;
- a variety of innovative beverages have entered the marketplace;
- market positioning has had an impact on the reasons to consume. Juice is positioned for its freshness and flavor, competing with several other drinks in the same segment.

Retail

In countries that are major consumers of orange juice, sales are concentrated among very few retailers. This increases the bargaining power and suppression of prices and decreases alternative distribution channels for orange juice on the part of bottlers, according to European bottlers interviewed for this study. Table 3 shows that the participation of five largest retailers in food sales, by country, has been growing year- after-year.

Table 3. Market share of the five largest retailers in food sales in selected countries, 2000 to 2010.

Countries	2000	2005	2010
Israel	99.3%	99.5%	100.0%
Switzerland	80.7%	85.1%	92.1%
South Korea	58.5%	72.3%	84.4%
Austria	72.5%	71.9%	84.4%
Germany	66.4%	72.9%	80.0%
France	70.0%	64.8%	74.7%
Russia	60.9%	55.1%	74.4%
Canada	60.6%	54.8%	73.7%
Japan	66.6%	63.4%	66.5%
Spain	52.7%	56.7%	69.2%
United Kingdom	50.6%	59.8%	67.9%
Italy	69.6%	67.5%	67.1%
Poland	51.4%	41.6%	53.2%
United States	42.7%	45.3%	46.3%
Brazil	41.0%	40.5%	43.0%

Includes only modern food distributors; does not include small neighborhood retailers.

Source. Prepared based on data from Planet Retail and Abras.

Another interesting aspect of retail is the strategy for reducing retail costs and expenditures is the adoption of own brands, the so-called private labels or white brands. This type of product is systematically gaining ground on the market in relation to the traditional brands, since, in the developed nations, they offer the same standard of quality at a lower price. Consequently, manufactures of traditional brands are putting enormous pressure on all the links in the chain in order to ensure the market competitiveness of their products.

Price levels in 2011 – according to estimates by the bottlers– a retailer's net earnings are at least 0.10 euro for each 1-liter package of orange juice sold, that the conversion rate euros to dollars, 2011, makes the retailer's net margin reach US\$ 761 per tonne of FCOJ 66° brix equivalent. Therefore, according to the interviewees, over 70% of the profit margin in the productive chain is earned by retailers, while the remaining 30% of profit margin remains for the bottlers, processors and growers.

Therefore it is necessary to strengthen the position of orange juice in alternative channels, and within retail, to deal with the rising costs of the production chain, in order to maintain sustainability. It is also necessary for the product to have higher added value, so it can be sold at higher prices.

Bottlers

Bottlers companies that purchase Brazilian orange juice (FCOJ or Not From Concentrated - NFC), for use in their drinks with different blends and brands, have far-reaching consequences. Since Brazil exports 95% of its production (comparing production data from CitrusBR and exports data from the Brazilian Department of Foreign Trade at the Ministry of Foreign Development, Trade and Industry (SECEX/MIDC)), the country is highly dependent on these bottlers located abroad, and their successful bottling, distribution and marketing campaigns. Without bottlers, the orange juice produced in Brazil couldn't reach the supermarket shelves and thus be available to consumers. The bottlers are largely responsible for stimulating orange juice consumption.

The investments required for the construction and commissioning of these bottling plants are significant, and almost all of them throughout the world also bottle various types of fruit juices and other types of beverages such as non-carbonated and carbonated soft drinks.

In recent years, the beverage market has gone through a strong period of consolidation (Figure 1). According to CitrusBR, just 30 bottlers purchase and bottle the equivalent of 71% of the orange juice produced worldwide. Out of this total, the 10 largest orange juice bottlers account for 52% of the entire market. Today the better part of distributed juice is done by multi-product companies, where orange juice is just one more item from their large portfolio of beverages such as juices, nectars and non-carbonated soft drinks made from other fruit flavors; bottled waters; soft drinks; energy drinks; milk-based beverages; and other non-alcoholic beverages that invariably channel more marketing investments, giving more attention and priority to the categories of beverage production that offer the best profit margin at any given time.

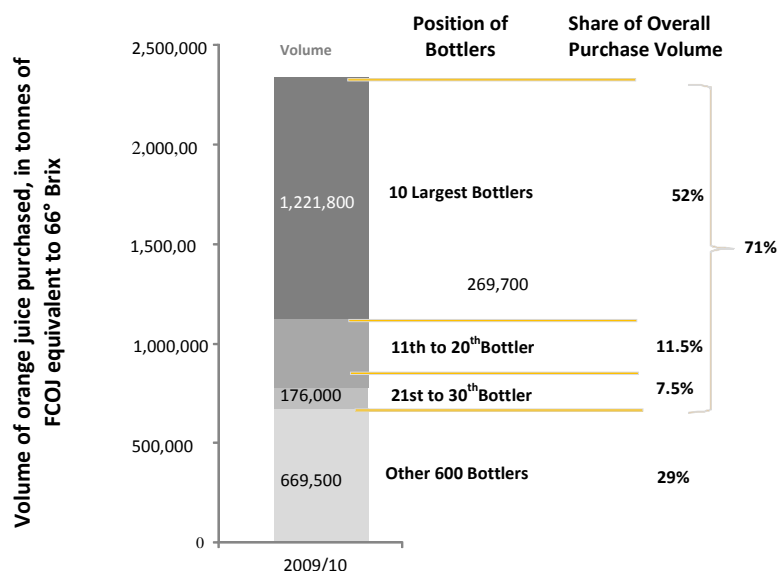


Figure1. Concentration of bottlers in the acquisition of orange juice around the world, 2009/10.

Source. Prepared based on data from CitrusBR.

Brazilian Industry

According to data from Foreign Agricultural Service (FAS) of United States Department of Agriculture (USDA), the global production of orange juice has decreased over the last few years and was below consumption in the 2008/09 season, according to data from Tetra Pak. In the last 15 seasons, from 1995/96 to 2009/10, the drop in worldwide production of juice was 13% (equivalent to 308,000 tonnes), with the largest reductions occurring in Florida (295,000 tonnes) and in the citrus belt of São Paulo (31,000 tonnes). Despite such decreases, these regions continue to lead world production of orange juice, accounting for 81% of all production.

Brazil is the largest producer and exporter, responsible for 53% of world production and exporting roughly 95% of this production.

In 2012, exports from the Brazilian citrus complex totaled 2.1 million tonnes of product and US\$ 2.6 billion in revenue, representing about 3% of Brazilian agribusiness exports (Table 4). The devaluation of the US dollar, coupled with rising costs from numerous stakeholders along the supply chain, caused the average cost of processing oranges to rise 224% over the period from 2003 to 2010, jumping from US\$ 347.54 to US\$ 534.28 per tonne of FCOJ.¹

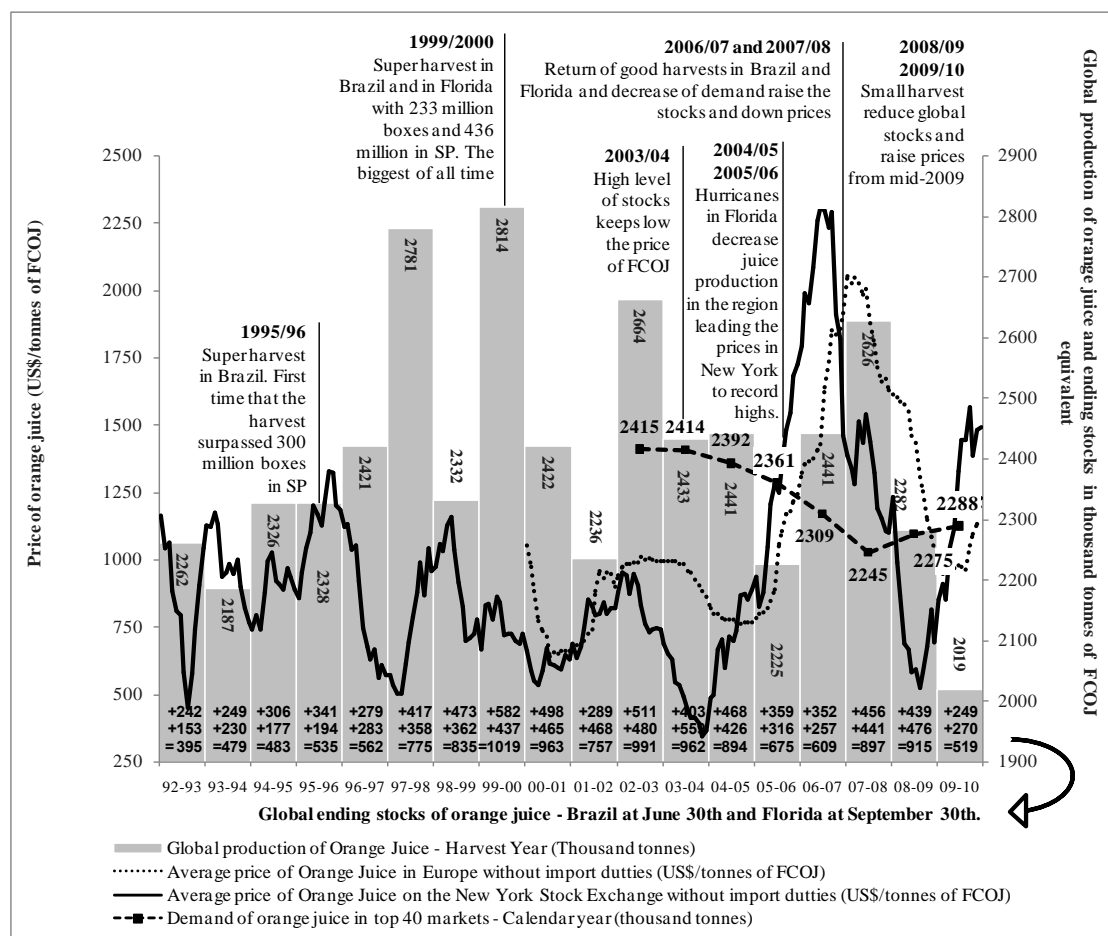
¹The cost of processing oranges was provided by CitrusBR.

Table 4. Exports from the Brazilian citrus complex, 2001-2012.

Year	Value (FOB)	Volume		
	Total exports from the citrus complex (US\$ million Total)	Processed products		Fresh oranges - Volume Exported (Thousand 40.8-kg box)
		FCOJ & NFC Conv. 66° Brix (Thousand Tonnes)	Other products & derivatives (Thousand Tonnes)	
2001	US\$ 986	1,348	1,261	3,421
2003	US\$ 1,375	1,362	1,015	1,667
2005	US\$ 1,273	1,403	929	751
2007	US\$ 2,507	1,416	962	1,219
2009	US\$ 1,839	1,301	851	642
2011	US\$ 2,722	1,155	435	816
2012	US\$ 2,593	1,097	405	539

Source. Prepared based on data from SECEX/MIDC.

Orange juice is a commodity with high volatility in production and prices, in contrast with a virtually constant demand (Figure 2).

**Figure 2.** Global production of orange juice, ending stocks and impact in prices at New York Stock Exchange and at physical market in Europe.

Source. Prepared based on data from CitrusBR, USDA, Foodnews, Tetrapak.

From one year to another, the difference in production reached 40% in the last seven years analyzed. Moreover, when observing the behavior of demand, the movements are much less abrupt and do not exceed 3%. In summary, the fact that 80% of world production is concentrated in São Paulo and Florida are the indices of productivity of orchards responsible for the great variability in the volume of orange juice being produced and offered to the market. These variations in short time period have caused the price of FCOJ to become highly volatile, causing great disturbances in the economic production chain. During this period there was a wide range of price fluctuation in the physical markets of Europe, ranging from an average of US\$ 712 per ton of FCOJ in January 2001 to US\$ 2,230 per ton of FCOJ in July 2007. In the New York Stock Exchange there was even greater amplitude. In May 2004, orange juice hit the floor with a daily average closing price of US\$ 0.56 per pound solids—equivalent to US\$ 396 per ton of FCOJ equivalent, tax free. In December 2006, it reached the roof with average daily closures of US\$ 2.0123 per pound in solids, an equivalent to US\$ 2,432 per ton of FCOJ equivalent, tax free.

The average prices without import duties shown in the graph were calculated based on the historical (averages) monthly deliveries of FCOJ to marine terminals in Europe as reported by the associates of CitrusBR. This is compared with historical sales (final prices) of FCOJ to bottlers. The prices were averaged without import duties and anti-dumping duties in the North American market and were calculated based on the average daily closing price and monthly sales of FCOJ in the New York Stock Exchange.

According to the interviews, the dynamics of the sector is influenced by several events:

- Climatic variability strongly impacts the volume of annual global production and global inventories of orange juice at the end of each growing season (carry-over stocks).
- The demand for orange juice, according to data from Tetra Pak, has shown slight changes in consumption from year to year, relatively independent from the amount of orange juice offered on the global market, since the final prices on store shelves undergo little change.
- The accentuated volatility of orange juice prices on the New York Stock Exchange and on the physical market in Europe is due to expectations of production and carry-over stocks of subsequent harvests.
- The increased firepower of retailers in a scenario of excess idle capacity on the part of juice bottlers (now estimated at more than 50% in Europe and roughly 30% in North America) causes negative pressure on selling prices to bottlers.
- The excess supply of orange juice to a small and increasingly concentrated portfolio of bottlers, which are idle and crushed by the retailers in turn, also causes negative pressure on selling prices of FCOJ from the orange juice producing industries, particularly in times of large harvests and oversupply of orange juice on the world market.
- In spite of a direct correlation, one can also see a natural lag between the monthly average quotes on the New York Stock Exchange and the average prices received by the industries on the European physical market, the main destination of Brazilian exports. Such lag stems from the fact that contract prices in Europe and Asia are

locked with bottlers for periods ranging from 6 months to 24 months, instead of the futures market that has low liquidity in periods longer than 6 months in the future.

As with other sectors in the world economy, the Brazilian citrus industry has been consolidating itself over time. This type of concentration is also witnessed in other sectors of Brazilian agribusiness, such as in beef and pork products, pulp and paper, sugarcane and chicken, among others. This trend is also present in the banking, automobile, mining and retail sectors. The consolidation of processors is justified by the quest for gains in efficiency generated by the economy of scale, such as, the dilution of fixed costs, and possibilities for setting up an efficient system for bulk storage and maritime shipping, as well as access to capital at competitive rates. However, the consolidation of processors does not happen in isolation, there are the links before and after the juice industry. The concentration of retailers is significant. In Germany, for example, the five top retailers control 80% of the sales of non-alcoholic beverages. In turn, the juice bottlers, who are direct customers for the orange juice exported by Brazil, follow the same path. According to CitrusBR, just 35 bottlers buy up 80% of the world's production of orange juice nowadays, with the remaining 20% being bought by around 565 bottlers. Following the same trend, the Brazilian orange producers are seeking gains in efficiency as a result of greater scale, the Brazilian orange producers have been swiftly consolidating—2% of them already own 55% of the trees in the citrus belt.

Producers

Orange growing is present in all Brazilian states. According to IBGE (Brazilian Institute of Geography and Statistics), oranges are the most widely grown fruit in the country occupying more than 800,000 hectares of crop land. Orange groves are expanding outside the state of São Paulo, which now accounts for 70% (2009/10) of the overall area cultivated. Although there has been growth in the area of orange groves in these regions, the total area dedicated to orange growing in Brazil has dropped by around 8% since the early 1990s. This decrease has not been accompanied by a reduction in the amount of boxes harvested. On the contrary, there has been a 22% increase. This inversion is the result of an impressive gain in productivity. The national average of 380 boxes per hectare, in 1990, jumped to 475 boxes per hectare by 2010. If today's citrus industry were the same as existed 20 years ago, it would take nearly 280,000 hectares more to reach today's production levels (Neves and Trombin 2011).

Some problems can also be seen in the orange production in Brazil, including rising production costs, as well as pests and diseases, which are decreasing profit margins of growers. The average operating cost of producing 100% of the oranges produced by industries in each growing season from 2000/01 to 2009/10 has been calculated. Table 5 represent the operating cost of producing around 35% of the oranges processed by industries in the state of São Paulo which come from their own orchards scattered throughout the citrus belt.

Table 5. Average operating cost of orange production of industry-owned orange groves (40.8-kg box)

Breakdown of production costs of company-owned orchards	2000/01	2009/10
Wages, comp. & fac. expenses, ppe ¹ , outsourced manpower	US\$ 0.30	US\$ 0.91
Pesticides and herbicides	US\$ 0.39	US\$ 0.49
Fertilizers (organic/chemical fertilizers, and soil additives)	US\$ 0.22	US\$ 0.41
Electricity	US\$ 0.03	US\$ 0.06
Expenditures on company-own vehicles and third-party services	US\$ 0.21	US\$ 0.17
Maintenance, servicing, and other expenses	US\$ 0.06	US\$ 0.17
Total expenditure on the trees	US\$ 1.21	US\$ 2.21
Harvest (wages, com. & fac. Expenses, nr 31, ppe)	US\$ 0.36	US\$ 1.19
Fruit Shipping Costs (Internal Removal, Shipping to Factories and Tolls)	US\$ 0.16	US\$ 0.56
Total costs ex-factory	US\$ 1.74	US\$ 3.96

¹ - Personal protective equipment.

Source: Prepared based on data from CitrusBR.

The analysis of operating production costs for the industry-owned orange groves for the ten-year period from 2000/01 to 2009/10, reveal that the cost of harvesting and shipping rose from 30% to 44% of the overall operating cost of orange production.

The higher costs of orange production underscores the need to rethink the management of citrus enterprises by adopting some solid production planning, long-term objectives and targets as well as implementation and allocation of resource strategies in order to achieve such goals. It is also important for the government to collaborate in this rethinking of production activity, and integrate future actions because of this sector's importance in generating jobs and income.

In citrus farming, there is a pressing need to increase productivity, in such a way as to reduce production cost per box of oranges. In order for there to be profitability by sending the fruit to industrial processing, there needs to be scale production, as well as compliance with relevant labor and environmental legislation. These requirements are more easily met by larger farms that use high technology and generally have an ideal size for a proper dimensioning of equipment, as well as stronger purchasing power for supplies. However, 87% of the growers in Brazil's citrus belt are small-scale growers (11,011 producers), producing on farms with fewer than 20,000 trees(fewer than 40 hectares). This group of producers owns only 21% of the total number of trees in the citrus belt (Table 6).

In 2009, 44% of the overall area planted in the citrus belt exhibited yield below what is necessary to turn a profit. An average of 280 boxes per hectare is produced in this area. This is a major difference when compared to the other properties that make up the other 56% of orange grove acreage, which on average produce 909 boxes per hectare (see Table 7).

Table 6. Stratification of growers in the citrus belt, by number of trees, 2001 and 2009.

Parameter	2001			2009		
	Trees (%)	Growers (%)	Number of Growers	Trees (%)	Growers (%)	# of Growers
> 400,000 trees	16.15	0.15	23	39.25	0.4	51
200,000 to 399,000 trees	7.65	0.25	38	7.35	0.55	69
100,000 to 199,000 trees	10.6	0.7	105	8.95	1.3	164
50,000 to 99,000 trees	12.4	1.75	263	10.75	2.95	372
30,000 to 49,000 trees	12.3	3.15	473	7	3.5	442
20,000 to 29,000 trees	8.95	3.9	585	5.3	4.1	518
10,000 to 19,000 trees	16.45	14.5	2.175	8	11.15	1.408
< 10,000 trees	15.45	75.55	11333	13.4	76.05	9603
Total	100.00%	100.00%	15.000	100.00%	100.00%	12.627

Source. Prepared based on data from CitrusBR.

Table 7. Stratification of orange production per range of yield in the 2009/10 growing season.

Range of Productivity	% of area (hectares)	% of boxes	Volume of boxes produced per range of yield	Yield (average boxes per hectare)
Over 1,400 boxes per hectare	2%	5%	16 million boxes	1,655
from 1,100 to 1,399 boxes per hectare	7%	13%	41 million boxes	1,209
From 800 to 1,099 boxes per hectare	19%	29%	92 million boxes	933
From 500 to 799 boxes per hectare	28%	30%	95 million boxes	639
From 200 to 499 boxes per hectare	36%	21%	67 million boxes	345
Below 200 boxes per hectare	8%	2%	6 million boxes	138
Total	100%	100%	317.4 million boxes	607
Total over 500 boxes per hectare	56%	77%	244.4 million boxes	909
Total boxes below 499 per hectare	44%	23%	73 million boxes	280

Source. Prepared based on data from CitrusBR.

This dynamic taking place in the Brazilian citrus industry explains why less efficient producers are unable to compete with more efficient ones, and have therefore, left the sector to focus on other crops. Those who remain in the citrus-growing business must find a more appropriate path for each of properties, i.e., a new strategy to run their farms, which could consist of cost leadership, differentiation, or diversification.

In addition to the cost of production, pests and diseases affect citrus production in Brazil and, undoubtedly, are a major threat to the nation's citrus industry. During the last decade, four diseases were responsible for the eradication of 39 million trees in the citrus-growing centers of São Paulo. Thus, the average annual rate of mortality, which previously hovered around 4.5% a year, jumped to 7.3%. Adopting an average yield of two boxes of oranges per tree, it is estimated that citrus canker (CVC), sudden death, and citrus greening were responsible for an annual reduction of around 78 million boxes, compared to the 317 million boxes harvested in 2009/10, representing a decrease in harvest of roughly 20%.

Conclusions

This paper has provided a detailed analysis of the complex nature of the orange juice chain, providing a greater understanding of this business, as well as the variables, trends and challenges.

Given this analysis, it is possible to see that the orange juice chain changed considerably. The changes seen throughout the productive chain have the same origin: an understanding that the end consumer does not want to and will no longer pay for the inefficiencies in the chain of supply. The demands of this new order have imposed challenges that cannot be met under the pretext of an isolated and static system. Only coordination of the chain as a whole and the incessant quest for efficiency and low costs will be able to boost the performance of all the links that make up the chain.

Probably, the orange juice sector will not realize the same future growth as other important sectors of Brazilian agribusiness. An important question for discussion is how to sustain the current market share. The answer is complex, but the authors present a series of steps that need to be taken and which have managerial implications:

1. Concentrate on marketing efforts aimed at recovering the loss of product consumption in major downturn markets;
2. Invest in development aimed at emerging markets involving industries; CitrusBR and the Brazilian agency to encourage exportations trade and investment in a promotion agency (APEX-Brazil);
3. Redeem consumers traditional values and repositioning orange juice as a liquid food;
4. Diversify distribution channels and efforts to development the brand "Drink Brazil", creating intimacy with the final consumer;
5. Support strategies to create a consumer pull effect through establishing one communication program working on one brand positioning for juice orange produced in Brazil. Such a mark could be used by bottlers international in order to add value to the product;
6. Develop of the domestic market;
7. Strengthen the representative associations to enrich the debate in favor of uniting the links in the productive chain;
8. Disseminate the best practices for agricultural management aimed at increasing the productivity and competitiveness of the chain;
9. Support citrus growers in technical and financial issues.

Additionally, it is necessary to create governance in order to establish the references, operating costs, and capitalization necessary to enable the identification of benchmarks for an equitable distribution from the results obtained through the production chain and exporters of orange juice. With this governance in full operation, the time and energy spent on settling disputes in the supply chain will be invested in the reconstruction of the entire sector, adding value aimed at the collective national interest in all aspects. It is believed that this contribution is important in this crucial time for the orange juice chain.

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International Food and Agribusiness Management Review
Volume 16, Issue 4, 2013

Smallholder Compliance with Private Standard Certification: The Case of GlobalGAP Adoption by Mango Producers in Peru

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Abstract

Our paper is a contribution to the literature exploring the patterns and determinants of smallholders' adoption of food standards. This case study focuses on the adoption of GlobalGAP by small-scale fresh mango producers in Peru. Based on primary data surveys, we find that a few smallholders comply with the standards because of the support received from exporters. The latter offers contract farming, including technical advice and the annual certification costs. Therefore, the paper underlines the key role of exporters in Peru as intermediaries and organizers in the way smallholders may participate in private standards in agrifood value chains.

Keywords: GlobalGAP, adoption, small-scale farmer, mangos, Peru

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Introduction

The last two decades have witnessed unprecedented changes in the agrofood sector through the proliferation of standards in international agricultural trade. After a period during which the states of developed countries actively implemented food safety standards (this has been exacerbated by a series of food scandals (Henson and Caswell 1999)), private food standards have rapidly penetrated agrofood markets (Reardon and Farina 2001). Expanding beyond their initial tiny market niche, they attend to rising consumer concerns regarding the conditions of production and trade of the goods they buy (Jaffee and Henson 2004). These voluntary standards on sustainable production generally combine a mixture of food safety, environmental, and social dimensions, while an inherent emphasis is given to product traceability. Consequently, standards not only affect the quality of final products, but also the whole organization of the supply chain (Reardon et al. 2000; Thorpe and Bennett 2004; Hammoudi et al. 2009). This significant change raises new opportunities and challenges for small export-oriented farmers in developing countries and has implications for agricultural development programs and policies.

The pattern of new standard adoption in developing countries has recently received much attention from economists. A wide range of empirical literature argues that standards may act as a barrier to market access for smallholders: the stringent conditions tend to lead to the exclusion of smallholders and the inclusion of larger farmers (Key and Runsten 1999; Dolan and Humphrey 2000; Escobal et al. 2000; Reardon et al. 2003; Augier et al. 2005; Vandermeer 2006; Unnevehr 2008; Fuchs et al. 2011). In fact, compliance with standards often requires considerable human, physical, financial, informational, and network resources. Lack of access to these resources and the certification costs are the most common factors explaining the non-compliance of smallholders with standards (Vorley and Fox 2004; Hatanaka et al. 2005; Henson and Jaffee 2006). On the contrary, some less pessimistic studies find positive effects, arguing that standards can be a catalyst for upgrade by improving farming techniques and product quality, thereby allowing them to participate in high-value added chains (Cocks et al. 2003; Henson and Jaffee 2008; Lee et al. 2010). Smallholders may be included in the high-standard market thanks to a contract-basis with the agro-exporters (Chemnitz 2007a; Chemnitz et al. 2007b; Maertens and Swinnen 2009; Minten et al. 2009; Asfaw et al. 2010a; Henson et al. 2011). Finally, since it didn't emerge any consensus among the different research works, it is becoming generally recognized that evidence is mixed (Henson and Jaffee 2008). Therefore, new debates arise over the degree to which compliance processes do indeed act to exclude smallholders (Henson and Humphrey 2009; Colen et al. 2012; Maertens et al. 2012) and with which conditions small farmers can really comply, pointing out both threshold capital requirements on the one hand and industry structure and institutional environment on the other hand that may greatly affect standard adoption by smallholders (Chemnitz et al. 2007b; Lee et al. 2010).

In this paper, we focus on the private GlobalGAP standard adoption by small-scale producers of fresh mangos in Peru. Fresh fruit production may greatly contribute to poverty reduction, thanks to the high labor intensive requirement and the high capita income generated (Lumpkin et al. 2005). However the opportunities of the fruit sector in developing countries can be restrained, here again, by the proliferation of standards (Vorley and Fox 2004), such as the GlobalGAP standard, which is the most important standard in export horticulture in the international produce market (Henson et al. 2011). Peru is an interesting case to study the effects and the determinants

enabling the standard adoption, because GlobalGAP has become “quasi” mandatory for the fresh mango exportation to the European Union (EU) since 2007 (Zoss and Pletziger 2007; Bain 2010; Souza and Amato Neto 2010). Actually, this standard is not mandated by law and thus remains ‘voluntary’, but the reality is that compliance with GlobalGAP has become an ‘entry ticket’ into EU (Campbell et al. 2006; Fox and Vorley 2006). Yet fresh mango is one of the major agricultural exports for Peru and two-thirds of mangos are exported to the EU.

Kleinwechter and Grethe (2006) have previously studied the adoption of the EurepGAP standard in the mango export sector in Peru in 2004-2005 (Kleinwechter and Grethe 2006). They have shown that the first major barrier to adoption is linked to accessing information about the standard. Since exporting enterprises were the most informed actors, the adoption of the standard is mostly found in their activities through vertical integration. According to the results of Kleinwechter and Grethe (2006), small-scale producers did not comply with EurepGAP certification in 2004-2005. Our research seven years later shows evidence that today, a slight percentage of smallholders comply with GlobalGAP as well.

Surveys with 228 small-scale mango producers were conducted from October 2010 to July 2011. Data was collected in the region of Piura, the main zone of mango production. Consistent with few others recent studies (Asfaw et al. 2009; Henson et al. 2011; Kersting and Wollni 2012), our findings show that the standard adopters comply with the standard thanks to the support of exporting companies through farming contracts, technical advice, and by paying the annual certification costs. Therefore, the inclusion of small-scale farmers ultimately depends on the compliance decision of exporters and their assistance to farmers in the compliance process.

The objective of this paper is thus a contribution to the current debate to what extent international standards may tend to exclude small-scale farmers from high-value food markets, and with which conditions some of them can eventually comply. We take underlying the fact that the role of intermediaries is essential to understanding the upstream decision to adopt private standards. Nonetheless, since the adoption of the standard by smallholders is very recent, it was not possible in this paper to measure whether the standard adoption allows really small-scale producers to be included in a more lucrative market.

The paper proceeds as follows: section two provides a background of mango production and trade in Peru and the evolving international trade towards standards; section three develops the empirical model and estimation strategy; section four describes the survey and data; section five presents and discusses the empirical findings; and section six concludes the paper.

Peruvian Fresh Mango Export Sector and Standards

Production and Trade

According to the World Bank definition, Peru is a low middle income country with a GDP of US\$ 152.8 billion and per capita income of US\$ 9,200 in 2010 (Worldfactbook 2010). In Peru, agriculture is still a source of economic development. It accounts for 8 percent of the GDP and provides 23 percent of direct and indirect employment (Inei 2008). Fresh mango is one of the major agricultural exports. Since 1985 with the first exports to the US, the sector has grown at

remarkable rates. Between 2000 and 2010, the cultivated areas increased from nearly 18,700 hectares to around 28,400 hectares and the production from 125,000 tons to 250,000 tons (Minag 2010). Peru exports around 30 percent of its national production (105,724 tons in 2009/2010) and is the fifth largest mango exporter in the world. Fresh mangos are by far the most important of exported mangos (87 percent of exported mango volumes in 2009, according to customs). Exports go to both the EU (65%) and US (35%) markets, but it is only since 2006 that the EU has surpassed the US as the main destination market (Figures 1 and 2)(Gerbaud 2010).

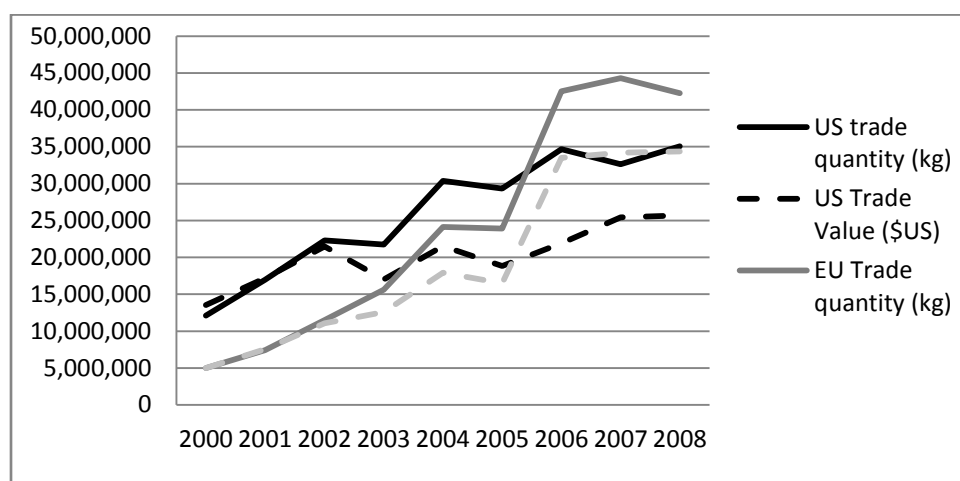


Figure 1. Evolution of Peruvian mango exports in the EU and the US (quantity and value) since 2000

Source. COMTRADE (2010).

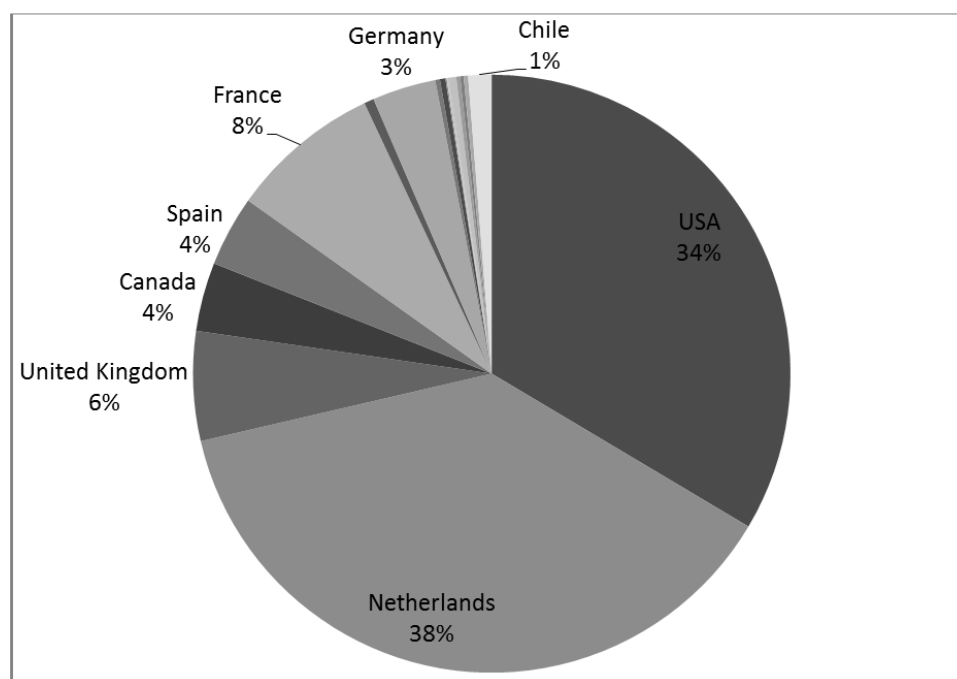


Figure 2. Export of Peruvian mangos in the world in 2010

Source. SENASA (2010).

For the EU market, Peru – the second largest supplier – competes with Brazil in November and December (Gerbaud 2010). Indeed the main mango harvested season is between November and March in the region of Piura where production is concentrated (around 70 percent of the national production and 90 percent of exported production). Varieties for domestic market (two thirds of the national production) and export market are nonetheless very segmented. The main mango varieties grown for the domestic market are the local variety Criollo, and the improved variety Edward. Improved varieties for export such as Kent (94.5 percent of export volumes) are not valued by the Peruvian consumers and Kent variety prices are substantially lower than those for the Edward or Criollo varieties on the domestic market. The domestic market alternative for Kent mango producers is thus not profitable; for them the international market is therefore the only lucrative market (Figure 3).

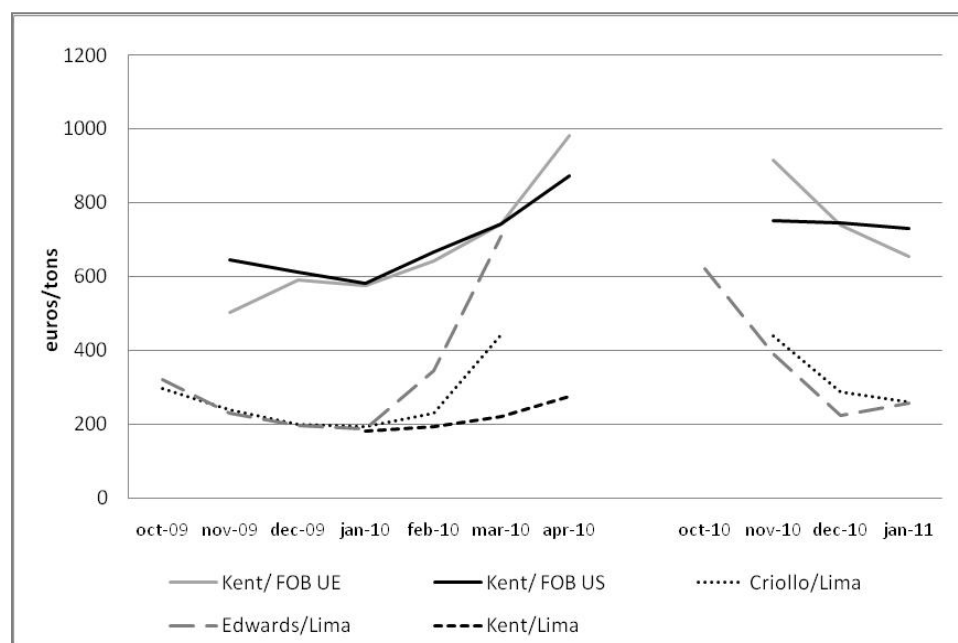


Figure 3. Mango prices according to varieties and targeted market (in euro/ton).

Source. According to the data from MINAG (2011).

On the other hand, the monthly FOB prices for exportation of Kent mangos to the EU and to the US are nearly similar for both markets (Figure 4). Nevertheless, there are some monthly or annual variations due to the other competitors for the targeted market (for instance, the EU market price was higher than the US price in November 2010 because of the shortage of Brazilian mangos on the international market, which was not the case in November 2009 (Gerbaud 2010).

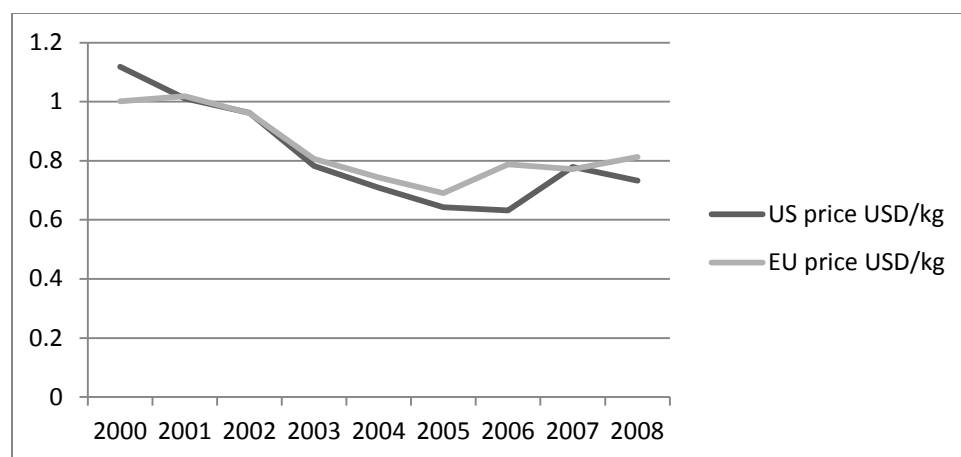


Figure 4. Evolution of Peruvian mangoes price in EU and US since 2000
Source. COMTRADE (2010).

Nonetheless, Peruvian mango growers face multiple inhibiting factors to export. The first constraint to accessing an outside market is a minimum volume required by the buyer (at least one container of 20 tons). This explains why small-scale producers (on average hardly producing 20 exportable tons) cannot export directly and work with exporters or form producer associations in order to get export market access. The second constraint is that the mango must meet commercial quality requirements (colour, appearance and size). The third constraint is that export-oriented producers require a phytosanitary certificate from the SENASA (Servicio Nacional de Sanidad Agraria del Peru) – the public agency in charge of eradication of the fruit fly. Lastly, the fourth constraint to accessing an outside market is due to the growing stringent non-tariff measures and private standards.

Non-Tariff Measures from the EU Market and Private Standards

For both the EU and the US markets, exports are required to respect the standard from Codex Alimentarius and maximum residual levels (MRL) for pesticides. Nevertheless, contrary to the US, the EU does not require hydrothermal treatments to kill fruit flies. Mangos exported to Europe are cleaned and then packed in 20 existing packing plants in Peru. Most of them are located in the Piura region. Barriers to trade in the EU are therefore much more relative to private standards: at the plant level, the HACCP is essential at the production level, organic certification has spread and GlobalGAP has become mandatory de facto since 2007 (Bain 2010; Souza et al. 2010; Zoss et al. 2007). Indeed, while European Retail Produce Good Agricultural Practices (EurepGAP) was developed by 13 European retailers, the Global Good Agricultural Practices (GlobalGAP) begin to have an expanding role as one of the major private standards in the international trade (Lee et al. 2010). Today, this standard is still not mandated by law and thus remains ‘voluntary’, but the reality is that compliance with GlobalGAP has become an ‘entry ticket’ into EU (Campbell et al. 2006; Fox et al. 2006).

As Chemnitz et al. (2007b) argue, the nature of the standard – namely the annual compliance cost, but also the type of capital required – may affect producers differently. The GlobalGAP

guideline ensures good agricultural practices focusing first on food-safety, but also a number of issues concerning environment quality (soil, water, and wildlife conservation), worker safety and hygiene, and traceability on the farm. The certificate includes some initial investments (such as toilets, canteens for workers, water taps, safety equipment, and storage facilities for agricultural inputs and outputs, respectively) that require substantial financial capital to upgrade the farm. It also entails annual costs for external inspection by a certification body. Finally, it requires that the producer knows how to read, write, and keep records – which means a high level of human capital.

Producers have two options to obtain certification under the standard: they can apply individually or apply collectively for a producer group certificate. Group certification is often the only possibility for small-scale farmers to become certified since it allows reducing individual cost of compliance.

In Peru, information on the GlobalGAP standard is relayed by government organizations, producer and exporter organizations, and NGOs. Concerning the cost of compliance, our interview results highlight a large variability of the compliance costs, ranging between 150 and US\$ 833/ha¹. This is influenced by the previous endowments in storage or other infrastructures and the technical level of the farm, but also by its size (since required infrastructure and technical levels are not size proportional). Some added costs are then spending for infrastructure maintenance. According to our first exploratory interviews with exporters, implementation costs remain the major constraint for farmers to adopt GlobalGAP standard. This is consistent with the Kersting and Wollni's findings (2012). In addition, the fixed cost of annual inspection in Peru is US\$ 2,000/year. This is high, all the more so without a premium in the product price. The size of an individual enterprise is thus a major determinant of standard adoption. According to interviews with supply chain's experts from the Piura agricultural chamber, the minimum profitable size to individually implement GlobalGAP is around 20 ha.

Export-Oriented Stakeholders

In Peru, most of the mango producers are smallholders (less than 20 ha of total land, according to the national census categories): 85 percent of them have less than 20 ha of total land including 15 percent who have less than five ha. This repartition and the rather small size of mango producers in Peru are due to the agrarian reform of 1969. In 2009, 1,627 producers were allowed to export their mangos by SENASA. Among these producers, 75 percent are smallholders (less than 20 ha of total land), 20 percent are medium farmers (from 20 to 50 ha), and 5 percent are large-scale farmers (more than 50 ha). They account for 30 percent, 30 percent, and 40 percent of exported produce, respectively (according to the data of Senasa, 2010). The mango-producing sector is little organized in Peru. According to an expert, this could be explained by the fact that there are lots of small producers and the mango season is very short, around three months.

In 2009-2010, there were 106 fresh mango-exporting companies (Senasa, 2010). There is a rather medium concentration of exports in few exporting companies: the top 10 represent 46 percent of

¹ In spite of a large variability in their results, Kleinwechter and Grethe (2006) calculate a compliance cost of US\$145 /ha/year on average and US\$9.51 /ton/year, that is 3.8 percent of the mango farm gate price.

the total export volume. However, when compared to the figures from 2005-2006 (Fulponi, 2007), this concentration in the mango-exporting sector has decreased during these last five years, revealing a still very attractive and expandable market: in 2005 there were around 70 mango exporters in Peru and the top six represented 54 percent; moreover the top one accounted in 2006 for 22.1 percent of the total fresh mango export and in 2010 only for 10.2 percent. Otherwise, there are still few foreign exporter enterprises (it seems there are only two for the moment) but since the sector has been attractive for foreign investments few years ago, we found Peruvian enterprises with a part of foreign capital (from the US, Colombia, Costa Rica, and so forth). Beyond attractive, the sector shows also a relatively low entry barrier since the concentration in the mango-exporting sector has decreased these last five years and the sector actors complain about the high number of small and very volatile exporter firms (60 percent treat less than 500 tons per year) that enter the market for short run market opportunities. These sporadic exporters are called “golondrinos” (meaning “swallows”). These firms, not demanding on quality and safety norms are subjected to the most border rejections.

Large exporters often own packing or treatment plants and are generally targeting both the EU and US markets. They have easily enforced quality, traceability, and certified production – in particular GlobalGAP. Indeed, they mostly rely on their own production (from 50 to 250 ha) and still tend towards increased vertical integration, even though land has become very expensive nowadays². However, there is large variability in mango production from year to year³. Thus, they generally complete their own production by purchasing from smaller farmers. Suzuki et al. (2011) also note, in their case study on pineapple exporters in Ghana, that this strategy is undertaken, at least in part, to shift quantity risks (Suzuki et al., 2011). Small-scale producers may thus have annual contracts (written or oral contracts, but hardly enforceable). Through these contracts, they steadily delegate harvests to the exporter (or a third party assigned to harvest on behalf of the packing plant), since it becomes very difficult to gather daily workers. In addition, in many cases, producers hardly have any access to credit to pay workers. A disadvantage to delegate harvests to the exporter is the high level of mangos discarded during the harvest – the discarded mango rate is on average 20 percent. Exporters are also in charge of carrying out transportation to the processing plant. Prices are rarely fixed and pay is often delayed. In some context, this type of contracts may be an option to assist small-scale farmers to achieve GlobalGAP certification (Asfaw et al., 2010b; Kersting and Wollni, 2012).

Empirical Model and Estimation Strategy

This paper questions to what extent international standards tend to exclude small-scale farmers from high-value food markets. The requirement of the GlobalGAP standard used in this case study can be considered an “external shock” to the EU export supply system. Indeed, while mango growers have seen a continuous positive growth in export dynamics since 2000, the new standard requirement may weaken many of them. We thus investigate the determinants of the adoption of GlobalGap by small-scale farmers. As Chemnitz et al. (2007) and Henson and Jaffee

² Escobal et al. found the same dynamic in the asparagus industry in Peru ten years ago (Escobal et al., 2000)

³ For example, the 2008-2009 season was disastrous in terms of production (due to agronomic reasons). Numerous producers mention a reduction of around 50 percent of their production level.

(2008) have already highlighted, the ability to comply with standards will depend on several factors at the country, market, and firm levels, as well as the specific food standards. Here, we have taken an essentially microeconomic approach, focusing on the determinants of farmer standard adoption at the farm level. We have characterized the country, the market, and the specificity of the GlobalGAP standard as an element of context in the section above. In this given context, we want to assess how farm characteristics determine farmers' compliance with the GlobalGAP standard. We thus model the farmers' decision whether or not to comply with the GlobalGAP standard as a standard static adoption decision, where adoption is determined by the incentives⁴ for and capabilities of farmers (Feder et al. 1985).

Regarding incentives, the GlobalGAP standard may offer farmers more demand reliability in terms of volume and/or allow higher prices. In our case study, the incentives are in part implicit to standard adoption and are further determined by farm characteristics themselves (size, bargaining power, and so forth). Therefore these factors will not be directly entered into the implementation model. Regarding capabilities, meeting the GlobalGAP standard requirement may imply the presence of or the investment in some physical as well as human capital. The GlobalGAP standard requirement is therefore hypothesized as determining a threshold capital requirement, which suppliers must have in order to benefit from the standard opportunity.

According to existing literature on the adoption of food quality standards, this threshold capital requirement may include physical capital (for examples, land, car, etc.), human capital (for examples, age, education, business experience), financial capital (for example, access to credit) and social and organizational capital (for example, group membership). Farmers with capital above this threshold capital requirement are expected to adopt the GlobalGAP standard if the incentives are there to continue to export for the EU market. Farmers with capital below this threshold capital requirement would be excluded from the GlobalGAP standard adoption and thus from the EU export chain.

We can refer to a conceptual reduced-form model defining standard adoption as follows:

For all i , we consider:

$$1) \text{ GlobalGAP}_i = \beta X_i + \varepsilon_i$$

GlobalGAP is a binary variable equal to one if the farmer i adopts the standard (and zero otherwise). X_i is a set of observed variables influencing the decision to adopt the GlobalGAP standard; other unobserved factors are summarized by the random variable ε_i .

We draw on the literature in order to derive hypotheses about the expected influences of the independent variables. It is worth mentioning that, for the estimation, we used lagged independent variables referring to the farm capital before the decision to adopt GlobalGAP or not (we used variables from 2006 since GlobalGAP has been become almost mandatory to export to

⁴ Nonetheless, since the adoption of the standard by smallholders is very recent, it was not possible in this paper to measure whether the standard adoption allows really small-scale producers to be included in a more lucrative market.

the EU since 2007). These lagged independent variables are used to control whether the standard adoption is due to an initial threshold capital and, thus, to ensure independency of these variables. In addition, we use variables referring to the farmer relationships to other agents of the marketing channels.

First, we assume that the standard adoption will mainly be determined by the farm's capital, which represents internal farm resources and access to external resources.

To capture the influence of human capital, we include the general household characteristics such as:

- an educational level beyond primary school. A low-level of human capital, in particular management ability, is found in empirical studies as an obstacle to the implementation of high standards (Okello 2005; Reardon and Timmer 2007; Asfaw et al. 2010b; Kersting and Wollni 2012). Yet, the GlobalGAP standard requires farmers to keep in-depth records of all their practices on the farm; we thus expect that more educated farmers are more likely to adopt the standard.
- experience as a farmer. The GlobalGAP standard requires high level of food safety and quality; it is hypothesized that farmer who have accumulate qualifications and build knowledge on producing mango over the years, may adopt the standard more easily. We test the experience squared as well, because we expect that older farmers (more experienced) won't, on contrary, invest in new practices for mango production.

Moreover, we take the physical capital into account by introducing farm characteristics such as:

- land under Kent mangos in 2006. Many authors argue that some stallholder-specific fixed costs of standard certification tends to cost small farmers more than their larger peers with economies of scale and lower transaction costs (Jaffee et al. 2005; Henson and Humphrey 2009; Barrett et al. 2011). Therefore, we expect that farmers with large areas of Kent mangos in 2006 were more likely to adopt the standard. Moreover they have a high incentive to adopt GlobalGAP in order to maintain their access to the EU outlet for their high amount of mangos.
- specialization in mango production in 2006 (land under mangos compared to total farm land area). Again, we expect that farmers who are more specialized in mango production in 2006, meaning that they are more dependent on mango revenue, are more likely to adopt the standard in order to maintain their access to the EU outlet.
- age of the production trees under 10 years. The quantity and quality of mangos depend on the age of the trees. We introduce this variable, which could be seen as a fixed investment, since we suppose a potential effect on GlobalGAP adoption.
- owning a mobile phone in 2006. As mango harvests are delegated to the exporter, a high level of coordination and communication is needed. We suppose that farmers with mobile phones in 2006 were more likely to adopt GlobalGAP.
- owning a car in 2006. Farmers don't have to transport mangos, nonetheless this variable should be interpreted as a proxy for the high level of the farm capital and the farmer's wealth. Yet the GlobalGAP standard requires substantial financial capital to upgrade the farm. We suppose that wealthy farmers are more able to make initial investments and to

pay for GlobalGAP certification – with the risks included (if there is no return on investment) – than others. We also integrate variables describing organizational and social capital such as:

- belonging to a producer organization. As we mentioned in the last section, producers have two options to obtain certification under the standard: either by applying individually or by applying collectively for a producer group certificate. In the case of small farmers who hold less than 20 ha, the standard adoption at the individual level seems difficult due to the fixed costs of compliance. The other option is thus that farmers organize themselves within producer organizations so as to comply collectively with standards. Moreover, forming producer groups may reduce costs at various levels (lower cost for external inspection, shared investments, and so forth) (Okello 2005; Narrod et al. 2009; Asfaw et al. 2010a; Belton et al. 2011). One could expect more positive results from GlobalGAP adoption when farmers belong to producer organizations.
- having had contracts with exporter in 2006. Annual contracts reveal confidence between producers and exporters. Since standard compliance often leads to stronger vertical coordination through farming contracts (Chemnitz 2007a; Chemnitz et al. 2007b; Maertens and Swinnen 2009; Minten et al. 2009; Asfaw et al. 2010a; Henson et al. 2011; Kersting and Wollni 2012). We expect that farmers who used to having contracts before 2006 are more likely to enter in this kind of relationship and adopt GlobalGAP.

Second, we assume that some variables referring to the market access will also determine standard adoption, such as:

- the distance to the plant. We suppose that farmers located far from the exporter plant are less likely to adopt GlobalGAP because of higher levels of transaction costs between them and exporters (less information, less confidence, and so forth). Literature underlines irregular market access (due to insufficient infrastructures or coordination problems) as a major obstacle to participating in the competitive market (Fafchamps et al. 2007; Barrett et al. 2011). Nonetheless, in our case study, this is the exporter who harvests. Therefore this variable is an exogenous variable that is more linked to the exporter's decision than the producer's one. This is a proxy of transaction costs perceived by exporter himself. In case where this variable comes statistically significant, that may reveal a selection from exporter side⁵.

Each of these explanatory variables is hypothesized to *ceteris paribus* influence the probability of standard adoption. We then estimate a probit regression model to test the hypothesis concerning the determinants of the adoption decision model defined above.

⁵ Contrary to Kersting and Wollni (2012), we were not able to control for the potential selection bias. However they do not find evidence for a selection bias in their model and finally calculate a univariate probit model to estimate GlobalGAP adoption, such as we do in our case study.

Data and Descriptive Statistics

Survey and Data

This empirical study was led in the framework of the European NTM-Impact Project (www.ntm-impact.eu), whose objectives include the analysis of the impacts of non-tariff measures (NTMs) from high-income countries – governmental regulations and private standards – on developing countries. Between October 2010 and May 2011, we undertook a survey of 213 mango producers in the main mango region of Piura, where over 90 percent of exported mangos originate. We focus our analysis here on small farmers with less than 20 ha and who represent 20-30 percent of mango exports and 70-80 percent of all mango producers. We randomly selected 19 villages located in Piura region where exporters' plants are found. Within these villages, producer surveys were chosen randomly among the farmers growing Kent mangos (export-oriented) with holdings of less than 20 ha (that is small farmer for whom individual GlobalGAP certification might be unprofitable). Surveys were conducted on a face-to-face basis. The data collected through the questionnaire include: household and farm general characteristics, household assets, mango production and marketing behaviour, mango standard certifications (organic and GlobalGAP), other activities, changes and perceptions since GlobalGAP has been required by exporters. This sample of 213 farmers is representative of the total small farms in Piura. Following this first wave of surveys, we found only eight percent of the sample (18 observations) which has adopted the GlobalGAP standard. To investigate the statistical significance of the determinants of the GlobalGAP adoption, we need to increase the sample of standard adopters. For this reason, a second wave of surveys was thus conducted during July 2011 among small farmers who comply with GlobalGAP. A total of 15 farmers were interviewed in this second wave. At this stage, the selection process of the whole sample (238 producers) was not random.

In addition to the farmer surveys, additional semi-structured interviews were conducted with 10 exporters and other supply chain actors (promoting agencies, state actors, leaders of producer organizations, and so forth) to collect supplemental contextual data allowing better understanding of various aspects of the mango supply chain in Peru. Finally, this primary data was supplemented with price information.

Characteristics of Farmers and Marketing Behaviors

Within our whole sample, the average farm size is 8 ha, 3.3 ha of which is dedicated to mango production (of which 85 percent is Kent mangos). All producers grow varieties for the domestic market and personal consumption (an average of 15 percent of their total mango crop surface). Some small-scale producers also grow lemons (39%), cereals (21%), and cocoa (6%). Among respondents, 80 percent say that mangos are the most important product grown in terms of cash flow. Some small-scale producers are also day laborers at other farms (13%) or have off-farm income (14%). On average, they have grown mangos since 1997, but most of them started after 2000, when exportation rose dramatically. Their distance from the nearest exporter plant is around 14 km.

From the first wave of surveys, that is the random process that led to a representative sample of small farmers in the Piura region, 31 percent of farmers surveyed have heard about GlobalGAP

certification and only eight percent are GlobalGAP certified. GlobalGAP certified producers are scarce, as one could expect for smallholders.

Thanks to the second waves of surveys, we collected data for 33 GlobalGAP adopters. In this sample of GlobalGAP adopters, the average certification date is 2009 (from 2007 to 2010). The compliance cost is US\$ 2,000 per year (without any variability among respondents). The certificate is sometimes paid by the producers themselves (8%), but mostly by the exporter (56%) or a producer organization (33%). Initial investments (such as toilets, canteens for workers, water taps) are more often paid for by the producers (91%) including 15 percent of farmers who have used credit from rural credit banks. Among respondents, 76 percent have decided to follow training courses for GlobalGAP implementation offered by the INCAGRO Peru project (an organization supported by the Peruvian Ministry of Agriculture and the World Bank to promote innovation in agriculture and partnership between public and private initiatives).

Table 1 compares producer characteristics according to standard adoption, using the student *t*-test and the Pearson's chi square test.

As presented in Table 1, the average total land size of GlobalGAP adopters is significantly lower than the non-adopters. However, the average size of land under Kent mangos is significantly higher than their counterparts. Regarding volumes in 2009, there are no significant differences among the groups. One of the main characteristics of GlobalGAP adopters is that they are more specialized in export-oriented mango production (77 percent of their total land area is under Kent mango production compared to 52 percent for the others). Finally, household characteristics show that GlobalGAP adopters are more likely to be a little younger and more educated than non-adopters. Experience and family size do not show any difference between the two groups.

Among variables related to market access, the distance is significantly lower for standard adopters. As we know that harvests are delegated to exporters, this could suggest that standard compliance may be more the result of an exporter's decision rather than that of the farmer. Other variables related to relationships with buyers, such as contracts and advance payments, differ significantly: we find that 66 percent of the producers who adopt GlobalGAP rely on written contracts. Contracts and advance payments attest to close relationships with the buyers. In the case of GlobalGAP adopters, farmers are also more likely to receive technical advice from the buyer compared to the control group. Nonetheless, standard adopters' buyers are not significantly more demanding in terms of commercial quality (color and weight) than those of their counterparts. Many empirical studies describe farming contracts as a key institutional arrangement in order to support smallholder participation in private standards (Jaffee and Henson 2004; Minten et al. 2009; Asfaw et al. 2010a; Barrett et al. 2011).

Table 1. Characteristics of adopters and non-adopters: summary characteristics and statistical differences.

	Non-globalGAP (n=195)	GlobalGAP (n= 33)
Farm characteristics		
Total land size	8.3	3.8***
Ratio of land size under Kent	0.52	0.77***
Volume of mangos 2009	25	21
Household characteristics		
Age	56.2	50.8*
Education level >primary school	0.45	0.66**
Experience	15.72	13.72
Children (<15 years)	1.6	1.8
Market access and relation w/ buyer		
Distance to plant	13.9	7.7***
Works only w/ 1 exporter	0.71	0.88*
Has written contract	0.12	0.66***
Technical advice	0.36	0.87***
Advance payment	0.14	0.69***
Month is important for buyer	0.11	0.12
Color is important for buyers	0.64	0.54
Weight is important for buyers	0.54	0.54

Statistical significance at the 0.01 (***), 0.05 (**), and 0.1 (*) level of probability

Results and Discussion

Based on maximum likelihood estimations, Table 2 presents the probit estimators of the conceptual model. In our dataset, individuals adopting GlobalGAP are oversampled so that the sample mean is more than the population mean. We calculate the average marginal effects (that is the average behaviour of individuals, (Bartus 2005)) that automatically adjust for any weight used during the estimation.

The high rate of pseudo- R^2 of the probit model indicates that there is probably a threshold level capital requirement, which farmers must have in order to adopt the GlobalGAP standard and enter in this high added-value chain.

Regarding human capital component, we found that *ceteris paribus* the number of years that the farmers have been growing mangos significantly increase the likelihood that they will adopt the standard. An extra year of experience would increase the probability of adoption by almost five percent. More-experienced farmers might be more aware of business opportunities and seem to move quicker towards new high-level quality requirements. The effect of an extra year becomes smaller the longer the farmer does this activity, as shown by the significance of the squared term.

This corroborates our hypothesis that older farmers won't invest in new practices for mango production.

Regarding physical capital component, we found no evidence that having more land area under Kent mangos increases the probability of adopting GlobalGAP. However, the specialization in mango production is positively correlated to the GlobalGAP adoption. This is as expected (marginal effect of almost 10 percent), since the farmer portfolio is reduced and these farmers are more likely to adopt standards in order to maintain their access to the EU outlet. The age of mango trees is also a determinant of GlobalGAP adoption. Trees aged five to ten years have better potential in terms of mango production quality and quantity than older trees, which explains a positive effect on GlobalGAP adoption. Finally, owning a mobile phone is a strongly positively determinant to explain standard adoption (marginal effect of 13.5 percent), whereas owning a car is not significant. Indeed, according to the organization of the chain (farmer delegate harvest to exporters), communication appears more essential than transport facilities. Having a mobile phone is thus a critical capital requirement for farmers who want to adopt the standard.

Table 2. Regression Estimation Results

Dependant Variable: GlobalGAP Adoption	Coefficient	Marginal
Human capital (Household characteristics)		
Education level >primary school	0.297	4.016
Experience as a farmer	0.369**	4.953
Experience as a farmer squared	-0.009*	-0.129
Physical capital (Farm characteristics)		
Land area under Kent mangos in 2006	-0.037	-0.501
Specialized in Kent mangos in 2006	0.736**	9.898
Mango trees between 5 and 10 years old	0.655*	9.340
Own a mobile phone in 2006	0.908***	13.524
Own a car in 2006	-0.599	-7.214
Social capital		
Belong to a producer organization	0.700**	10.352
Used to having contracts in 2006	1.058***	16.973
Financial capital		
Off-farm income in 2006	0.229	3.228
Market access		
Distance to the plant	-0.171***	-2.304
<i>Constant</i>	-3.735**	
<i>Pseudo-R²</i>	0.45	
<i>N</i>	201	

Statistical significance at the 0.01 (***), 0.05 (**), and 0.1 (*) level of probability

Regarding the social capital component, we found that farmers who are members of a producer organization are significantly (marginal effect of 10.35 percent) more likely to adopt GlobalGAP than their counterparts. In addition, when farmers have been used to having contracts, they are significantly more likely to adopt the standard (marginal effect of almost 17 percent).

Regarding access to external resources – namely financial capital through off-farm income – were not significant in predicting GlobalGAP adoption.

Finally, at the minimum, findings on the different types of capital suggest that certification is non-random and underlines the relevance of a threshold capital requirement (experience, specialization, young mangos trees, mobile phones, producer organizations) that accounts for endogenous selection.

Otherwise, we have assumed that some variables referring to market access, such as distance to the plant, will also *ceteris paribus* determine the standard of adoption. Estimation results show a strong negative correlation between the distance to the plant and the likelihood that the farmer will adopt the standard. An extra kilometre of distance to the plant would decrease the probability of adoption by 2.3 percent. Since it is the exporters who manage the harvest inside the mango farms and offer contract farming to small farmers for the GlobalGAP adoption, we think that the standard compliance may be more the result of an exporter's decision rather than that of the farmer. Standard implementation may increase transaction costs and agency costs (namely moral hazard) for exporters who will thus prefer nearby farmers. In a second stage, farmers choose whether or not to adopt the standard. According to these findings, exporters might select their GlobalGAP suppliers on the basis of these latter's distance to the plant and ability to become reliable suppliers over the long term (experienced, specialized, and used to respecting contracts). These farmers must also demonstrate their ability to deliver with short lead times (presence of mobile phone, distance to the plant). Moreover, adopters comply with the support from exporters most of time but also with the support of producer organizations. According to Barrett et al. (2011), membership in a farmer organization is an observable signal that helps the firms identify the best prospective suppliers because of the technical support, the economies of scale, the reduced transaction costs, and the group enforcement mechanisms.

Exporters play thus a key role as intermediaries and organizers in agrifood value chains, by deciding who and how suppliers will meet buyers' sophisticated demands. These results have been described in others cases (Kersting and Wollni 2012). Lee et al. (2010) argue that the influence of intermediaries on smallholders is particularly important in buyer-driven and producer-driven value chains. These cases are more beneficial to smallholders compared to bilateral oligopolies, where traders may be more vertically integrated.

Conclusion

This paper is a contribution to the debates on whether international standards tend to exclude small-scale farmers from high-value food markets. Drawing on a microeconomic approach, we investigated the determinants of small-scale farmers' adoption of GlobalGAP.

Data collected through a large number of surveys with small-scale export-oriented producers (228 surveys) show three main results: First, there is evidence that GlobalGAP adoption by smallholders exists, since eight percent of the representative sample is complying with GlobalGAP. Second, exporting companies support these farmers in complying with the standard through farming contracts, technical advice, and by paying the annual certification costs. This support allows small-scale producers to be included in the lucrative international market.

Therefore, while Kleinwechter and Grethe (2006) have shown previously that GlobalGAP-certified exporter companies tend to increase the vertical integration of the mango production, we observe nowadays that a mixed picture of their mango supply exists thanks to contract farming, allowing the integration of small-scale farmers into the high standard market. Consistent with other outcomes (Henson and Jaffee 2008; Lee et al. 2010), our results show that GlobalGAP standard doesn't act as a barrier for all the smallholders. Their inclusion depends thus on the exporter's support. Third, nonetheless, farmers who are integrating into this supply chain seem to be selected according to two characteristics: they are more specialized in mango production (more than 80 percent of their land) and they are located closer to the exporter plant. Exporters may thus decrease transaction costs by selecting productive farmers close to their plants.

This study aimed thus to contribute to the analysis of the conditions under which small-scale farmers are more likely to comply with a voluntary food standard. The latter is of interest to policymakers since Peruvian agriculture is a still source of economic development and represents a large source of employment. Adoption or not of growing international standards in different agricultural sectors is very important to analyse in order to develop adapted policy recommendations and support for farmers. However, the question is whether policymakers can do anything to facilitate the compliance of smallholders with new sustainable standards. While our results highlight that private firms may assist small capitally constrained and financially distressed farmers to adopt standard, we also agree with Cock et al.(2003), arguing that this assistance could be provided by third party facilitator, such as public aid agency. These authors have shown that the establishment of an integrated approach of assistance by public aid agency, covering product quality improvement program, product management, credit, leadership development, training in collective governance, and accountability, may allow groups in expanding ability of sustaining long term credible exchange relationships among producers and between producers' organisation and exporters. Furthermore, others authors have shown that donors and development countries' governments have identified the need for assistance and support of public-private partnerships with exporters (Humphrey 2008; Bignebat and Vagneron 2011; Kersting and Wollni 2012). For instance, to ensure to spread smallholders' compliance with international standards, the development of the public guidelines for good agricultural practices by product and the definition of a clear direction for technical assistance and support programs for small-scale farmers may be key elements of success (Jaffee and Henson 2004).

Finally, to pursue this analysis further, it would be interesting to measure the income and poverty effects of such high-standard trade (or even labour market effects) on small-scale farmers. Nonetheless, to do that, we would need to go back to the very date of standard adoption by farmers (it requires at least a whole year to register the short-term effects on price and income). In addition, more consideration must be given to analyse how industry structure and institutional environment of a given country affect the implementation of compliance with private standards.

Acknowledgements

This paper was made possible through the support provided by the EU NTM-Impact Project (www.ntm-impact.eu). The data and qualitative details were collected in Peru in collaboration with AVSF Peru. Thanks to Cesar Paz for helpful field work coordination.

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International Food and Agribusiness Management Review
Volume 16, Issue 4, 2013

Linking Wine Consumers to the Consumption of Local Wines and Winery Visits in the Northern Appalachian States

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Abstract

Wineries in the Northern Appalachian states have expanded significantly over the past 10 years, however, marketing still presents challenges in this globally competitive industry. We explore the linkages between general wine consumption and winery tourism. A market segmentation model is applied to local wine purchases and winery visit behavior. In this four state study of 1,609 wine consumers in Pennsylvania, Ohio, Kentucky, and Tennessee we provide insights into local wine purchasing differences among core, mid-level, and periphery wine consumers. We analyze the determinants of trying local wine and visiting local wineries. Finally, we examine differences in post-winery visit behavior. Our results suggest that the frequency of wine consumption and increase in wine knowledge positively influence the decision to try a local wine and visit a local winery.

Keywords: wine consumption, winery tourism, market segmentation, local winery promotion and post-winery visit behavior.

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Introduction

Wineries in the Northern Appalachian states have expanded significantly over the past 10 years, however, marketing still presents challenges in this globally competitive industry. Most wineries in this region depend heavily on tourism and on-site sales while differentiating themselves through experience-based value propositions. Transaction costs (search costs) for wine are high for both the winery and consumers because of asymmetric information and product proliferation (Maumbe and Brown 2013), challenging the success of new wines, new wineries and new wine-producing regions. Local origin labeling is one way to help new wine-producing regions market and establish a reputation for their products (Loureiro 2003); however, the product needs to be of high quality. Experience dimensions of products encountered at a winery can add further value and sustained differentiation as visitors bring past experiences with local products to purchases in later retail venues. Winery visits and appropriate marketing strategies can help local wineries in the Northern Appalachian states of Pennsylvania, Ohio, Kentucky, and Tennessee create increased awareness, differentiation, and value in a crowded wine market. These states share common geographic proximity and recent growth in the number of wineries, increasing from 76 in 2003 to 342 in 2011 (Woods and Ernst 2011a, 2011b), but have differences in wine marketing and distribution that could contribute to some differences in where and how consumers shop for local wine. Local wineries need to understand the linkages between general wine consumption, winery tourism, and the consumers' behavioral response following local winery visits in different retail settings as they create future marketing strategies.

We explore the linkages between general wine consumption and winery tourism in this paper. A market segmentation model is used following a Hartman consumer study on natural foods consumers (The Hartman Group 2000) and applied to local wine purchases and winery visit behavior. In this four state study of 1,609 wine consumers in Pennsylvania, Ohio, Kentucky, and Tennessee, we provide insights into channel participation differences among periphery (purchased wine at least once per year), mid-level (at least once per month), and core (at least once per week) wine consumers. We analyze the determinants of trying local wine and visiting local wineries. Finally, we examine differences in post-winery visit behavior across these groups. These results have important implications for local winery promotion in this region.

The objectives for this paper are: 1) to analyze the linkages between general wine consumption and local winery tourism; and 2) to determine differences in the behavioral response to local winery visits between core, mid-level, and periphery wine consumers. Successful marketing strategies are becoming increasingly important as wineries continue to expand in the Northern Appalachian states of Pennsylvania, Ohio, Kentucky and Tennessee. Winery visits are a major driver in local wine seeking and promoting by wine consumers at all levels, suggesting the experiential value dimension is carried forward into future purchases. Wineries need to understand the behavior and consumption patterns of their potential consumers to develop successful marketing strategies. Our analysis provides important results for local wineries with implications for strategic market development.

There are several general studies related to wine tourism in new regions. Dodd (1995) examines the characteristics of winery visitors in Texas. His results show that people with an existing knowledge and interest in wine are the main visitors to Texas wineries. These consumers have

high levels of wine consumption, high income and education levels. He suggests that new wineries should initially target this consumer group rather than introduce the product to new consumers. More recently, Rasch and Gretzel (2008) investigate how effectively Texas wineries market tourism. Their results indicate that wineries in Texas are missing strategic opportunities to market wine tourism to other areas. Current online marketing efforts are not sufficient to promote Texas wine regions in the state. Collaborative marketing efforts through websites can be an important tool to develop wine tourism in Texas. Wargenau and Che (2006) investigate wine tourism development in southwest Michigan. They find that alliances along the Southwest Michigan Wine Trail have advanced the development and marketing of wine tourism.

Regarding countries outside the United States, Tefler (2001) conducted interviews at 25 local wineries in the Niagara Wine Route to document the importance of strategic alliances to develop wine tourism. His results suggest that wineries that have taken an aggressive approach to tourism have benefited through increased sales. Charters and Ali-Knight (2002) examine the behavior and characteristics of the wine tourist by looking at the purpose of visit, general tourist motivation and relationship to other tourist activities in Australia. Bruwer (2003) conducted 125 face-to-face interviews with wine route estate enterprises in South Africa to study the wine tourism “product” offered. He finds that South Africa has an active wine tourism market with well-developed facilities and infrastructure. Most wine tourists are classified as “wine lovers”, who are also the most likely group to purchase wine during the visit. Martin and Williams (2003) describe the policies that influence the development of wine tourism in British Columbia, Canada. Jaffe and Pasternak (2004) determine the potential for wine tourism in Israel. Murphy, Ho and Chan (2005) examine the importance of website features and replies to consumer emails for Australian wineries. Their results suggest that the wineries studied are approaching the first stage in website evolution providing basic information. The wineries, however, are weak in providing societal and virtual information. They identify several opportunities for gaining competitive online advantages in wine tourism. Getz and Brown (2006) examine the consumer characteristics for long-distance wine tourism. A sample of 161 wine consumers in Calgary, Canada, revealed that highly motivated, long-distance wine tourist prefer destinations offering a wide range of cultural and outdoor activities.

Some studies focus on identifying the determinants of wine consumption. For example, Hussain, Cholette and Castaldi (2007) identify econometrically the determinants of wine consumption in the United States. They use 122 survey responses from Northern California consumers. The authors identify knowledge as the most important determinant of wine consumption, with knowledgeable consumers consuming larger volumes of wine, across all price points. Bruwer, Saliba and Miller (2011) conduct exploratory research in Australia to determine differences in behavior dynamics and sensory preferences of different consumer groups. They surveyed 150 visitors to ten wineries in the Yarra Valley wine region in Australia. The authors find specific differences by gender and generation. Preszler and Schmit (2009) conduct a survey of upscale restaurants and wine stores in New York City to identify the attributes influencing wine purchasing decisions. The authors find that larger, more expensive restaurants usually include fewer New York wines. Restaurants that serve more domestic wines, and Riesling and Cabernet Franc wines usually include more New York wines. Price, variety across several dimensions and wine’s collective reputation (region and grape variety) were the most important attributes influencing wine purchasing decisions. Wolf, Carpenter and Qenani-Petrela (2005) show that the

California wine market is segmented by age. Wine consumption behavior of Generation X consumers is different from Generation Y and Baby Boomers. The authors find differences in demographics, purchasing attitudes and behaviors among the different generations.

Most market segmentation studies focus on generational differences, in particular, identifying the preferences of Millennial (Generation Y) consumers (Thach and Olsen 2006; Fountain and Charters 2010) and how wineries are incorporating new components in their marketing strategy (Thach 2009). Thach and Olsen (2006) interviewed 108 Millennials. The authors describe the Millennials perceptions and attitudes regarding wine and what the wine industry can do to better market to them. Their results indicate that wineries need to advertise specifically to this group utilizing fun, social, and relaxed settings; innovative packaging and labels; and a focus on value wines. Millennials are also interested in learning about wine, taste enhancements and the environmental emphasis of the winery. Fountain and Charters (2010) use a modified mystery shopping approach to explore the expectations and experience of Generation Y as wine tourists, as compared to Generation X and Baby Boomers. The authors find that Generation Y participants placed an emphasis on enjoying the entire experience of the winery, not just wine tasting. Specifically, Generation Y participants want: relaxing and informal settings; a personalized experience; interaction with the staff; and different experiences depending on the type of winery. Thach (2009) investigates to what extent 208 US wineries are incorporating Wine 2.0 components in their marketing strategy. The author defines Wine 2.0 components as social networking, blogs, vlogs (online videos), and interactive e-commerce. Results suggest US wineries have not adopted Wine 2.0 components to a great extent as of the time of the study.

Few studies focus on more specifically on consumer attitudes towards new wine areas or areas that are new to wine tourism. Loureiro (2003) studies consumer response towards wine grown in Colorado. The author calculates the mean willingness to pay for Colorado environmentally friendly and Colorado regular wines. Her results suggest that wineries need to achieve a reputation for high quality to obtain a higher premium in differentiated markets. Kolyesnikova, Dodd and Duhan (2008) conduct a telephone survey to study consumer attitudes toward local wines in an emerging region, Texas. They find that the Texas wine market was segmented into four clusters: local enthusiasts, local detractors, local advocates and local non-advocates. The authors develop socio-demographic and wine consumption profiles for each cluster to help local wineries and marketers to establish new products. Marzo-Navarro and Pedraia-Iglesias (2012) study a region in Spain with a long wine-making tradition, but new to wine tourism, Aragon. The authors research the attitude of Aragon wineries towards wine tourism, and the wineries' ideas about how to further develop their marketing strategy to increase wine tourism in the region. They identify some of the characteristics necessary to develop wine tourism: good wine, good food, appropriate lodging, and complementary touristic activities. Most of the wineries in Aragon, however, are located in rural areas with little infrastructure. For Aragon to become an important wine tourism destination the tourism industry, the wine industry and the government would have to invest in infrastructure to provide the appropriate global experience for consumers.

Our results are consistent with general studies related to new wine regions, suggesting that the frequency of wine consumption and increase in wine knowledge positively influence the decision to try a local wine and visit a local winery. However, there are only a few studies using

econometric analysis of the characteristics and determinants of consumer behavior in terms of wine consumption and even fewer studies analyzing winery visits and post-winery visit behavior, as we describe in the following paragraphs. Our study also differs from previous studies by using a total of 1,609 useable survey data from wine consumers in the region. We obtained information on wine purchases, expenditure, preferences, knowledge, winery visits, post-winery visit behavior, preferences for local foods, and demographics.

Reputation is extremely important in wine consumption (Schamel 2009), also in the context of wine choices by patrons in restaurants (Preszler and Schmidt 2009), establishing legitimacy and regional identity for new wineries and wine regions (Sprouse, Ross, Chaddad and Gomez 2013), and agro-tourism (Sharpley and Vass 2006), creating a potential market penetration problem for new wine areas. Furthermore, all wineries need to understand what consumers need and want, which can only be done through a thorough understanding of consumer characteristics and how those characteristics affect consumer behavior. Our study contributes to the literature by analyzing wine consumption, winery visits, and post-winery visit behavior for the Northern Appalachian states of Pennsylvania, Ohio, Kentucky, and Tennessee. We identify differences in wine consumption, winery visits and post-winery visit behavior based on several characteristics: consumption level, demographic characteristics, preferences for local foods, among others. Our analysis provides important results for local wineries with implications for strategic market development.

Data

The data used for this study were collected through a web-based consumer survey using an existing consumer panel maintained by Zoomerang.com, an affiliate of MarketTools, Inc. The survey was administered during mid-September 2012 to a diversified array of consumers who are at least age above 21 from these four states: Pennsylvania (25.05%), Ohio (24.92%), Kentucky (24.98%), and Tennessee (25.05%). A total of 1,609 useable survey data were collected.

Following a Hartman consumer study on natural foods consumers (The Hartman Group 2000), the first section was designed to understand respondents' wine consumption and frequency on specific types of wine. The second part contains the respondents' wine knowledge and experiences with local wine and local winery visits. The third part attempts to understand respondents' post-winery visit behavior. And the fourth part comprises the demographic questions and some related questions, like purchasing behavior for the local food, preparing fresh food at home, and watching food channel programs.

This study focuses on the linkage between general wine consumption and winery tourism, thus, our survey attempts to extract the information associated with wine purchases, expenditure, preferences, knowledge, winery visits, post-winery visit behavior, preferences for local foods, and demographics. About 57% of respondents reveal that they have purchased wine for any occasion at least once per month during the past 12 months. In general, respondents buy more super wine (\$7-\$14/bottle) compared to popular wine (\$4-\$7/bottle), ultra wine (\$14-\$25/bottle),

and luxury wine (above \$25/bottle). Almost 50% of respondents classified their wine knowledge level in “average” and “above average” categories.

In terms of experiences on local wine and local winery visits, 38% of respondents have tried local wine within the past 12 months, and 45% of respondents have visited local wineries at least once during the past three years. The top three post-winery visit behaviors in terms of frequency are: actual purchase of a wine in the store, recommendation of the winery to a friend, and recognizing a wine in a store. We also include information on resident period in the state, the local concept in terms of mile range, local food purchases, food channel, and frequency of fresh food preparation at home. The definitions and descriptive statistics of these variables are presented in Tables 1 and 2 (see Appendix). The expected signs, actual signs and references for the independent variables are presented in Table 3 (see Appendix).

Several interesting results can be observed in the data relating wine consumers to local wine consumption and propensity to visit a local winery. The frequency of wine consumption in general, as one might expect, relates positively to the likelihood that the consumer had tried local wine within the past 12 months. Similarly, more frequent wine consumers are more likely to have visited a local winery at least once during the past three years (Table 4). These would appear to be favorable results from the perspective of local wineries wondering about the potential demand situation as wine consumption likely continues to increase in the region. Wine consumption per capita in the U.S. has been growing steadily for decades, although, at 9.4 l/capita, still well behind European countries like the UK (21.6) and Germany (24.5) and South American countries like Chile (18.8) (The Wine Institute 2013).

Methodology

We use a market segmentation model following Wells and Haglock (2005) who used the Hartman consumer study on natural foods consumer lifestyle segments and applied this model to local wine purchases and winery visit behavior (The Hartman Group 2000). The concept of differentiation through experience goods is discussed by Besanko et al. (2010) based on the seminal work exploring search and experience goods by Nelson (1970) and explored specifically in the context of marketing wine through wineries. In the four-state study of 1,609 wine consumers in Pennsylvania, Ohio, Kentucky, and Tennessee we provide insights into channel participation differences among core, mid-level, and periphery wine consumers. We analyze the determinants of trying local wine and visiting local wineries. Approximately 45% of wine consumers reported visiting a local winery at least once during the past three years. We examine differences in post-winery visit behavior across these groups.

The linkage between general wine consumption and winery tourism can be studied from consumers' past experiences. We use a logit model to analyze the characteristics of consumers that: 1) have tried a state local wine within the past 12 months, and 2) have visited a state local winery during the past three years. The time range is a little arbitrary, but tries to balance the expected low frequency of visits and the ability of a respondent to recall details associated with the visit. The logistic regression model specifies

$$(1) \quad p = L(x_i'\beta) = \frac{e^{x_i'\beta}}{1 + e^{x_i'\beta}}$$

where $L(\cdot)$ is the standard logistic distribution function, x is a regressor vector, and β is a $K \times 1$ parameter vector. The estimated parameters in a logit model are not easy to interpret directly, thus, we calculate the marginal effects to interpret the parameters:

$$(2) \quad \frac{\partial p_i}{\partial x_j} = \frac{\partial \Pr[y_i = 1 | x_i]}{\partial x_{ij}} = \frac{\partial L(x_i'\beta)}{\partial x_{ij}} = \frac{\sum L(x_i'\beta)[1 - L(x_i'\beta)]}{n} \beta_j$$

Following random utility theory, consumers are assumed to optimize their utility for their choices to try state local wine and visit state local winery. As a result, their decision of trying local wine and visiting a local winery can be explained by demographic factors, food consumer behavior factors, and wine consumer attributes. The demographic factors are gender, age, race, income, education, family with kids, urban versus rural, state differences, and length of residency in the state. The food consumer behavior factors are whether consumers purchased locally produced foods, how far from their home is considered local, whether consumers watch food channels, and whether they prepare fresh food at home. The wine consumer attributes are wine knowledge, frequency of wine purchasing, and purchasing frequency by price category.

The definitions and summary statistics of dependent and independent variables are exhibited in Tables 1 and 2. Approximately 38% of consumers have tried local wine and 45% have visited state local wineries. The model specification is: for those consumers who have tried a state local wine is:

$$(3) \quad Y = \beta_0 + \beta_1 \text{Male} + \beta_2 \text{Age} + \beta_3 \text{White} + \beta_4 \text{Income} + \beta_5 \text{Income}^2 + \beta_6 \text{Education} + \beta_7 \text{Kids} + \beta_8 \text{Urban} + \beta_9 \text{PA} + \beta_{10} \text{KY} + \beta_{11} \text{TN} + \beta_{12} \text{Residency2} + \beta_{13} \text{Residency3} + \beta_{14} \text{Buy_local2} + \beta_{15} \text{Buy_local3} + \beta_{16} \text{Local_range} + \beta_{17} \text{Food_channel} + \beta_{18} \text{Prep_freshfood2} + \beta_{19} \text{Prep_freshfood3} + \beta_{20} \text{Wine_knowledge2} + \beta_{21} \text{Wine_knowledge3} + \beta_{22} \text{Mid_level} + \beta_{23} \text{Core} + \beta_{24} \text{Popular_wine} + \beta_{25} \text{Super_wine} + \beta_{26} \text{Ultra_wine} + \beta_{27} \text{Luxury_wine} + \varepsilon$$

here Y represents *Local_tried* or *Winery_visit*, depending on the model, β_s are the coefficient estimates, the variables are defined in Table 2 (see Appendix), and ε is a standard logistic distributed error term. Table 3 (see Appendix) includes the expected and actual signs for the coefficients estimates and the previous studies that have used the same or similar explanatory variables.

Consumers were asked to indicate the frequency of post-winery visit behaviors, a series of future actions either at another retail store or during a subsequent visit to the winery. Only 713 out of 1,609 respondents indicated they had visited a winery within the past three years. For each post-winery visit behavior, consumers were asked to choose an ordered frequency response: “1: hasn’t happened,” “2: once,” “3: 2-3 times,” and “4: more than 3 times.” Respondents could mark one category as an indication of the frequency regarding their post-winery visit behavior. Hence, an

ordered logit model is individually applied to these seven post-winery visit behaviors, which are explained by the same set of independent variables in equation (3).

We divide the post-winery visit behaviors in two groups: four in-store behaviors and three additional winery visit behaviors. The in-store behaviors are: recognizing a wine in a store; asking about the availability of a wine in a store; actual purchase of a wine in the store; and purchase of another state local wine in the store. The additional winery visit behaviors are: recommendation of the winery to a friend; follow-up visit to the same winery; and visit of another winery in local state.

The ordered logit model is based on one latent variable (y_i^*) but with a different match to the observed independent category ($y_i = 1, 2, \dots, M$). It can be specified as:

$$(4) \quad y_i^* = x_i' \beta + u_i.$$

For an M -alternative ordered model we define:

$$(5) \quad y_i = j \text{ if } \gamma_{j-1} < y_i^* \leq \gamma_j,$$

where $\gamma_0 = -\infty$ and $\gamma_M = \infty$. Then, the probability of chosen alternative j is the probability of latent variable (y_i^*) between two unknown boundaries γ_{j-1} and γ_j . Assuming that u_i is i.i.d. the ordered logit model has a logistic cdf: $F(z) = e^z / (1 + e^z)$. In this case M equals 4 and is also a cumulative outcome. We can frame our ordered logit model as:

$$(6) \quad y_i^* = x_i' \beta + u_i.$$

$$(7) \quad y_i = 1 \text{ if } y_i^* \leq 0,$$

$$(8) \quad y_i = 2 \text{ if } 0 < y_i^* \leq \gamma_1,$$

$$(9) \quad y_i = 3 \text{ if } \gamma_1 < y_i^* \leq \gamma_2,$$

$$(10) \quad y_i = 4 \text{ if } y_i^* > \gamma_2,$$

where the y_i^* can loosely be interpreted as “how likely wine consumers would reveal their post-winery visit behavior.” The ordered logit model in this study was estimated using the logistic procedure with the descending option in SAS. This option allows us to interpret the positive coefficient, which also corresponds to an increase in the value of the dependent variable.

We use maximum likelihood to estimate the ordered logit model. The estimated coefficients cannot be directly interpreted, thus, we calculate the odds ratios by taking the exponent of the estimated coefficients. A positive odds ratio means that the odds of a specific post-winery visit behavior increase with a higher value of the explanatory variable. A negative coefficient has an odds ratio between 0 and 1, which decreases the odds of a specific post-winery visit behavior for the explanatory variable.

The ordered logit model assumes that the estimated parameters between each pair of outcome groups are the same. This is called the proportional odds assumption. The logistic procedure in SAS provides a Chi-Square Score Test for the examination of the proportional odds assumption. A rejected null hypothesis for the proportional odds test suggests that the one-equation model is not valid and we should fit a less restrictive model, like a multinomial logit model.

Results

Local Wine Purchasing and Frequency of Wine Consumption

Following the frequency of consumption in the Hartman consumer study, wine consumers were segmented into three groups: periphery (purchased wine at least once per year), mid-level (at least once per month), and core (at least once per week). Table 4 shows the percentage of consumers in each group based on local wine purchases, local winery visits and post-winery visit behavior. Over half of the wine consumers in the core group have tried local wine and visited local wineries; however, only less than half of wine consumers have tried local wine and visited local wineries in the periphery and mid-level groups. In terms of post-winery visit behavior, core wine consumers are more likely to purchase a wine from the winery in a subsequent visit to another retail store and are more likely to recommend the winery to a friend. These observations reveal that wine consumers in each group behave differently. Therefore, it is necessary to explore the characteristics of each group of consumers.

Table 4. Local Wine Behavior by Frequency of Wine Consumption^a

Behavior	Periphery (N=682)	Mid-level (N=732)	Core (N=195)	Total ^b (N=1,609)
<i>Local_tried</i>	30%	43%	54%	38%
<i>Winery_visit</i>	38%	49%	61%	45%
Post-Winery Visit Behavior				
Behavior	Periphery (N=246)	Mid-level (N=348)	Core (N=119)	Total ^c (N=713)
In Store:				
<i>Recognize brand</i>	54%	76%	76%	68%
<i>Ask about availability</i>	43%	64%	78%	59%
<i>Purchase same local</i>	75%	82%	82%	80%
<i>Purchase other local</i>	46%	60%	67%	57%
Winery Visit:				
<i>Recommend same</i>	66%	80%	79%	75%
<i>Visit same</i>	54%	68%	75%	65%
<i>Visit other</i>	48%	62%	66%	58%

a –the initial survey question allowed for an extent of frequency of each behavior; “hasn’t happened”, “once”, “2-3 times”, and “more than 3 times”. These percentages represent “hasn’t happened” or “happened”.

b –frequency of local wine trial and winery visit by wine consumption is measured here across all wine consumers responding.

c –frequency of post-winery behaviors is reported by frequency only for the sub-set of consumers indicating they had visited a local winery within the past 3 years.

This study places a special emphasis on the relation between winery visits and post-winery visit behaviors that potentially have some reflection on the quality of the winery experience and/or bearing on future local wine purchasing. Within the full sample of wine consumers is a subset of those that actually visited a winery – 713 of the 1,609 (44.3%). Selected behaviors following a visit to a local winery are evaluated in more detail later, but initially we explore the relation between in-store and future winery behaviors across frequency of wine consumption in general. There appears to be a medium to strong positive relation between frequency of wine consumption and the range of in-store behaviors (Table 4). More frequent wine consumers are more likely to recognize and ask about a wine coming from a winery they have visited, as well as purchase other local wines. The frequencies of each of these in-store behaviors are relatively high given that many wineries in the region are fairly small, typically with limited distribution outside of the winery.

Post-winery visit behaviors involving recommending the same winery, actually visiting the same winery again, and subsequently visiting other local wineries also appear to be positively related to the frequency of wine consumption. In sum, initial winery visits have clear positive impacts both in subsequent retail purchase settings and future winery visits – an important component to building the local wine awareness and experience.

Determinants of Trying Local Wine and Visiting Local Wineries

The logit models examining the likelihood of trying a local wine within the past 12 months and visiting a local winery within the past three years provided more detail with respect to other variables explaining variation. These models were estimated using the full sample of 1,609 regional wine consumers and are summarized in Table 5 (see Appendix). More senior wine consumers and those indicating an urban residence were less likely to indicate they had tried a local wine. Tennessee consumers also were less likely to have tried a local wine relative to the omitted Ohio consumer group. Income had a positive effect but at a decreasing rate (given the negative squared coefficient). White ethnicity, makes significant local food purchases in general, wine knowledge, and wine frequency (both mid-level and core compared to the omitted periphery group) were all positively associated with the likelihood to consume local wine. Frequent consumption of mid-priced wines (both Super and Ultra categories – typical of the price range of many local wines) also was positive.

The likelihood of visiting a local winery within the past three years was negatively influenced by age, urban residency, and the miles defined as local – suggesting the more narrow the individual's geographic concept of local the more likely they were to have indicated having visited a local winery. Kentucky wine consumers were less likely to have indicated visiting a local winery compared to Ohio consumers. Male consumers, those indicating making more frequent local food purchases, those more frequently preparing fresh food at home, watching food channels, consumers indicating greater wine knowledge, and more frequent consumption (Core) were each positively associated with the likelihood of having visited a local winery. Income, similar to trying local wine, was positive but at a decreasing rate.

Determinants of In-Store Purchase Behavior Post-Winery Visit

Possible determinants of four selected in-store behaviors are examined among those respondents that indicated they actually visited a local winery (Table 6, see Appendix). The frequency of each behavior is summarized in Table 1 (see Appendix). Of course it is difficult to determine if the retail experience caused the winery visit or the other way. Further, there is a likely cognitive limit to behavior recall across the behaviors explored. It is reasonable, for example, to expect a respondent to have a better recollection of purchase frequencies than recognition frequencies associated with a local wine, especially since we allow for visits as far back as three years to be included. At the very least, we want to explore here joint recognition of the brand and to get some sense of awareness and promotion complementarity between the winery and other retail settings. The frequency of each in-store behavior was framed in an ordered logit model for each behavior based on the recalled extent of frequency of each behavior; “hasn’t happened”, “once”, “2-3 times”, and “more than 3 times”.

Consumers were asked first if they recognized a wine in a store following their visit, exploring brand recognition carrying into another setting. The ordered logit regression suggested that age and urban residency adversely affected recognition of the local winery brand. Tennessee and Pennsylvania consumers were also less likely to recognize the brand relative to Ohio consumers. Male, local food orientation, wine knowledge, and wine consumption frequency (particularly Mid-level) positively impacted recognition. More frequent consumption of popular, super, and luxury wines also contributed positively to recognition. The odds ratio allows us to interpret the coefficients in terms of relative likelihood of a higher value for the independent variable. A positive coefficient estimate, such as BUY_LOCAL3 at 1.432 with an odds ratio of 4.187, means the odds of recognizing a local wine in the store following a winery visit is 4.187 times more likely for those consumers indicating positively that they “often” or “always” purchase what they know to be locally produced foods. The odds ratio, then, allows us to not only determine the positive or negative effects, but the magnitude of the effect.

The second in-store behavior inquired whether the consumer had asked about the availability of a wine in a store following a winery visit. The regression suggested age and income as the only negative variables – older and wealthier consumers are less likely to inquire. Longer in-state residency, greater wine knowledge, and more frequent consumption were all positive. Consumers that frequently purchased higher end wines (ultra and luxury) were also more likely to inquire. Kentucky consumers were more likely to inquire when compared to those in Ohio. Length of residency had the strongest influence on this behavior; consumers that were residents for more than 10 years were 2.625 times more likely to inquire about availability than those that had lived in the state for 1-4 years.

The third and fourth in-store behaviors explored whether consumers indicated they actually purchased a wine from the winery at the store or, related, whether they purchased a wine from another local winery. Purchasing wine from the visited winery was negatively affected by age and urban residence – younger and non-urban consumers were more likely to make this purchase. Male, length of in-state residency, strong tendency to buy local, and high wine knowledge were positive factors influencing both the likelihood and frequency of purchasing wine specifically from the winery visited and purchase wine from another local winery.

Consumers that frequently watched the Food Channel were more likely to purchase wine from another local winery, as were Kentuckians relative to wine consumers in Ohio.

These in-store behaviors are different, each with different implications for local wine marketing. Different factors contributed to helping explain the variation observed in these behaviors, but four common factors were observed in all four regressions. Males are more likely to report positive inquiry and purchase in the store following a winery visit compared to females. Younger wine consumers, similarly, are more likely to be more active seekers in a store, as are those with greater wine knowledge. These results alone would seem to offer implications for local wine promotion programs where local wineries are expanding beyond simply winery premise sales.

Determinants of Additional Winery Visit Behaviors Post-Initial Winery Visit

Three behaviors relating specifically to additional winery visits were examined – recommending the same winery, actually visiting the same winery again, and visiting another local winery (Table 7, see Appendix). The frequency of each behavior is, again, summarized in Table 1 (see Appendix). We examine if there appears to be a relation between a recent winery visit and these three behaviors. Word of mouth promotion and repeat sales are extremely important to smaller wineries that depend on experience goods, many with limited promotion budgets and unable to take advantage of the scale economies associated with brand development (Schamel 2009; Sprouse, Ross, Chaddad and Gomez 2013).

The frequency of recommending the same winery was positively influenced by tendency to buy local food, hold a higher range defining local in terms of miles, and wine knowledge. Higher frequency of purchasing super and ultra-priced wines were also positively related to recommending the same winery. Younger wine consumers and those outside of an urban area were more likely to recommend the same winery.

The frequency of actually visiting the same winery was positively influenced by being male and having higher knowledge of wine. More frequent purchasing of super and ultra-priced wines was also positively related to visiting the same winery. Age, education, and urban residency were each negative factors influencing repeat visits to the winery.

Finally, males, consumers tending to buy local food, and those with higher wine knowledge were apt to more frequently visit other local wineries, given they had visited at least one local winery within the past three years. Frequent purchases of popular, super, and luxury-priced wines were also positively related to visiting other local wineries.

The ordered logit model was selected given the ordered nature of the dependent variable (“none”, “once”, “two-three times”, and “more than three times”). Ordered logit models are appealing in that they can address not only whether a behavior occurred, but can also take into account the frequency of the behavior. A limitation of these regressions, however, is generalizing from the coefficients in the event significant differences are observed moving through degrees of frequency of behavior – the so-called parallel influence assumption. The proportional odds test suggested a more restrictive general multinomial logit model be employed in 5 of the 7 behaviors

modeled. Observation of the expanded regressions in each of the multinomial representations, however, did not suggest significant differences from the ordered logit results presented here.

It is somewhat difficult to draw absolute causal relations between the winery visits and the subsequent observed behaviors. But it is difficult to conceive of a controlled experiment where cause and effect between these events and behaviors could be measured. These regressions, at the very least, examine the importance of the relation of a host of variables between an initial local winery visit and subsequent behavior that can provide some direction for local wine and winery awareness and consumption.

One may be concerned about the goodness of fit of our models (Pseudo $R^2 = 0.097$ and 0.072 , McFadden's Adjusted $R^2 = 0.071$ and 0.047). However, having low R^2 is characteristic of consumer behavior studies, especially related to a behavior recall. Abello, Palma, Anderson and Waller (2012) obtain an Adjusted $R^2 = 0.138$, while Govindasamy and Nayga (1997) obtain a McFadden's $R^2 = 0.14$. That said, the larger sample size studying a population like this, and resulting signs and levels of statistical significance suggest that our results are encouraging. These results document some important relations between variables often mentioned but rarely integrated into local food behavior studies.

Conclusions

Wineries have expanded significantly in the Northern Appalachian states, particularly within the past 10 years. Most of these wineries started small and emphasized on-premise sales to complement the tourism aspect of these businesses. These wineries have expanded in scale and number, however, making marketing and sales through other retail channels more important regionally. There are differences in off-premise wine sales approaches allowed in each of the states studied, but wineries in the region still depend significantly, if not exclusively, on sales locally – on premise.

This study draws several conclusions from its survey of regional wine consumers. The frequency of wine consumption plays favorably to local wine trial and winery visitation. Increases in wine knowledge generally also have a positive effect on the consumer connections to the local wine industry. The young local wine industry in the region should benefit from growth in wine awareness and consumption generally as the U.S. wine consumer continues to drink more wine. The analysis stops short of relating post-winery visit behaviors, but there is likely a relationship between the overall quality of the experience at the winery with the subsequent search, purchase, and informal referral of products marketed from the winery. These factors increase in importance as off-premise sales increase.

Getting the wine consumer to the local winery provides an important opportunity to influence future purchasing behaviors off-premise, but also for future visits to local wineries. Several striking results noted across the various measures of wine trial and purchase behavior is that younger wine consumers and those residing outside of the urban area are regularly showing stronger connections to the local wines and wineries. Measures that show strong consumer connection to place, such as years of residence and enthusiasm toward local food in general, also

are important drivers. This study suggests several potentially interesting launching points for further study of consumer behavior toward local wine consumption and engaging the winery experience. For example, it would be useful for the industry to understand the relation between on-premise and off-premise purchases, the effects of in-store merchandise on winery visits, the effects of agro-tourism programs and state-specific local programs (like Kentucky Proud) on local wine consumption and local winery visits, and in general what motivates consumers to try a local wine and visit a local winery.

Acknowledgements

We would like to thank the Kentucky Horticulture Council, the Kentucky Ag Development Fund and the USDA Southern Risk Management Education Center for supporting this project.

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Appendix

Table 1. Definitions and Summary Statistics of Dependent Variables

Variable	Description	Mean	Std. Dev.	Min.	Max.
<i>Local_tried</i> ^a	Binary variable=1 if respondents have tried what they know to be a state local wine within the past 12 months.	0.38	0.48	0	1
<i>Winery_visit</i> ^a	Binary variable=1 if respondents have visited a winery in the state during the past 3 years.	0.45	0.49	0	1
<i>Recognize brand</i> ^b	Discrete variable for “recognizing a wine in a store”; respondents may respond one of these categories: 1: hasn’t happened (32%); 2: once (27%); 3: 2-3 times (28%); and 4: more than 3 times (13%).	2.22	1.03	1	4
<i>Ask about availability</i> ^b	Discrete variable for “asking about the availability of a wine in a store”; respondents may respond one of these categories: 1: hasn’t happened (41%); 2: once (31%); 3: 2-3 times (20%); and 4: more than 3 times (8%).	1.94	0.96	1	4
<i>Purchase same local</i> ^b	Discrete variable for “actual purchase of a wine in the store”; respondents may respond one of these categories: 1: hasn’t happened (20%); 2: once (31%); 3: 2-3 times (32%); and 4: more than 3 times (17%).	2.45	0.99	1	4
<i>Purchase other local</i> ^b	Discrete variable for “purchase of another state wine in the store”; respondents may respond one of these categories: 1: hasn’t happened (43%); 2: once (26%); 3: 2-3 times (22%); and 4: more than 3 times (9%).	1.95	0.99	1	4
<i>Recommend same</i> ^b	Discrete variable for “recommendation of the winery to a friend”; respondents may respond one of these categories: 1: hasn’t happened (25%); 2: once (30%); 3: 2-3 times (30%); and 4: more than 3 times (15%).	2.35	1.01	1	4
<i>Visit same</i> ^b	Discrete variable for “follow-up visit to the same winery”; respondents may respond one of these categories: 1: hasn’t happened (36%); 2: once (30%); 3: 2-3 times (21%); and 4: more than 3 times (13%).	2.12	1.03	1	4
<i>Visit other</i> ^b	Discrete variable for “visit of another winery in the state”; respondents may respond one of these categories: 1: hasn’t happened (42%); 2: once (30%); 3: 2-3 times (19%); and 4: more than 3 times (9%).	1.94	0.97	1	4

Table 2. Definitions and Summary Statistics of Independent Variables

Variable	Description	Mean	Std. Dev.	Min.	Max.
<i>Male</i>	Binary variable=1 if respondent is male.	0.30	0.46	0	1
<i>Age</i>	Continuous variable; year of age.	52.80	14.26	21	82
<i>White</i>	Binary variable=1 if respondent's race is white.	0.90	0.29	0	1
<i>Income</i>	Continuous variable; total yearly household income before tax (\$1,000).	67.33	41.12	7.5	225
<i>Education</i>	Continuous variable; year of education.	14.56	2.10	9	18
<i>Kids</i>	Binary variable=1 if respondent has kids under 18 at home.	0.26	0.44	0	1
<i>Urban</i>	Binary variable=1 if respondent is from urban (including city and suburb).	0.63	0.48	0	1
<i>PA</i>	Binary variable=1 if respondent is from Pennsylvania.	0.25	0.43	0	1
<i>KY</i>	Binary variable=1 if respondent is from Kentucky.	0.24	0.43	0	1
<i>TN</i>	Binary variable=1 if respondent is from Tennessee.	0.25	0.43	0	1
<i>OH</i>	Binary variable=1 if respondent is from Ohio.	0.24	0.43	0	1
<i>Residency1</i>	Binary variable=1 if respondent has lived in the state for 1-4 years.	0.05	0.22	0	1
<i>Residency2</i>	Binary variable=1 if respondent has lived in the state for 5-9 years.	0.08	0.28	0	1
<i>Residency3</i>	Binary variable=1 if respondent has lived in the state for 10 or more years.	0.85	0.34	0	1
<i>Buy_local1</i>	Binary variable=1 if respondent never purchases what they know to be locally produced foods.	0.06	0.23	0	1
<i>Buy_local2</i>	Binary variable=1 if respondent sometimes purchases what they know to be locally produced foods.	0.52	0.49	0	1
<i>Buy_local3</i>	Binary variable=1 if respondent often or always purchases what they know to be locally produced foods.	0.41	0.49	0	1
<i>Local_range</i>	Continuous variable; respondent defines "local" winery in terms of mile range from their home.	60.68	64.82	0	1001
<i>Food_channel</i>	Binary variable=1 if respondent watches the food channel or similar programs.	0.75	0.42	0	1
<i>Prep_freshfood1</i>	Binary variable=1 if respondent never prepares fresh food at home.	0.02	0.16	0	1
<i>Prep_freshfood2</i>	Binary variable=1 if respondent prepares fresh food at home for 1-6 times per month.	0.25	0.43	0	1
<i>Prep_freshfood3</i>	Binary variable=1 if respondent prepares fresh food at home for 7 times above per month.	0.72	0.44	0	1
<i>Wine_knowledge1</i>	Binary variable=1 if respondent rates their wine knowledge as "little" or "novice" level.	0.50	0.50	0	1
<i>Wine_knowledge2</i>	Binary variable=1 if respondent rates their wine knowledge as an "average" level.	0.37	0.48	0	1
<i>Wine_knowledge3</i>	Binary variable=1 if respondent rates their wine knowledge as an "above average" and "expert" level.	0.12	0.32	0	1
<i>Periphery</i>	Binary variable=1 if respondent has purchased wine for any occasion within the past 12 months at least once per year.	0.42	0.49	0	1
<i>Mid_level</i>	Binary variable=1 if respondent has purchased wine for any occasion within the past 12 months at least once per month.	0.45	0.49	0	1
<i>Core</i>	Binary variable=1 if respondent has purchased wine for any occasion within the past 12 months at least once per week.	0.12	0.32	0	1
<i>Popular_wine</i>	Binary variable=1 if respondent purchases popular wine (\$4-\$7/bottle) at the frequency of sometimes or often.	0.50	0.50	0	1
<i>Super_wine</i>	Binary variable=1 if respondent purchases super wine (\$7-\$14/bottle) at the frequency of sometimes or often.	0.71	0.45	0	1
<i>Ultra_wine</i>	Binary variable=1 if respondent purchases ultra wine (\$14-\$25/bottle) at the frequency of sometimes or often.	0.43	0.49	0	1
<i>Luxury_wine</i>	Binary variable=1 if respondent purchases luxury wine (above \$25/bottle) at the frequency of sometimes or often.	0.15	0.36	0	1

Note. Full sample N = 1,609.

Table 3. Expected and Actual Signs for Independent Variables (Local Wine Trials and Local Winery Visit)

Independent Variables	Expected Sign	Actual Sign	References
<i>Demographic factors</i>			
Gender (Male)	+	+	Hussain, Cholette and Castaldi (2007); Bruwer, Saliba and Miller (2011); Wolf, Carpenter and Qenani-Petrela (2005); Thach and Olsen (2006); Fountain and Charters (2010); Loureiro (2003); Kolyesnikova, Dodd and Duhan (2008); Marzo-Navarro and Pedraia-Iglesias (2012)
Age	-	-	Hussain, Cholette and Castaldi (2007); Bruwer, Saliba and Miller (2011); Thach and Olsen (2006); Fountain and Charters (2010); Loureiro (2003); Kolyesnikova, Dodd and Duhan (2008); Marzo-Navarro and Pedraia-Iglesias (2012)
Race (White)	+	+	Hussain, Cholette and Castaldi (2007); Bruwer, Saliba and Miller (2011); Kolyesnikova, Dodd and Duhan (2008)
Income	+	+	Hussain, Cholette and Castaldi (2007); Bruwer, Saliba and Miller (2011); Wolf, Carpenter and Qenani-Petrela (2005); Loureiro (2003); Kolyesnikova, Dodd and Duhan (2008); Marzo-Navarro and Pedraia-Iglesias (2012)
Education	+	0	Bruwer, Saliba and Miller (2011); Wolf, Carpenter and Qenani-Petrela (2005); Loureiro (2003); Kolyesnikova, Dodd and Duhan (2008); Marzo-Navarro and Pedraia-Iglesias (2012)
Family with kids	+	0	Bruwer, Saliba and Miller (2011); Wolf, Carpenter and Qenani-Petrela (2005)
Urban vs. rural	+	-	
Length of residency in the state	+	0	Loureiro (2003)
<i>Food Consumer Behavior Factors</i>			
Purchase locally produced foods	+	+	Loureiro (2003); Kolyesnikova, Dodd and Duhan (2008)
How far is local	-	-	Sirteix, Grolleau and Schaefer (2008); Hu, Batte, Woods and Ernst (2013)
Watch food channels	+	+	
Prepare fresh food	+	+	
<i>Wine Consumer Attributes</i>			
Wine knowledge	+	+	Hussain, Cholette and Castaldi (2007); Fountain and Charters (2010); Kolyesnikova, Dodd and Duhan (2008); Marzo-Navarro and Pedraia-Iglesias (2012)
Frequency of wine purchasing	+	+	Bruwer, Saliba and Miller (2011); Thach and Olsen (2006); Fountain and Charters (2010); Loureiro (2003); Kolyesnikova, Dodd and Duhan (2008)
Purchasing frequency by price category	+	+	Bruwer, Saliba and Miller (2011); Wolf, Carpenter and Qenani-Petrela (2005); Loureiro (2003)

Table 5. Results of Logit Model for Local Wine Trial and Local Winery Visit

Dependent Variable	<i>Local_Tried</i>		<i>Winery_Visit</i>	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
<i>Male</i>	0.182 (0.123)	0.038 (0.025)	0.205* (0.119)	0.046* (0.026)
<i>Age</i>	-0.009** (0.004)	-0.001* (0.001)	-0.012*** (0.004)	-0.002*** (0.001)
<i>White</i>	0.380* (0.195)	0.076** (0.037)	0.311** (0.180)	0.068* (0.039)
<i>Income</i>	0.008** (0.004)	0.001** (0.0008)	0.008** (0.004)	0.001** (0.0008)
<i>Income</i> ²	-4.9e-04** (0.00002)	-1.0e-04** (4.2e-06)	-4.2e-04** (0.00001)	-9.6e-06** (4.4e-06)
<i>Education</i>	-0.005 (0.023)	-0.001 (0.005)	0.013 (0.027)	0.003 (0.006)
<i>Kids</i>	-0.169 (0.137)	-0.034 (0.027)	0.035 (0.132)	0.008 (0.029)
<i>Urban</i>	-0.326*** (0.119)	-0.068*** (0.025)	-0.238** (0.114)	-0.053** (0.025)
<i>PA</i>	-0.233 (0.154)	-0.048 (0.031)	-0.027 (0.151)	-0.006 (0.033)
<i>KY</i>	-0.168 (0.161)	-0.034 (0.032)	-0.387** (0.157)	-0.085** (0.034)
<i>TN</i>	-0.673*** (0.169)	-0.134*** (0.031)	-0.154 (0.158)	-0.034 (0.035)
<i>Residency2</i>	-0.163 (0.318)	-0.033 (0.064)	-0.203 (0.286)	-0.045 (0.063)
<i>Residency3</i>	0.225 (0.258)	0.046 (0.052)	-0.118 (0.226)	-0.026 (0.051)
<i>Buy_local2</i>	0.380 (0.287)	0.076 (0.055)	0.085 (0.251)	0.019 (0.055)
<i>Buy_local3</i>	0.956*** (0.294)	0.204*** (0.061)	0.596** (0.257)	0.136** (0.058)
<i>Local_range</i>	-0.0003 (0.0008)	-6.4e-04 (0.0001)	-0.001** (0.0009)	-0.0004** (0.0002)
<i>Food_channel</i>	-0.063 (0.137)	-0.013 (0.028)	0.291** (0.130)	0.065** (0.029)
<i>Prep_freshfood2</i>	-0.054 (0.393)	-0.011 (0.081)	0.906** (0.441)	0.195** (0.086)
<i>Prep_freshfood3</i>	0.223 (0.385)	0.046 (0.079)	0.851** (0.432)	0.182** (0.084)
<i>Wine_knowledge2</i>	0.524*** (0.127)	0.109*** (0.026)	0.368*** (0.122)	0.082*** (0.027)
<i>Wine_knowledge3</i>	0.986*** (0.194)	0.216*** (0.042)	0.781*** (0.191)	0.177*** (0.042)
<i>Mid_level</i>	0.256** (0.129)	0.053** (0.027)	0.120 (0.123)	0.027 (0.027)
<i>Core</i>	0.493** (0.198)	0.106** (0.043)	0.427** (0.197)	0.097** (0.045)

Table 5. Continued

Dependent Variable	<i>Local_Tried</i>		<i>Winery_Visit</i>	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
<i>Popular_wine</i>	0.060 (0.118)	0.012 (0.024)	-0.098 (0.112)	-0.022 (0.025)
<i>Super_wine</i>	0.380*** (0.133)	0.078*** (0.027)	0.142 (0.124)	0.032 (0.028)
<i>Ultra_wine</i>	0.246* (0.133)	0.051* (0.028)	0.198 (0.127)	0.045 (0.029)
<i>Luxury_wine</i>	0.273 (0.172)	0.058 (0.037)	0.187 (0.169)	0.042 (0.038)
<i>constant</i>	-1.863*** (0.711)		-1.689** (0.711)	
Log Likelihood	-971.266		-1,029.677	
Wald χ^2	178.980***		140.320***	
Pseudo R ²	0.097		0.072	
McFadden's Adjusted R ²	0.071		0.047	
N. of observations	1,609		1,609	
Correctly predict	67.25%		63.77%	
Goodness-of-fit (χ^2)	1,628.500		1613.390	

Note. Asterisks indicate levels of significance: * = 0.10, ** = 0.05, and *** = 0.01. Standard errors in parenthesis.

Table 6. Ordered Logit Regressions for Post-Winery Visit In-Store Behavior

Dependent Variable	<i>Recognize Brand</i>		<i>Ask About Availability</i>		<i>Purchase Same Local</i>		<i>Purchase Other Local</i>	
	Coefficient	O.R. ^a	Coefficient	O.R. ^a	Coefficient	O.R. ^a	Coefficient	O.R. ^a
<i>Male</i>	0.283* (0.158)	1.327	0.451* (0.162)	1.571	0.356** (0.156)	1.428	0.419*** (0.160)	1.521
<i>Age</i>	-0.015*** (0.005)	0.985	-0.022*** (0.005)	0.977	-0.009* (0.005)	0.990	-0.011** (0.005)	0.988
<i>White</i>	-0.026 (0.026)	0.974	-0.228 (0.264)	0.796	0.140 (0.259)	1.151	-0.396 (0.262)	0.672
<i>Income</i>	-0.0009 (0.005)	0.999	-0.010* (0.005)	0.990	-0.004 (0.005)	0.995	-0.006 (0.005)	0.993
<i>Income</i> ²	0.00001 (0.00002)	1.000	0.00004 (0.00002)	1.000	0.00001 (0.00002)	1.000	0.00002 (0.00002)	1.000
<i>Education</i>	-0.023 (0.037)	0.977	0.031 (0.038)	1.032	-0.056 (0.036)	0.945	-0.009 (0.038)	0.990
<i>Kids</i>	-0.127 (0.168)	0.880	-0.038 (0.172)	0.962	0.116 (0.167)	1.123	0.218 (0.170)	1.244
<i>Urban</i>	-0.330** (0.151)	0.719	-0.236 (0.155)	0.790	-0.415*** (0.148)	0.660	-0.029 (0.153)	0.971
<i>PA</i>	-0.857*** (0.205)	0.424	-0.105 (0.212)	0.900	0.090 (0.199)	1.094	-0.083 (0.209)	0.920
<i>KY</i>	-0.298 (0.212)	0.742	0.501** (0.219)	1.651	0.131 (0.211)	1.141	0.482** (0.217)	1.620

Table 6. Continued

Dependent Variable	Recognize Brand		Ask About Availability		Purchase Same Local		Purchase Other Local	
	Coefficient	O.R. ^a	Coefficient	O.R. ^a	Coefficient	O.R. ^a	Coefficient	O.R. ^a
<i>TN</i>	-0.935*** (0.213)	0.392	0.050 (0.217)	1.052	0.022 (0.207)	1.023	0.163 (0.215)	1.178
<i>Residency2</i>	0.176 (0.379)	1.193	0.335 (0.390)	1.399	-0.123 (0.369)	0.884	0.097 (0.382)	1.103
<i>Residency3</i>	0.426 (0.316)	1.532	0.965*** (0.328)	2.625	0.237 (0.309)	1.268	0.560* (0.319)	1.751
<i>Buy_local2</i>	0.719* (0.420)	2.053	0.142 (0.412)	1.153	0.587 (0.384)	1.800	0.363 (0.420)	1.439
<i>Buy_local3</i>	1.432*** (0.427)	4.187	0.686 (0.419)	1.986	1.332*** (0.393)	3.792	0.961** (0.426)	2.616
<i>Local_range</i>	-0.0008 (0.001)	0.999	-0.001 (0.001)	0.999	-0.0004 (0.001)	1.000	-0.00006 (0.001)	1.000
<i>Food_channel</i>	-0.087 (0.190)	0.916	0.627 (0.204)	1.872	0.104 (0.186)	1.110	0.494** (0.201)	1.640
<i>Prep_freshfood2</i>	1.371 (1.070)	3.939	0.022 (0.860)	1.023	0.741 (0.780)	2.099	0.252 (0.874)	1.288
<i>Prep_freshfood3</i>	1.311 (1.067)	3.712	-0.305 (0.858)	0.737	0.580 (0.777)	1.786	0.042 (0.872)	1.044
<i>Wine_knowledge2</i>	0.556*** (0.171)	1.745	0.545*** (0.176)	1.726	0.417** (0.168)	1.518	0.676*** (0.174)	1.966
<i>Wine_knowledge3</i>	0.596** (0.238)	1.816	0.789*** (0.242)	2.201	0.388* (0.236)	1.475	0.565** (0.240)	1.760
<i>Mid_level</i>	0.437** (0.175)	1.549	0.277 (0.182)	1.320	0.016 (0.172)	1.017	0.002 (0.179)	1.002
<i>Core</i>	0.199 (0.252)	1.221	0.643** (0.257)	1.903	0.037 (0.248)	1.038	-0.085 (0.255)	1.089
<i>Popular_wine</i>	0.267* (0.152)	1.307	0.090 (0.157)	1.095	0.103 (0.149)	1.109	0.190 (0.155)	1.210
<i>Super_wine</i>	0.748*** (0.177)	2.113	0.236 (0.181)	1.267	0.772*** (0.172)	2.166	0.210 (0.179)	1.234
<i>Ultra_wine</i>	0.062 (0.170)	1.065	0.333* (0.176)	1.396	0.433** (0.168)	1.542	0.088 (0.174)	1.093
<i>Luxury_wine</i>	0.718*** (0.204)	2.050	0.545*** (0.205)	1.725	0.250 (0.202)	1.285	0.411** (0.204)	1.509
<i>Intercept 4</i>	-4.491*** (1.313)		-4.184*** (1.154)		-3.320*** (1.072)		-3.981*** (1.159)	
<i>Intercept 3</i>	-2.706** (1.310)		-2.468** (1.147)		-1.617 (1.069)		-2.257* (1.153)	
<i>Intercept 2</i>	-1.339 (1.307)		-0.840 (1.143)		0.005 (1.066)		-0.994 (1.151)	
N. of observations	713		713		713		713	
LR χ^2	180.705***		201.478***		126.459***		131.230***	
Proport. odds test	83.107*** ^b		63.290		73.934** ^b		63.264	

Note. Asterisks indicate levels of significance: * = 0.10, ** = 0.05, and *** = 0.01. Standard errors in parenthesis. Wald Test was performed in SAS for inference of each coefficient, $\beta_k : z^* = b_k / s\{b_k\}$. ^a O.R. represents odds ratio. ^b The result of proportional odds test suggests that we use a less restrictive model, like a multinomial logit model. Results using a multinomial logit model are very similar and available upon request.

Table 7. Ordered Logit Regressions for Post-Winery Visit Additional Winery Visit Behavior

Dependent Variable	<i>Recommend Same</i>		<i>Visit Same</i>		<i>Visit Other</i>	
	Coefficient	O.R. ^a	Coefficient	O.R. ^a	Coefficient	O.R. ^a
<i>Male</i>	-0.117 (0.155)	0.890	0.370** (0.156)	1.448	0.307* (0.159)	1.360
<i>Age</i>	-0.011** (0.005)	0.988	-0.012** (0.005)	0.987	-0.003 (0.005)	0.997
<i>White</i>	0.320 (0.259)	1.377	-0.110 (0.259)	0.895	0.099 (0.265)	1.105
<i>Income</i>	-0.005 (0.005)	0.994	-0.0001 (0.005)	1.000	0.003 (0.005)	1.003
<i>Income</i> ²	0.00002 (0.00002)	1.000	9.7e-06 (0.00002)	1.000	-1.3e-07 (0.00002)	1.000
<i>Education</i>	-0.029 (0.036)	0.971	-0.120*** (0.037)	0.886	-0.044 (0.037)	0.957
<i>Kids</i>	0.225 (0.166)	1.253	-0.030 (0.168)	0.970	0.233 (0.170)	1.263
<i>Urban</i>	-0.339** (0.148)	0.712	-0.437*** (0.150)	0.646	-0.037 (0.152)	0.963
<i>PA</i>	-0.253 (0.199)	0.776	0.084 (0.202)	1.088	-0.044 (0.207)	0.957
<i>KY</i>	0.152 (0.210)	1.165	-0.132 (0.213)	0.876	0.042 (0.217)	1.044
<i>TN</i>	-0.084 (0.206)	0.919	-0.074 (0.209)	0.928	0.193 (0.213)	1.214
<i>Residency2</i>	-0.195 (0.368)	0.822	-0.151 (0.369)	0.859	0.332 (0.381)	1.394
<i>Residency3</i>	-0.052 (0.308)	0.949	-0.167 (0.308)	0.846	0.291 (0.320)	1.338
<i>Buy_local2</i>	0.567 (0.389)	1.765	0.054 (0.388)	1.056	0.418 (0.417)	1.519
<i>Buy_local3</i>	1.023*** (0.396)	2.782	0.487 (0.395)	1.628	0.798* (0.424)	2.221
<i>Local_range</i>	0.001* (0.001)	1.002	-0.002 (0.001)	0.998	-0.0009 (0.001)	0.999
<i>Food_channel</i>	-0.137 (0.185)	0.871	0.180 (0.190)	1.198	-0.051 (0.193)	0.950
<i>Prep_freshfood2</i>	1.418 (0.882)	4.132	0.477 (0.793)	1.612	0.800 (0.903)	2.227
<i>Prep_freshfood3</i>	1.262 (0.879)	3.532	0.298 (0.790)	1.347	0.504 (0.900)	1.656
<i>Wine_knowledge2</i>	0.476*** (0.167)	1.610	0.725*** (0.170)	2.067	0.843*** (0.175)	2.325
<i>Wine_knowledge3</i>	0.781*** (0.236)	2.184	0.917*** (0.237)	2.502	1.182*** (0.241)	3.264
<i>Mid_level</i>	0.105 (0.171)	1.112	0.007 (0.174)	1.008	-0.125 (0.178)	0.882

Table 7. Continued

Dependent Variable	Recommend Same		Visit Same		Visit Other	
	Coefficient	O.R. ^a	Coefficient	O.R. ^a	Coefficient	O.R. ^a
<i>Core</i>	0.173 (0.247)	1.189	0.048 (0.249)	1.049	-0.159 (0.254)	0.853
<i>Popular_wine</i>	-0.010 (0.149)	0.989	0.205 (0.151)	1.228	0.368** (0.154)	1.445
<i>Super_wine</i>	0.371** (0.171)	1.449	0.463*** (0.175)	1.590	0.334* (0.179)	1.397
<i>Ultra_wine</i>	0.380** (0.167)	1.464	0.336** (0.169)	1.400	0.038 (0.173)	1.039
<i>Luxury_wine</i>	0.115 (0.201)	1.122	0.102 (0.201)	1.108	0.558*** (0.204)	1.748
<i>Intercept 4</i>	-3.590*** (1.149)		-1.013 (1.081)		-4.675*** (1.181)	
<i>Intercept 3</i>	-1.912* (1.146)		0.369 (1.080)		-3.119*** (1.174)	
<i>Intercept 2</i>	-0.453 (1.144)		1.751 (1.082)		-1.686 (1.171)	
N. of observations	713		713		713	
LR χ^2	108.929***		111.914***		115.712***	
Proportional odds test	75.902** ^b		93.029*** ^b		88.370** ^b	

Note. Asterisks indicate levels of significance: * = 0.10, ** = 0.05, and *** = 0.01. Standard errors in parenthesis.

Wald Test was performed in SAS for inference of each coefficient, $\beta_k : z^* = b_k / s\{b_k\}$.^a O.R. represents odds ratio. ^b The result of proportional odds test suggests that we use a less restrictive model, like a multinomial logit model. Results using a multinomial logit model are very similar and available upon request.

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The IFAMR (ISSN #: 1559-2448)