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EDITOR'S NOTE

Dear Colleagues,

Let me first get my good-byes and farewells out—and then I can focus on this wonderful quarterly issue of the journal.

I came to the IFAMR eight years ago bringing a new vision to the board of IFAMA inspired to enrich the work accomplished by my predecessors and build a much needed high-quality journal for food and agribusiness management scholars. With the help of Administrative Editor Kathryn White, a team of fabulous Managing Editors, and the thankless hours of participation from nearly 1000 reviewers, we have built a really nice journal. It took all of us to do it, so please pat yourselves on the back.

This is the last issue for Kathryn and me as we are both stepping down with the release of this publication. The new Executive Editor is Gerhard Schiefer. Please direct all future correspondence to Dr. Schiefer beginning 1-September. His email address is: schiefer@uni-bonn.de.

Volume 19 Issue 3 marks the 31st issue of the journal published since 2008—all published on time. The third quarterly issue is a *Special Conference Edition,* highlighting papers presented during IFAMA's annual scientific Symposium which occurred in Aarhus last June. The "Best Paper Competition" is a collaboration between the IFAMR and IFAMA, and this year we include our conference partners from Wageningen University (WICaNeM). The purpose of the Best Paper Competition is to not only to offer members an opportunity to compete in the competition but accelerate the blind peer review process so that the conference is populated with peer reviewed, full-manuscripts that can also be published by 1-September of the same year. Congratulations to the winners.

This issue contains six papers from the competition: two winners and four finalists. We also have a nice group of five standard research articles and a case study. Please take a moment and look over Dr. Wachenheim's case study from war-torn Afghanistan. It takes a special team to continue to do research under arduous conditions.

We wish you the very best in your future research endeavors, and it's highly likely that our paths will cross again as we are a family of scholars devoted to the issues of agribusiness, and that makes it a small world after all.

Peter Goldsmith, Executive Editor, IFAMR

Can a Multi-Level Label do Better than a Binary Label for Animal Welfare? A PLS-Analysis of Consumer Satisfaction

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Abstract

Labeling is an important marketing tool for food producers and retailers. With growing product heterogeneity, labels can help consumers differentiate higher quality products on supermarket shelves. Currently, most labels are of a binary nature—meaning a product either has certain characteristics or not—although there is a larger product heterogeneity in the food market than just two standards. A multi-level label might be a solution to addressing this problem. The objective of this article is to investigate if influences on consumer satisfaction with ethical food labeling systems differ between a binary and a multi-level labeling system. A consumer survey was carried out in Germany (n = 1,538) comparing the two types of labels with a split-sample approach. The influence of five factors (comprehensibility, involvement, time pressure, trust and use), derived from the literature, were analyzed in a structural equation model. All these factors influence satisfaction with labeling. Furthermore, differences between the two labeling systems were detected. This article delivers important results for food producers and policy makers. The group comparison indicated that trust as a precondition is more necessary for a binary label whereas time pressure factors reduce satisfaction with multi-level labeling.

Keywords: labeling, consumer research, animal welfare, structural equation modeling,

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Introduction

Labeling is an important marketing tool for food producers and retailers. Although van der Merwe et al. (2010) found that habitual purchasing is more important than detailed product information on packages; it is known that with growing product heterogeneity, labels can help consumers differentiate higher quality products on supermarket shelves. Additionally, labeling is the most important means of reducing information asymmetry (Akerlof 1970; Darby and Karni 1973; Nelson 1970). Compared to consumers, producers usually have more information about their products and the underlying production processes. This is especially true for credence attributes, which cannot be verified by consumers when purchasing a product (Darby and Karni 1973). For example, a credence attribute can be an animal-welfare-related production method as seen in the practice of limiting floor space per animal for the purpose of pig fattening. Therefore, labels can help consumers who are looking for special products by turning credence attributes into search goods (Caswell and Mojduszka 1996; Caswell and Padberg 1992; Jahn et al. 2005). Thus, labels are frequently used for especially ethical attributes, which are usually credence attributes.

Ethical consumerism is on the rise: in Germany for example, 30% of consumers actively consider two or more ethical issues when making purchasing decisions (UK: 29%, France: 24%, Spain: 9%); a further 31% consider some ethical issues but not habitually (UK: 28%, France: 26%, Spain: 18%) (IGD.com 2010). In the food sector, the ethical consumerism trend is expressed by a wide range of ethical labels. The different labels identify products to be produced to certain ethical production standards, such as positive frames (e.g. pasture-raised beef), negative frames (e.g. GM free) or value neutral frames that stand for a certain production method (e.g. organic farming) (Schröder and McEachern 2004). However, although consumers' concerns about ethical problems have been well documented, skepticism about ethical labeling is still prevalent (Hoek et al. 2013). Currently, most ethical food labels are of a binary nature, meaning that a product either has a certain characteristic or does not. Hence, by means of a binary label, a complex production or process method such as animal welfare is reduced to one dimension. The product is labeled animal welfare or not. Nevertheless, many food characteristics that are gaining in importance nowadays require more detailed labels to display their quality information accurately such as complex ethical processes or product standards. A multi-level label might be an appropriate solution to address this problem as it can show consumers that there is not only "good and bad" in the food market but product heterogeneity. In this way, a differentiated labeling strategy might defuse the discussion about "good and bad" foods, the resulting "food wars" and the public debate in the mass media which has been fueled by deep controversies between a productionist versus an ecologically integrated paradigm (Lang and Heasman 2004).

At the moment, there are only a few examples of multi-level labels for ethical food. One is an animal welfare label called *Beter Leven* in the Netherlands with one to three stars. Another example is the 5-Step® Animal Welfare Rating standards which can be found in Whole Foods Market chain in the US. There is also a NOP labeling system in the US which uses four levels showing the gradations of organic content: *100% Organic; Organic* (95% or more organic ingredients); *Made with organic ingredients* (at least 70% organic ingredients); and *Specific organic ingredients* (USDA–AMS 2012).

Yet there are already two world-renowned multi-level labeling systems in the non-food sector: energy class labeling (e.g. for electronic products, buildings, cars or TVs) and hotel classification (stars or diamonds). It is not clear, however, whether a multi-level label might be a long-term solution for ethical food labels as well. This study was therefore primarily aimed at testing a multi-level label in the food sector. A preliminary study has shown that when a two-level labeling scheme is explained to consumers, willingness to pay rises with the label standard (Weinrich, Franz, and Spiller *Forthcoming*). Furthermore, Weinrich and Spiller (2016) showed that a multi-level animal welfare label can achieve higher market shares, increase animal welfare levels and result in higher sales.

In general, the following study amends the growing body of literature about food labeling with a special focus on an unexplored part of the debate. The innovation of this article is a measurement of the level of satisfaction and its drivers comparing a binary and a multi-level label in a split sampling design.

Multi-Level Labeling Schemes

In contrast to the food sector there are established multi-level labeling schemes for hotels and energy. With revealed preference methods for these sectors it is therefore possible to calculate willingness to pay for different quality levels, either with regression analyses or hedonic pricing models.

For the hotel market, Espinet et al. (2003) showed a significant rise in prices from a 3-star to a 4-star hotel. Abrate et al. (2011) confirmed that a higher classified hotel has higher prices. Furthermore, Zhang et al. (2011) calculated that room prices in New York are 35.8% higher with each incremental star. However, on the contrary, Núñez-Serrano et al. (2014) found that the different classification systems in the hotel industry in Spain could lead to a loss of credibility. Su and Sun's (2007) results were similar—hotel rating systems should be updated and incorporate consumers' viewpoints in order to gain more acceptance.

In terms of energy efficiency, Galarraga et al. (2014) showed for the car market that consumers buy relatively rationally. They determine their price structure by including the respective fuel saving which the brands promise. A and B labeled cars are sold with surcharges between 3.0 and 5.9% more than similar but less energy-efficient cars. Consumers even pay more for the car than the value of fuel saving. Also for cars, Alberini et al. (2016) calculated that when a car is A-labeled in energy efficiency, there is a surplus of 6–11% on the selling price. Furthermore, Galarraga et al. (2011) found that for energy efficient labeled dishwashers 15.6% of the price is due to the label. For buildings, Eichholtz et al. (2010) revealed that prices for green rated properties are around 3% higher per square foot than for otherwise identical buildings.

However, the transfer of such results to the food market must be limited and careful. Hotels belong to the service sector, not to the fast moving consumer-good sector. Energy efficiency is a unidimensional sustainability characteristic referring only to energy which is much easier to understand in comparison to animal welfare, which is a multidimensional construct that includes, for example, space per animal, use of medicines or animal behavior. In addition, the incentive to

buy energy-efficient labeled products are most likely about saving money in the long run which is not the case when buying animal welfare labeled products with altruistic motives.

For the food market, there has been a variety of studies with a focus on nutrition labeling. Nutrition labeling can be binary (e.g. "Healthier Choice Tick" or "Smileys"), but can also be multi-level ("Traffic light" [TL; rating saturated fat, sugar, and sodium per serving], "Wheel of Health" and "GDA [Guideline Daily Amount] scores") Andrews et al. (2011) compared a binary nutrition label indicating a healthier choice (Smart Choices Program) to a TL labeling scheme in their study. Although the participants stated that they preferred the simpler label, the binary label could lead to positive (and potentially misleading) nutrient evaluations and product-healthiness perceptions when compared to a multi-level labeling system (ibid.). These findings are supported by Kelly et al. (2009), who found that consumers could identify healthier food with the TL system five times better than with the GDA system and three times better than with a colored GDA system. This work has been complemented by Roberto et al. (2012), who conducted an analysis that used nutrient quizzes. They found that participants achieved the best overall performance with the TL+ (additionally rating fiber and protein per serving) system when compared to no label, TL and GDA labeling systems.

These results from the literature indicate that a multi-level label might have clear benefits compared to a binary labeling system. However, these findings cannot be transferred to ethical labeling directly because, while nutrient and nutrition labeling refers to physical aspects, ethic labeling has different, often motivational, underlying consumption reasons. Additionally, ethical aspects often do not affect product attributes themselves but process attributes. However, Fisher et al. (2013) have suggested the use of a multi-level ecolabel based on theoretical calculations.

Objectives and Conceptual Framework

For the success of a food label which aims to reduce information asymmetry, it is important to meet the information needs of the target group (Verbeke 2005). If the information provided by a label is sufficient, satisfaction with the label and therefore with the product rises and repeated purchase is probable (Grunert 2002; Scott and Worsley 1994). The given amount of information differs between a binary and a multi-level label. Thus, the objective of this article is to investigate whether influences on consumer satisfaction with ethical food labeling systems differ between a binary and a multi-level labeling system. In this way, it can be analyzed whether an ethical multi-level label can be considered superior to a binary label and so deliver important results for both food producers and policy makers.

Our study uses an experimental animal welfare label to test the viability of using a multi-level label in the food market due to the fact that animal welfare is representative for ethical food labels as e.g. discussed by Schröder and McEachern (2004). Furthermore, animal welfare is discussed intensely in many industrialized countries (e.g. Clark et al. 2016). Since no well-known multi-level label exists for animal welfare in the German market, a potential bias of the study due to images of existing labels could be prevented.

In detail, this study was aimed at identifying the potential problems and advantages of a multi-level label in comparison to a binary label. This was achieved by using a split-sample design to

differentiate between both approaches. Again, to prevent potential bias, the binary as well as the multi-level label were designed specifically for the study and do not currently exist in the market. The two facets of this study were undertaken as they will contribute to the consumer research that needs to be conducted prior to introducing a multi-level label for ethical food products.

In order to assess consumers' satisfaction with a labeling scheme, influencing factors had to be identified. From the literature, the following five factors influencing labeling satisfaction were determined:

1-Comprehensibility

Comprehensibility is an essential factor for the distribution and success of a food label. If a label is not understood by consumers, it does not facilitate the weekly shopping. It adds no value so consumers would almost certainly be dissatisfied with such a labeling scheme. Aarset et al. (2004) found that in Europe, consumer knowledge about what organic and respective ecolabels actually mean is not sound. This was confirmed by Buxel and Schulz (2010) in a consumer survey with German consumers—less than 50% of the participants indicated that they knew all about food labels and what particular labels actually revealed. Consumers did not possess any specific information about most labels. An explanation for these results might be found in the so-called 'information overload,' whereby consumers are confronted with a mass of information in everyday life—not only concerning food (Kolodinsky 2012; Kroeber-Riel and Esch 2004; van Kleef et al. 2008; Verbeke 2005). Due to limited cognitive capacity not all information provided on food packages, especially in textual form, can be processed – viz. limited willingness and opportunity to process information on food packages (Verbeke 2005). This is supported by the results from Schulte-Mecklenbeck et al. (2013), who confirmed that very little time has been spent on the decision-making process in order to understand and evaluate all relevant factors; instead, heuristics are applied. Furthermore, these authors found that visual stimuli gained more attention than numeric illustrations. Caputo et al. (2013) supported these findings regarding climate-friendly labeling. They found that environmental information related to time and distance is preferred by consumers in comparison to abstract numbers in the form of a carbon footprint.

From the above literature, it is inducible that the influence of comprehensibility on satisfaction with a label system is not predictable. A tiered presentation of different standards in food processing and product standards might either increase the comprehensibility of a multi-level label by transparently showing different standards or conversely, it might decrease comprehensibility, despite its transparency, due to complexity. The first hypothesis is derived as a result of the literature analysis:

H$_1$: Comprehensibility of food labels influences consumer satisfaction with an ethical food labeling system.

2–Involvement

Usually, consumer involvement in everyday products in the food sector is rather low as purchases are characterized as habitual in developed countries (Aertsens et al. 2009). However,

knowledge may help increase food involvement (ibid.). Silayoi and Speece (2004) confirmed that visual packaging plays a major role in low involvement decisions. Here, a multi-level label can provide more information in a visual form than is possible with a binary-labeling system. However, if consumers are characterized by higher involvement, more information is usually sought (ibid., Spiller 2010). This has been confirmed by Espejel et al. (2009), who found that the influence of quality attributes on consumers' satisfaction with a labeling system depends on whether the consumers have a high or a low involvement. Consequently, the second hypothesis is:

H$_2$: Involvement influences consumer satisfaction with an ethical food labeling system.

3–Time Pressure

As shown in the previous section concerning involvement, most food decision-making processes are characterized by low involvement. In accordance with this is the fact that the time consumers spend on shopping has decreased over the last decade (Feunekes et al. 2008). Even seventeen years ago, Warde (1999) confirmed that consumers were facing more time constraints in everyday life, which resulted in an increased consumption of convenience food. Likewise, Darian and Cohen (1995) emphasized in an earlier study the time constraints for purchasing and preparing food as well as food consumption itself. Moreover, the analyses of Schulte-Mecklenbeck et al. (2013) showed that decision-making in terms of food purchasing is based on the assumption of limited search and also due to time constraints in everyday life. In addition, in a study carried out by van der Merwe et al. (2010), participants stated that their disinterest in label information was due to time pressure. Thus, time pressure can also be a variable that influences label satisfaction. A consequence of this pressure might be less time spent reading and understanding food labeling. Consumers' satisfaction with labeling could then be influenced in one of two ways: if consumers feel under time pressure, they could feel confronted with too much information on a multi-level label or they might find the information easier to access compared with a binary label as they do not have to read additional information. In order to test these assumptions in empirical research, the third hypothesis is formulated:

H$_3$: Time pressure influences consumer satisfaction with an ethical food labeling system.

4–Trust

Trust is an important construct concerning food labeling as a label transfers credence attributes into a search good (Caswell and Mojduszka 1996; Caswell and Padberg 1992; Jahn et al. 2005). However, Buxel and Schulz (2010) found that trust in labels is very variable depending on the particular label. For example, the Demeter label, a label from a German organic farming association with higher standards than the legal minimum for organic products, had 90% agreement for trust. The German governmental organic label was only trusted by 68% of the respondents. These agreement rates from German consumers can still be considered high after Aertsens et al. (2009) detected in a literature review, an overall lack of trust in the certification process for organic food. Specifically, Krystallis and Chryssshoidis (2005) found that less than one-third of Greek consumers trusted retail outlets which distributed certified organic products, reflecting great distrust in those vendors of organic products.

This lack of trust could possibly be explained by the fact that differences between labels are not transparent for consumers. A multi-level label might gain more trust as product and process differences are more transparently presented. This might in turn effect satisfaction with the label. In an Australian consumer study conducted by Williams and Mummery (2012), the results showed that high proportions of consumers trusted the Heart Foundation Tick which signals healthy food. Logically, trust in a label is accompanied by a higher degree of satisfaction (ibid.).

In contrast, Fenko et al. (2016) modeled skepticism (a related concept) rather than trust in food labels. According to their results, skepticism (i.e. lack of trust) is a crucial factor that influences consumer responses to food. With respect to the present research question, therefore, it is possible that this would mean the more consumers trust a label, the more they are satisfied with that label. However, consumers who have higher generalized trust are no more likely to buy environmentally labeled products than those who have lower trust (Grebitus et al. 2015). Unlike this result, Roosen et al. (2015) showed that German and Canadian consumers' willingness to pay for new food characteristics increases when trust is higher. Thus, trust is essential when introducing innovative products which imply higher prices. Herrera and Blanco (2011) analyzed trust as a precursor for satisfaction. They also found that satisfaction influences willingness to buy and the purchase frequency. This was confirmed by Nocella et al. (2010, 2014). These authors ascertained that trust in a label is essential and that trust raises the willingness to pay a price premium for products with high animal welfare certification. Thus, due to this potentially higher willingness to pay, producers and retailers should also consider trust in their food labeling.

An analysis is required on whether a multi-level label system can gain more trust due to grading in its design and if the subsequent label satisfaction is higher compared to a binary label system. Hence, the fourth hypothesis is:

H$_4$: Trust in food labels influences consumer satisfaction with an ethical food labeling system.

5–Use

A label is only a helpful search attribute for consumers' decision making if it is used frequently. Thus, for a labeling system to succeed, it is crucial to examine whether satisfaction with a multi-level or a binary labeling system is influenced by use. However, this question has not been addressed in research as yet. Generally, despite limited label knowledge, consumers have a positive attitude towards food labeling. According to Buxel and Schulz (2010), 85% of German consumers think that a food label is a good thing, and 80% say that labels are useful. Besler et al. (2012) stated that about 75% of Turkish consumers report using food labels, with barriers for use being the lack of understanding of terms, symbols and values together with poor presentation of information. Both these sets of authors' results might be interpreted as being in favour of a multi-level labeling system as such a design could be understood more intuitively, would increase use, which in turn would raise consumer satisfaction. In contrast, other results from empirical research favour binary labeling systems. Although label information is used by nearly all consumers, they still prefer simplified labeling (Silayoi and Speece 2004). However, it may even be that the label's degree of comprehensibility is less important with respect to use, as Verbeke et al. (2012) proved that label use is closely connected with interest.

There is also still a percentage of consumers who do not use food labels at all. Such consumers rely instead on the availability of food, freshness, quality and the impression of the package design itself (van der Merwe et al. 2010). This would mean that use itself had no influence on consumer satisfaction with a labeling system. In order to analyze whether label use has an influence on satisfaction with a labeling system, the fifth hypothesis is proposed:

H5: Food label use influences consumer satisfaction with an ethical food labeling system.

The five above-mentioned factors were modelled as latent variables influencing consumer satisfaction with a labeling system. In a consumer study, the participants were presented with either an ethical binary or a multi-level label. This split sampling approach serves as a moderator variable. Figure 1 shows the relationships between the latent variables used in our model. The underlying items are shown in Table A2 in the Appendix. Finally, a multi-group comparison between the binary and the multi-level split for all five hypotheses will be carried out in order to test for differences between the two labeling systems.
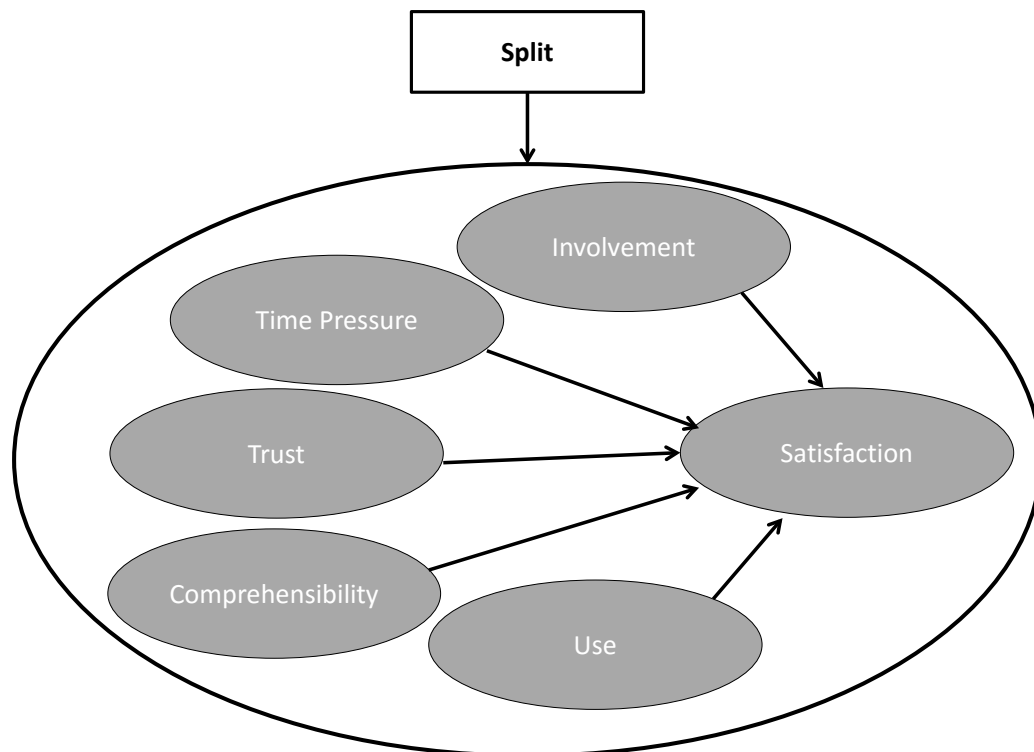
Figure 1. Moderator modeling framework
Source. Authors' illustration

Material and Methods

The data collection took place in 2014 by means of an online access panel. The sample size is 1,538 German consumers. Quotas were set for age, gender, education and income to ensure maximum representation from the German population.

Split-sampling design signifies that the participants were randomly allocated to one of two groups so that they either saw the binary or the multi-level label. The quotas mentioned above were also set within each sub-sample (n = 769).

The questionnaire had the following structure:

At the beginning of the survey, the participants were given information about and shown either an experimental binary or a multi-level label. The consumers received two examples of the standards of the label: floor area per animal and transport time requirements to the slaughterhouse (the minimum standards used are those legally required by the Federal Republic of Germany). These two standards were chosen as examples because transportation time has an influence on animal welfare (Vecerek et al. 2006) and is an important and straightforward aspect for consumers (Pouta et al. 2010). From a scientific perspective, stocking density is also an important factor for animal welfare (Bokkers et al. 2011; Talebi et al. 2014; Turnbull et al. 2005) and is considered to be essential information for animal welfare oriented customers (de Jonge and van Trijp 2013; Vanhonacker et al. 2009).

After this introduction, consumers had to make a choice between conventionally produced meat and the labeled product (binary split) or one of the labeled alternatives (multi-level split) and the label information was provided a second time[1]. Subsequently, there were questions about attitude towards the label. Further questions regarding quality aspects, labeling, and purchasing behavior were the same for both sub-samples.

The respondents scored their answers on five-point Likert scales or Likert-like scales. The Likert scales for the statements concerning time pressure were taken from the Marketing Scales Handbook (Bruner et al. 2001) and partly from a modified version of a labeling study conducted by Buxel and Schulz (2010). However, most of the items had to be developed by the authors due to the explorative character of the study.

Initially, expert pre-tests were carried out in order to carefully examine whether the items loaded were the intended latent variables. Ten colleagues involved in similar research fields were asked to allocate the items, which were mixed in order of their latent variables. Those items not allocated to the same latent variable by the majority of experts were removed. Finally, before the field phase, pre-tests were carried out with consumers of differing age, sex, education and net household income.

The field phase took place in September and October 2014. All statements were presented randomly to the participants to prevent sequence effects.

The data was analyzed using SmartPLS statistical software, Version 3.1 and by applying structural equation modeling methods (Ringle et al. 2015). The analysis of PLS models contains two steps which are an assessment of the reliability and validity of the measurement model (outer model) and an assessment of the structural model's fit (inner model) (Hair et al. 2011).

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[1] For the choice sets and the corresponding detailed information given to the respondents see Figures A1 and A2 of the Appendix.

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The moderator modeling framework described above was then built into SmartPLS. Afterwards, the PLS Algorithm, bootstrapping, blindfolding procedures and the multi group analysis (MGA; Sarstedt et al. 2011) were conducted.

Results

Sociodemographic Characteristics of the Sample

Due to the set quotas, the sample is in accordance with the distribution of age, sex, regional distribution, education and net household income in Germany. Furthermore, this is also valid for both sub-samples as the quotas were set within each of them. The average age is forty-four years, and 49.2% of the participants are male. The regional distribution corresponds to the German population. Of the respondents, 30.1% have a net household income of less than €1,500 per month. Only the education levels were not perfectly met, as the higher education level is slightly overrepresented. However, this is not unusual for online surveys as Granello and Wheaton (2004) have shown, and the advantages of online surveys outweigh this single disadvantage. The complete results including the results for the distribution in Germany can be found in Table A1 of the Appendix.

Satisfaction with an Animal Welfare Label

To capture first impressions of satisfaction with the respective label, statements were evaluated descriptively and mean values calculated for each sub-sample. In order to analyze whether there are significant differences between the binary and the multi-level labels sub-sample t-tests were performed. The results are shown in Table 1 below.

It can be seen that for each statement the mean value is higher for the multi-level split. With the exception of three items (1: "I think the animal welfare label is reliable"; 7: "Products with this label would attract my attention in the supermarket"; 10: "I would look for such products at the weekly market") the differences are statistically significant. In more detail, consumers in the second split (=multi-level-label) have a better idea of what the label is based on than in the first split (2; μ Split 1 = 0.46; μ Split 2 = 0.58). The same applies to Item 3; that the animal welfare label facilitates the comparison between products (μ Split 1 = 0.41; μ Split 2 = 0.54). Participants in the multi-level split are also of the opinion that the label provides precise information without being forced to read it for a long time (4; μ Split 1 = 0.34; μ Split 2 = 0.53) and they also think that the label gives the opportunity to learn more about a product without taking up too much time (5; μ Split 1 = 0.39; μ Split 2 = 0.57). In addition consumers in the multi-level split are more interested in products with this type of label than in the binary split (6; μ Split 1 = 0.55; μ Split 2 = 0.67). Furthermore and as a matter of choice participants in Split 2 would look for products with such a label in the supermarket or at the butcher (8; μ Split 1 = 0.35; μ Split 2 = 0.47; 9; μ Split 1 = 0.26; μ Split 2 = 0.36).

Table 1. Satisfaction with an animal welfare label

	Statement	I totally disagree (-2)	I disagree (-1)	Partly/ partly (0)	I agree (1)	I totally agree (2)	MV (SD)
1	I think the animal welfare label is reliable.	3.6	9.0	45.2	33.8	8.4	0.34 (0.888)
		3.1	9.1	41.1	37.2	9.4	0.41 (0.895)
2	I can imagine what the animal welfare label is based on.***	3.2	11.3	32.1	43.2	10.2	0.46 (0.933)
		2.7	9.1	28.4	46.5	13.3	0.58 (0.925)
3	The animal welfare label facilitates the comparison between products.***	4.0	13.9	31.0	39.8	11.4	0.41 (0.992)
		3.9	9.4	30.2	41.6	14.9	0.54 (0.985)
4	The animal welfare label provides me precise information without being forced to read for a long time.***	4.2	13.2	36.3	36.9	9.5	0.34 (0.965)
		3.3	9.4	31.6	42.3	13.4	0.53 (0.950)
5	The animal welfare label gives me the opportunity to learn more about a product without requiring me to read for a long time.***	3.4	13.4	34.6	38.0	10.6	0.39 (0.962)
		3.4	8.8	29.4	43.8	14.6	0.57 (0.957)
6	I am interested in products with such a label.**	3.7	10.7	28.9	40.0	16.6	0.55 (1.009)
		4.6	6.7	26.0	43.1	19.7	0.67 (1.012)
7	Products with this label would attract my attention in the supermarket.	3.8	14.2	32.5	38.9	10.6	0.38 (0.982)
		3.9	10.9	33.9	39.2	21.1	0.45 (0.971)
8	I would look for products with such a label in the supermarket.**	5.6	15.0	30.5	37.0	11.9	0.35 (1.050)
		4.8	12.0	30.9	35.7	16.5	0.47 (1.054)
9	I would look for such products at the butcher.**	6.0	17.3	32.6	33.5	10.7	0.26 (1.054)
		6.0	14.0	33.0	31.7	15.3	0.36 (1.085)
10	I would look for such products at the weekly market.	7.5	18.8	32.6	31.2	10.0	0.17 (1.082)
		7.6	15.3	34.4	29.5	13.2	0.25 (1.103)

Notes. The first line indicates sub-sample one with the binary label; the second line indicates sub-sample two (multi-level)
* = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level
Source. Authors' own calculations

Evaluation of the Measurement Model

In the following sections, the results of the PLS analysis are presented. Before starting the analyses, we conducted a confirmatory factor analysis in order to identify all the relevant items for a latent variable (cf. Appendix, Table C). All items that had an outer loading of less than 0.4

were removed from the latent variables (4 items[2]) (ibid.). Apart from a few exceptions (one loading each on *satisfaction*, *involvement*, *comprehensibility*, *time pressure* and two loadings each on *trust* and *use*; all are > 0.4 but < 0.7), all the factor loadings on each latent variable are above a threshold of 0.7 or higher (Hair et al. 2013). Removing these items did not improve internal consistency reliability, and so they were included in the analyses (ibid.).

For internal consistency reliability, we applied both Cronbach's Alpha and composite reliability. This was done as Cronbach's Alpha usually tends to underestimate internal consistency reliability (Hair et al. 2013), whilst composite reliability is possibly a better indicator as it takes into account outer loadings of the indicator variables (Hensler et al. 2009, Hair et al. 2011). The recommended threshold of 0.7 or above was reached for both reliability coefficients (Nunnally and Bernstein 1994). The convergent validity was measured by the average variance extracted (AVE), which is comparable to the proportion of explained variance in the factor analysis and should be higher than 0.5 so that it explains more than half of the indicators' variance on average (Fornell and Larcker 1981). This criterion is fulfilled by the model. Table 2 contains the results for Cronbach's Alpha, the composite reliability and the average variance extracted in detail.

Table 2. Evaluation of the measurement model

Variables	Number of items	CRA (>= 0.7)	CR (>=0.7)	AVE (>=0.5)
Satisfaction	10	0.926	0.938	0.602
Comprehensibility	6	0.830	0.863	0.514
Involvement	8	0.873	0.900	0.533
Time pressure	6	0.857	0.866	0.522
Trust	7	0.870	0.900	0.569
Use	5	0.806	0.868	0.572

Notes. CRA = Cronbach's Alpha, CR = Composite reliability, AVE = Average variance extracted
Source. Authors' own calculations

For the assessment of the discriminant validity, the Fornell-Larcker criterion, and the cross loading should be considered. The Fornell-Larcker criterion requires that a latent variable should explain the variance of its own indicators better than the variance of other latent variables (Fornell and Larcker 1981). This criterion is met (see Appendix, Table A3). For the cross-loading criterion, an indicator's loading on its assigned latent variable should be higher than its loading on all other variables (ibid.). The data analysis revealed that there was no evidence of any cross-loadings (data not provided but available on request).

Evaluation of the Structural Model

A number of quality criteria were applied for the evaluation of the structural model. Firstly, the coefficient of determination, R-squared, was found to be 0.499 for the endogenous variable

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[2] *Labels on packages often present food better than it is in reality. (recoded)*; I miss important information on labels on food packages.; *I find details on food package well explained. (recoded)*; For many labels, I cannot understand the meaning.

satisfaction. This means that the five latent variables moderately explain 49.9% of the variance in *satisfaction* (Hair et al. 2011). Secondly, the predictive relevance, f-squared, was determined, whereby we found a moderate effect for *trust* (0.160). All the other four latent variables showed weak effects (< 0.15) (Cohen 1988). Thirdly, we evaluated the size and significance of all the path coefficients in the complete model and in the two sub-samples (binary vs. multi-level label) (see below).

The bootstrap analysis showed that all five latent variables – *comprehensibility* (p ≤ 0.10), *involvement* (p ≤ 0.1), *time pressure* (p ≤ 0.05), *trust* (p ≤ 0.1) and *use* (p ≤ 0.1) – have a significant effect on *satisfaction* in the case of the complete sample. These results indicate that the influence of *trust* is the strongest (0.389) on consumer *satisfaction* with the perspective labeling system, followed by *use* (0.266), *involvement* (0.141) and *comprehensibility* (0.043). *Time pressure* was found to have a negative influence (-0.074) on *satisfaction*.

Multi-Group Analysis

A comparison of the binary and the multi-level label split revealed slight differences. R-squared for the binary split is 0.513, for the multi-level split 0.497. The composite reliability criterion was met for all five variables in both splits. However, the AVE for *comprehensibility* in the binary split is slightly smaller than the threshold of 0.5 (0.491). For all the other latent variables, the AVE is larger than 0.5. All the results for the variables for both splits can be seen in detail in Table A4 in the Appendix.

The multi-group analysis (MGA) also showed differences in the path coefficients. For the binary split, two of the five latent variables were found not to have a significant effect (*time pressure* and *comprehensibility*). In contrast, all five latent variables showed significant results for the multi-level split.

To summarize, the hypotheses H2, H4, and H5 can be confirmed: *involvement*, *trust,* and *use* have a significant influence on consumers' *satisfaction* with labels for both splits. For *time pressure* (H3) and *comprehensibility* (H1), the hypotheses could only be verified for the multi-level split. An overview of the results is provided in Figure 2.

The bootstrap for PLS-MGA (Henseler 2007) revealed that two of the five latent variables – namely *trust* and *time pressure* – have significant differences between the consumers who saw the binary label and those who saw the multi-level label (p ≤ 0.1). *Comprehensibility, involvement,* and *use* do not show any significant differences whether the respondents were confronted with a binary or a multi-level label. Consequently, the significant differences confirm hypotheses H3 and H4. The detailed findings are presented in Table 3.
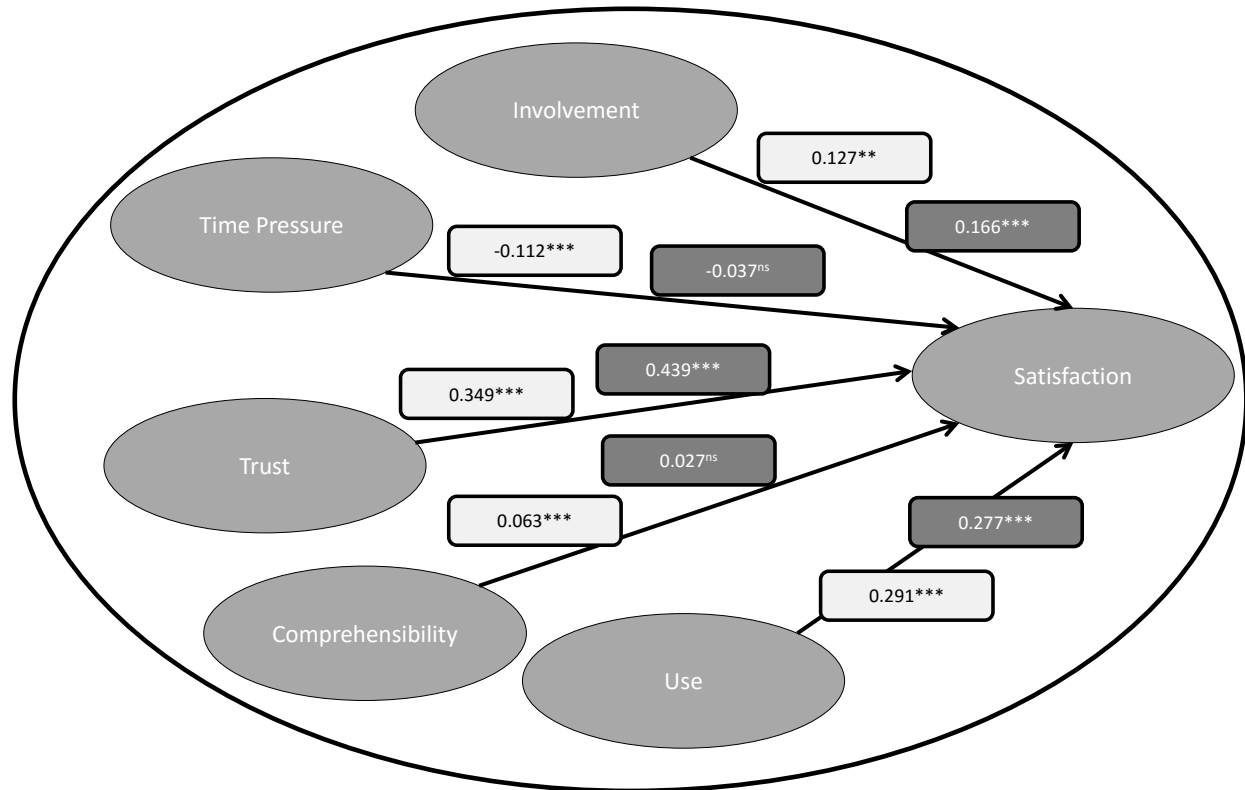
Figure 2. Results of the path coefficients

Notes: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level; ns = not significant; dark grey boxes = binary split; light grey boxes = multi-level split; for detailed results see Tables A5 and A6 of the Appendix
Source. Authors' own calculations and illustration

Table 3. Multi-group comparison results

Relationship	Comparison	|diff|	PLS-MGA (P-Henseler)
comprehensibility → satisfaction	binary vs. multi-level label	0.036	0.799
involvement → satisfaction	binary vs. multi-level label	0.039	0.253
time pressure → satisfaction	binary vs. multi-level label	0.075	0.069
trust → satisfaction	binary vs. multi-level label	0.091	0.080
use → satisfaction	binary vs. multi-level label	0.064	0.819

Source. Authors' own calculations

Discussion and Conclusion

The results of the present study on the five latent variables and their effect on consumer satisfaction with respect to the two different labeling schemes (binary and multi-level) provided interesting insights. At first sight, significant differences for seven out of ten statements building the latent variable *satisfaction* indicate that consumers might be more satisfied with a multi-level label than with a binary label.

There were no statistical differences between the two labeling schemes for the latent variables *comprehensibility*, *involvement,* and *use*. In contrast, there were differences for both *time pressure* and *trust.* The group comparison indicated that trust as a precondition is more necessary for a binary label whereas high time pressure reduces satisfaction with a multi-level label.

There could be several explanations for the lack of statistical difference between the two sub-samples for *comprehensibility*. First, it might be the case that the multi-level label was no more easily understood than the binary-level label. However, the influence of *comprehensibility* on *satisfaction* was not significant for the binary split and when only the multi-layer split is considered on its own then *comprehensibility* significantly increases *satisfaction*. This is an indication that the multi-level labeling schemes might indeed be superior in terms of *comprehensibility*. Secondly, the non-significant result in the MGA might be explained by the information overload theory (Kolodinsky 2012; Kroeber-Riel and Esch 2004; van Kleef et al. 2008; Verbeke 2005), as a five-level label such as the one used in this study is rather complex. Accordingly, this study's multi-level label may have provided too much information so that the probands applied heuristics rather than trying to understand the underlying principles of the labeling scheme (Schulte-Mecklenbeck et al. 2013). However, to verify this assumption, further research needs to be carried out.

If five levels are too many, the vital factor of how to design the labeling scheme would not be how much information is included but whether or not consumers are confronted with too much information. Therefore, *comprehensibility* remains a crucial factor for food labeling in general (Aarset et al. 2004; Grunert and Wills 2007). Food packages are often cluttered and not user-friendly. Producers should focus instead on those essential features they want to emphasize in the package design. However, one argument against the idea that a five-level label is too complex to have high *comprehensibility* is that the worldwide five-level labeling system works for hotel classification. Further studies analyzing *comprehensibility* should be aimed at detecting the optimal number of grades for a multi-level food label.

There was also no statistical difference between the splits for the second latent variable *involvement* although *involvement* was seen to have an influence on consumer *satisfaction* when each split was considered separately. It can, therefore, be concluded that *involvement* has an influence, but its strength is similar in both of the two labeling schemes. This may be explained by considering the level of involvement as an attitude or part of an individual's character rather than an influence on a labeling scheme. So whether consumers make the effort to gather further information on a labeling scheme depends on their involvement characteristics. This explanation for the current result would be in line with the outcomes of Spiller (2010) and Espejel et al. (2009) who also stated that consumers either have high involvement or not in food products.

The fact that the PSL-MGA for *use* is also not significant is unsurprising considering the result for *comprehensibility*. *Use* is closely connected with the label being understandable or not. Labels are generally considered to be important for consumers (Besler et al. 2012, Buxel and Schulz 2010). However, it is also entirely possible that a multi-level labeling scheme does not outclass a binary label in terms of impact on the user. Nevertheless, the literature still shows that label design remains a crucial factor in its use (Besler et al. 2012, Silayoi and Speece 2004).

A significant difference between the two food labeling systems can be found for *time pressure*. *Time pressure* was found to lower satisfaction with a multi-level label compared to a binary label as the value for the multi-level split is more negative (-0.112) than the result for the binary split (-0.037). This could be explained by the fact that a multi-level labeling scheme is presently unknown in the food sector. The pro-bands (i.e. the consumers) would have to become accustomed to such a labeling system, especially as weekly food shopping is characterized by habit purchases (Silayoi and Speece 2004, Schulte-Mecklenbeck et al. 2013). Furthermore, this might be supported by the argument that the multi-level seems more complex for consumers at first sight. However, once a multi-level labeling scheme becomes more familiar to consumers, *time pressure* might have an opposite effect. That is if a product's details are shown transparently on food packaging so consumers would not have to search for additional information on different binary labels (e.g. about the governmental organic label and an organic label allocated by an organic farming association). A multi-level label can indicate differences in such labels without the requirement of additional information. These assumptions should be verified by further qualitative research approaches. However, this result does emphasize the need to take great care in introducing a multi-level labeling system. No matter whether the label is allocated by the state or by a manufacturer, its introduction should be accompanied by marketing campaigns such as advertising on nationwide TV to make both the labeling system and the label itself popular.

Although a significant difference was found for *trust* between *satisfaction* with the multi-level (0.349) and the binary label (0.439), *trust* still seems to have less influence on *satisfaction* with the multi-level label than the binary label. This can be explained by the fact that a multi-level label displays more detailed information than a binary label and might thus inspire more confidence. As *trust* is an essential component for a label's success (Fenko et al. 2016, Herrera and Blanco 2011, Nocella et al. 2010, 2014), it is a good indicator for a multi-level label's potential market impact as the multi-level label seems to be more trustworthy. Nevertheless, it is important to investigate the underlying reasons for this difference in future qualitative research. *Trust* might also be influenced by the label allocator or the label's design. It would be most important to learn about these influences before the setting up and launching of a multi-level food label. This result is especially interesting for producers. In times when consumers have little trust in the food sector, a multi-level label seems to provide an excellent opportunity to enhance reputation.

As ever in empirical research, this study also has its limitations. It was the first one of its kind, and its design could be improved by experiences gained during the explorative survey into further studies. Another challenge for the preparation of a multi-level label launch is the pricing of the different levels. For this purpose, progressive as well as retrograde cost analyses should be calculated and matched with willingness-to-pay studies for ethical products. In addition, research should be carried out for different ethical products in order to gain deeper consumer insights into the grading of ethically labeled products.

The results indicate that a multi-level label has to be introduced carefully, and its design needs to be thought through in great detail. Grading should also be consistent with a multi-level labeling system, e.g. only stars, but not "premium stars", "star plus" or "star superior" in order to prevent consumer confusion. However, such a label can also be used to improve ethical food products' labeling as differentiated product characteristics are displayed to consumers more transparently.

Multi-levelling, therefore, provides producers with a good tool to highlight the advantages of a premium quality product. Are there also options for more price sensitive consumers who do not want to pay a high surplus for ethical attributes? If producers do not agree to consistent labeling schemes for ethical products or if there is failure of agreement to fund a marketing campaign, it might be advisable that the state is the allocator. The success of any multi-level labeling scheme will depend on transparency and communication.

Acknowledgement

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Appendix

It is about animal welfare in livestock farming. The label is controlled and granted by the Federal Republic of Germany. The requirements go beyond the legal minimum standards of livestock farming. Here are two examples:

In the traditional, conventional pig fattening there are **0.75 sqm of space** available per pig by law. The transport time to the slaughterhouse may take **8 hours**.

A fattening pig standing in a stall that is certified with the label has are **1.50 sqm of space** available. The transportation duration to the slaughterhouse may not take more than **4 hours.**

Figure A1. Choice set and label information for the binary label
Source. Weinrich and Spiller.

It is about animal welfare in livestock farming. The label is controlled and granted by the Federal Republic of Germany. The requirements go beyond the legal minimum standards of livestock farming. Here are two examples:

5 stars: **2.00 sqm** space and maximum **2 hours** transport time to slaughterhouse
4 stars: **1.75 sqm** space and maximum **3 hours** transport time to slaughterhouse
3 stars: **1.50 sqm** space and maximum **4 hours** transport time to slaughterhouse
2 stars: **1.25 sqm** space and maximum **5 hours** transport time to slaughterhouse
1 star: **1.00 sqm** space and maximum **6 hours** transport time to slaughterhouse
without label: **0.75 sqm** Platz and maximum **8 hours** transport time to slaughterhouse

Figure A2. Choice set and label information for the multi-level label
Source. Weinrich and Spiller

Table A1. Sample characterization

Variable	Description	Frequency (%) Sub-sample 1	Frequency (%) Sub-sample 2	Frequency (%) Germany
Age	16 to 29	22.1	20.7	22.3
	30 to 39	17.0	17.3	17.3
	40 to 49	21.1	20.7	21.1
	50 to 59	23.1	23.7	22.8
	60 to 69	16.6	17.7	16.6
Gender	Male	49.5	49.0	48.8
	Female	50.5	51.0	51.2
Region	North	15.7	16.5	16.1
	South	28.0	25.2	28.7
	East	21.7	21.2	21.0
	West	34.6	37.1	34.2
Education level	No qualification	1.2	0.5	4.8
	Primary school	21.1	19.0	30.7
	Secondary school	36.9	37.6	32.3
	Technical college qualification	9.8	9.9	7.7
	German equivalent to A-levels	31.1	33.0	24.5
Net household income(€)	Less than 500	3.4	2.9	2.1
	500-899	8.1	7.7	10.4
	900-1,499	19.2	19.1	21.8
	1,500-1,999	19.0	19.7	16.4
	2,000-2,599	17.9	19.0	15.6
	2,600-3,199	12.6	13.4	10.9
	More than 3,200	19.8	18.2	22.8

Source. Authors' calculations on the basis of preliminary results of the German census 2011, census data in the version of 10/04/2014 (Federal Statistical Office 2014)

Table A2. Measurement items for the variables in the research model

Variables and Measurement Items[1]	Mean	Standard Deviation	Factor loading[2]
Satisfaction			
I believe the animal welfare label is reliable.	0.37	0.892	0.738
The animal welfare label makes it easier to compare products.	0.47	0.988	0.823
I am interested in products with such a label.	0.61	1.007	0.806
I can imagine what stands behind the animal welfare label.	0.52	0.932	0.657
The animal welfare label provides me with exact information without me having to read too much.	0.44	0.959	0.762
The animal welfare label gives me the opportunity to know more about a product without me having to inform myself more comprehensively.	0.48	0.960	0.760
Products with this label would attract my attention in the supermarket.	0.42	0.975	0.744
I would look for products with such a label in the supermarket.	0.41	1.051	0.846
I would look for products with such a label at the butchers.	0.31	1.069	0.810
I would look for products with such a label at the weekly market.	0.21	1.093	0.799
Comprehensibility			
The many different labels on food packages confuse me.	0.13	0.935	0.667
I do not get the meaning of many labels.	0.61	0.782	0.785
Information about food confuses me.	0.03	0.876	0.704
I do not know what lies behind many of the labels.	0.71	0.803	0.786
Information on food packages is often incomprehensible.	0.51	0.846	0.723
Information about food is too complicated.	0.18	0.888	0.621
Involvement			
It is important for me to get good quality food.	0.97	0.721	0.752
When it comes to buying products, I try to make a perfect choice.	0.65	0.811	0.742

Table A2. *–Continued*

Variables and Measurement Items[1]	Mean	Standard Deviation	Factor Loading[2]
I usually try to buy the very best quality.	0.49	0.868	0.791
I always try to choose the very best quality products.	0.49	0.839	0.786
I am interested in food.	0.71	0.849	0.743
I would like to know which ingredients are contained in food.	0.89	0.894	0.731
Concerning food I just want to fill my stomach.	0.60	1.007	0.562
I think a lot about food.	0.15	0.992	0.708
Time Pressure			
I find myself pressed for time when I go grocery shopping.	-0.51	0.947	0.672
I am in a hurry when I do my grocery shopping.	-0.43	0.951	0.681
I have only a limited amount of time to finish my grocery shopping.	-0.22	1.076	0.622
I quickly finish my grocery shopping because I have other things to do.	-0.09	0.997	0.749
In everyday life, I take the time to busy myself with the information on the food package when doing the shopping.	-0.18	0.948	0.772
I have more than enough time to complete my weekly grocery shopping.	-0.48	0.955	0.819
Trust			
I trust the governmental food control.	0.09	0.929	0.602
I trust food control which is carried out by private companies.	-0.36	0.930	0.529
Information on food packages is an important purchase aid for me because I trust it.	0.17	0.904	0.776
I have considerable confidence in the labels on food packages.	-0.13	0.882	0.856
I have more trust in food with labels than in alternative products without labels.	0.009	0.940	0.806
Labels help me to recognize the quality of food.	0.24	0.886	0.848
Labels are a good thing.	0.43	0.824	0.800

Table A2. –*Continued*

Variables and Measurement Items[1]	Mean	Standard Deviation	Factor Loading[2]
Use			
I particularly notice food with labels when shopping.	0.08	0.923	0.793
I deliberately choose products with labels.	-0.16	0.882	0.874
If a food product has a label and another not, I will choose the product with the label.	-0.10	0.851	0.820
Yet another label – nobody needs this.	0.01	1.004	0.614
I know a lot about labels on food packages.	-0.57	0.833	0.646

Notes. [1]Respondents answered on a five-point Likert scale; [2]Results of the PLS confirmatory factor analysis, italicized items were recoded.
Source. Authors' own calculations

Table A3. Discriminant validity analysis based on the Fornell-Larcker criterion

Variables	Satisfaction	Comprehensibility	Involvement	Time Pressure	Trust	Use
Satisfaction	**0.776**					
Comprehensibility	-0.136	**0.726**				
Involvement	0.458	-0.076	**0.730**			
Time pressure	-0.345	0.140	-0.462	**0.734**		
Trust	0.640	-0.249	0.373	-0.294	**0.755**	
Use	0.625	-0.234	0.533	-0.362	0.696	**0.757**

Notes. Diagonal values in bold are the square root of the average variance extracted.
Source. Authors' calculations

Table A4. Label-specific results

Latent Variables		Binary Label	Multi-Level Label
Comprehensibility	CR	0.851	0.877
	AVE	0.491	0.544
Involvement	CR	0.987	0.903
	AVE	0.525	0.541
Time Pressure	CR	0.897	0.903
	AVE	0.530	0.545
Trust	CR	0.871	0.877
	AVE	0.562	0.578
Use	CR	0.865	0.904
	AVE	0.567	0.580
Satisfaction	CR	0.940	0.935
	AVE	0.612	0.591
n		769	769
Path Relationships			
Comprehensibility → Satisfaction		0.032	0.061*
Involvement → Satisfaction		0.166***	0.130**
Time Pressure → Satisfaction		-0.042	-0.112**
Trust → Satisfaction		0.448***	0.358***
Use → Satisfaction		0.216***	0.278***
R-squared		0.513	0.497

Notes. CR = composite reliability; AVE = average variance extracted; *Significance at 0.10; **Significance at 0.05; ***Significance at 0.001
Source. Authors' own calculations

Table A5. Structural path estimates for the binary label

Variables	Endogenous Construct	Path Coefficient	Standard Deviation	t-value	p-value
Comprehensibility	satisfaction	0.027	0.031	0.873	0.383
Involvement	satisfaction	0.166	0.038	4.421	0.000
Time pressure	satisfaction	-0.037	0.037	1.001	0.317
Trust	satisfaction	0.439	0.048	9.206	0.000
Use	satisfaction	0.227	0.051	4.486	0.000

Source. Authors' own calculations

Table A6. Structural path estimates for the multi-level label

Variables	Endogenous Construct	Path Coefficient	Standard Deviation	t-value	p-value
Comprehensibility	satisfaction	0.063	0.031	2.057	0.040
Involvement	satisfaction	0.127	0.044	2.908	0.004
Time pressure	satisfaction	-0.112	0.035	3.215	0.001
Trust	satisfaction	0.349	0.044	7.997	0.000
Use	satisfaction	0.291	0.049	5.919	0.000

Source. Authors' own calculations

Understanding Coffee Certification Dynamics: A Spatial Analysis of Voluntary Sustainability Standard Proliferation

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Abstract

Third-party Voluntary Sustainability Standards (VSS) have emerged as an increasingly popular strategy to guarantee sustainability in the coffee value chain. Yet, knowledge of the population characteristics of certified farmers, and of the influence of transnational and local supply chain actors on the uptake of VSS at the producer level, is still scarce. Using expert interviews, a comprehensive database of certificate holders and spatial mapping analyses, this paper adds to present knowledge concerning the effectiveness of VSS in the coffee sector in three ways. First, it showcases the structural, geographical and socio-economic tendencies toward VSS adoption in Guatemala, Colombia and Costa Rica, and allows first insights in the additionality and effectiveness of certification schemes derived from these indicators. Second, it contributes to an up-to-date understanding of the coffee supply chain, a sector of great economic importance both to producing and consuming countries that is in constant flux and reorganization, and it explains how current VSS interact with this type of global supply chain. Finally, through the construction of a comprehensive population of certified farmers, it enables better evaluation of existing case studies, generalizability, possible biases and provides valuable information for the preparation of future impact evaluation projects.

Keywords: Voluntary Sustainability Standards, standard take-up, coffee, sustainable value chains

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Introduction

In the last twenty years, third-party voluntary sustainability standards (VSS) have emerged as an increasingly popular strategy to guarantee sustainability in global value chains (Auld et al. 2007). VSS schemes can be conceptualized as non-state, market-driven governance approaches that aim to improve the economic, environmental and social sustainability of production through the establishment and enforcement of specific norms of behavior (Cashore et al. 2004). Due to their voluntary nature, scheme buy-in and long-term commitments by firms and NGOs are an essential success factor for the spread of VSS. Hence, much academic attention has been focused on explaining standard uptake and adaption decisions by these stakeholders (Cashore et al. 2004; Auld et al. 2007; Nadvi 2008; Levy et al. 2016; Pattberg 2006; Fransen and Burgoon 2012). Yet, there has been comparatively little analysis of how these supply chain actors influence the proliferation of sustainability standards at the producer level. Furthermore, there exists a lack of aggregated knowledge about the current supply base of certified products and the characterization of participating farmers (with the notable exception of Guedes Pinto et al. (2014)). Our paper aims to fill this research gap through a combination of qualitative and geographical research in a cross-section of coffee-producing countries in Central America.

Ensuring sustainability is of particular importance in the coffee industry. Changing climates, exacerbating price volatility, and recurring disease outbreak threaten the continued global supply, while consumption demand is projected to increase (ICO 2014). Simultaneously, the coffee sector is at the forefront of VSS adoption (Panhuysen and Pierrot 2014) and the academic evaluation of their impact (KPMG 2013). Yet, few studies address the representativeness of the certified entities they are evaluating (Arnould et al. 2009; Bolwig et al. 2009; Kuit et al. 2013). Comprehensive country-level data on the population of certified farmers are difficult to obtain and suffer from fragmentation and poor quality. Yet, location-specific insights on the total population of certified producers are crucial for understanding the true effectiveness of VSS in improving sustainability. If mainly above-average producers—in terms of farm size and, relatedly, wealth—are the only ones that can achieve certification, the scheme's impact on economic development is minimal. Equally, if certified producers are scattered across uncertified landscapes, their effect on overall ecosystem sustainability will be suboptimal.

This paper adds to the knowledge base on the effectiveness of voluntary sustainability standards in the coffee sector in three ways. First, it showcases the structural, geographical and socio-economic tendencies toward standard adoption in three important origin countries and allows first insights in the effectiveness of VSS schemes derived from these indicators. Second, it contributes to an up-to-date understanding of the coffee supply chain, a sector of great economic importance both to producing and consuming countries that is in constant flux and reorganization, and explains how current VSS interact with this type of global supply chain. Finally, through the construction of a comprehensive population of certified farmers, it allows to better evaluate existing case studies' generalizability and possible biases and provides valuable information for the preparation of future impact evaluation projects.

Objectives and Research Questions

Beyond anecdotal evidence, little is known about the drivers and determinants of VSS adoption. In addition to individual farm-level interest and motivation, other factors – such as pre-existing business relations, buyer interest, or location – may be determinants of certification success (Bitzer et al. 2013; Valkila et al. 2010). The necessity of being embedded in a fully certified supply chain further limits farmers' self-determination of choosing whether and which sustainability schemes to participate in. In particular, the crucial role of external agents—roaster-led programs, in-country exporters, governments, coffee institutions and NGOs—has not yet been sufficiently examined. As the first link of farmers to export markets, they take on a central interface position between local supply and global demand. This paper investigates this demand-driven decision-making process using supply chain analysis as well as geographical meta-data to identify the main pathways toward coffee VSS adoption in Guatemala, Costa Rica and Colombia. Furthermore, the compilation of a database of all certificate holders of four main VSS (FLO, Fair Trade USA, Rainforest Alliance and UTZ Certified) allows a first characterization of the countries' respective producers of certified coffee. Through a combination of qualitative and spatial research, this paper aims to answer the following research questions:

> *What are the main pathways toward participation in Voluntary Sustainability Standards in the coffee sector? Are there major structural (geographical and institutional) determinants of participation connected to these pathways?*

On the basis of a literature review of supply chain and governance-related publications as well as semi-structured expert interviews we inductively construct a classification of VSS adoption pathways, their characterization and determinants of participation. The model is then tested using the construction of a comprehensive database of the certified producers of four VSS schemes in three coffee-producing countries with differing institutional arrangements. The following Sections three and four present the literature review and introduce the country-specific settings. Section five discusses the methods in more detail, Section six provides both qualitative and quantitative results, and Section seven concludes the analysis.

Literature Review

The coffee sector has been a popular subject for case studies on the impact of VSS, particularly regarding Fair Trade and organic certification (such as summarized in Potts et al. (2014) and KPMG (2013)), as well as larger systemic impact analyses (e.g. Fransen 2011; Lambin et al. 2014; Kalfagianni and Fuchs 2015). Additionally, first attempts at integrating supply chain management and VSS research have found it to be a promising field with much remaining research potential (Karjalainen and Moxham 2013; Forrer and Mo 2013; Howard and Jaffee 2013; Moxham and Kauppi 2014). Yet, sector-encompassing analyses of farm-level determinants of standard adoption have been scarcer. From a theoretical perspective, the global commodity chain analysis (Gereffi 1999) and governance cost (Dietz and Auffenberg 2014) approaches add insights for the construction of a framework that can be supplemented by evidence from empirical case studies and interviews.

Gereffian global supply chain analysis views global commodity chains as either producer-driven —where large manufacturing companies coordinate production network—or buyer-driven— which are dominated by end-buyers that set up decentralized networks of atomic, small-scale producers (Gereffi 1999). Kaplinsky and Fitter (2004) and Raynolds (2009) identify the coffee supply chain as a typical buyer-driven commodity chain, where retailers, roasters and traders set the standards that isolated producers have to fulfill. Indeed, the buyer's end is increasingly consolidating (Elder et al. 2014). In 2013, the ten largest roasters controlled more than 40% of total world coffee sales (Panhuysen and Pierrot 2014). After recent mergers and acquisitions, the two leading firms (Nestlé and JAB Holding Company) alone now account for that share, with 22.7% and 21% of global sales, respectively (Boyle 2014; Cohen 2015). Similarly, the green coffee trading sector is highly concentrated: three companies trade more than 50% of the global green coffee volume (Panhuysen and Pierrot 2014). In this type of industry, the vertical integration of supply chains, including of certified products, is common, and inclusion in these chains fundamental for the survival of smallholder farmers (Raynolds et al. 2004). It is thus likely that downstream actors play an important role in farmers' decisions whether to get certified. Indeed, Bolwig (2009) notes that organic coffee production schemes in Uganda frequently resemble contract farming in their design.

In addition to existing market linkages, the governance cost approach suggests that a certain minimum size, accessibility and regional location are important for VSS roll-out. Dietz and Auffenberg (2014) argue that, in view of stable per-unit payoffs in terms of price premiums, rational market actors prefer to engage in sustainability schemes with low implementation and enforcement costs. Generally, VSS schemes exhibit large economies of scale, since the main costs of infrastructure adaptation and auditing are unitary, whereas the economic benefit accrue per unit of output (Kuit and Waarts 2014; Gibbon and Ponte 2005). Thus, larger-scale farms and groups with greater membership should derive greater net benefit from VSS participation than independent smallholder farmers. In Peru, for instance, Bitzer et al. observe that "already existing inter-organizational relationships with the partnership initiator were the most influential factors for being chosen as beneficiaries. Most of these were large, well-known producer organizations that were relatively easy to access in terms of road infrastructure" (2013, 11). Indeed, pre-existing infrastructure, such as good road access or the existence of schools and public hospitals in the vicinity, and stringent public regulatory standards can decrease implementation costs and might facilitate VSS roll-out (Bitzer et al. 2013; Vogel 2008). This is particularly the case for schemes that explicitly include the provision of health and education services.

Furthermore, the cost-benefit analysis for industry actors to engage in certified value chains is more beneficial in product lines with high mark-ups and consumer willingness-to-pay (Kolk 2005). Hence, it might make more sense for high-quality coffee to bear a sustainable label, which, in turn, requires a sourcing strategy that is region-specific. In Colombia, Vellema et al. highlight that "differences in certification rates between regions are not explained by easily observable farm characteristics. Rather, they appear to be driven primarily by the region in which farms are located" (2015, 15).

Finally, Bitzer et al. (2013), Bolwig (2009), and Raynolds et al. (2004) all stress the importance of donor support in achieving and sustaining certification over time and report high levels of dependency, particularly on financial assistance.

Such observations on VSS adoption pathways and special characteristics of certified farms, though recurring, are often made as an aside and have not yet been the focus of sufficient academic research. We intend to contribute to this knowledge gap by constructing and analyzing the comprehensive population of certificate holders in three origin countries.

Country-Specific Settings

When analyzing the supply chain linkages of producers to export channels, it is imperative to understand the surrounding institutional and structural settings producers find themselves in. These conditions diverge strongly between coffee-producing countries, driven by the historical development of institutions, land tenure, and coffee-related legislation. This section will characterize the coffee sectors of Colombia, Costa Rica and Guatemala respectively.

Colombia

With an output of 750,000 tons of green coffee beans in 2014, Colombia is the third-largest global coffee producer after Brazil and Vietnam (USDA 2015). Though the coffee sector has shrunken in its economic significance (making up 4.5% of exports in 2014 as compared to 60% in 1970), it provides employment to more than half a million households and is an important backbone of rural development (USDA 2015).

The Federación Nacional de Cafeteros de Colombia (FNC), the national coffee federation, is one of the world's best-organized coffee institutions and provides an array of services to its members. Among others, it guarantees the purchase of all coffee at a local reference price, provides smallholders with credit, storage facilities and quality control, leads research and extension services, and supports rural development through education, infrastructure and value chain development (Roldán-Pérez et al. 2009). Historically, the government has also repeatedly provided direct income support and renovation subsidies schemes (OECD 2015); most recently and expansively during the outbreak of coffee rust in 2012/13, when more than US$ 300 million were spent on direct transfers to coffee farmers alone (MADR 2013).

Thanks to its high level of organization, Colombia is an attractive country of origin for sustainably certified products. According to the Coffee Barometer 2014, more than 60% of Colombian production is either certified or verified as sustainable (Panhuysen and Pierrot 2014). This allows Colombia to be the second-largest source of standard-compliant coffee worldwide after Brazil, providing 17% of the world supply (Potts et al. 2014). Indeed, in 2011–2012, 28% of global Fair Trade certified supply came from Colombia, 11% each of Rainforest Alliance and UTZ Certified coffee, and 15% of global 4C supply. After Peru, Colombia is the country with the second-largest share of multiple-certified farms, which leads to a significant oversupply especially of UTZ Certified coffee (of which only 12% is sold as certified) (Potts et al. 2014).

Costa Rica

In comparison to Colombia, Costa Rica is a marginal player in the international coffee market. Its economy is dominated by the service sector and it cannot compete either on quantity or on comparative costs. Instead, it has focused on quality and has become an important origin for specialty coffees (Bamber et al. 2014). Nevertheless, the number of coffee farmers is steadily dropping (by almost one-quarter between 2004 and 2014) as lower-altitude farms that cannot reach peak quality tend to succumb to urbanization pressure (ICAFE 2014).

Due to the crop's historical significance and the country's democratic tradition, the coffee sector is extremely well regulated. The Coffee Law of 1961 (Ley 2762) regulates the production process in minute detail, including quality control at processing, profit margins of mills and exporters, price-setting mechanisms and even credit provision (Costa Rica 1961). Since 1989, the government only allows Arabica coffee to be grown in order to protect the Costa Rican reputation for quality (Chacón Sánchez 2008). Furthermore, several laws regulate the environmental effects of coffee production and processing, most importantly the water pollution linked to wet-milling, and many mills upgraded their technologies in the 1990s (ICAFE 2015a). The historical focus on wet milling also streamlined the production process, since all coffee cherries are brought to mills which then leverage their size to sell the green coffee beans to exporters. Indeed, the 10% largest mills process around 70% of all coffee (Coricafe 2012). A strictly regulated liquidation process allows farmers to get a minimum price upon delivery, followed by trimestral payments and a final premium once all processed coffee has been sold to international markets (ICAFE 2015b). This smoothing of cash flows has noticeably benefitted farmers' investment possibilities (ResponsAbility 2013).

In 2011–2012, Costa Rica produced 4% of global Rainforest Alliance-certified coffee, 6% of Fair Trade volumes and 0.25% of UTZ Certified coffee. 24% of Costa Rica's production was Fair Trade certified, with Rainforest Alliance making up another 13% of production. Overall, in 2011–2012 Costa Rica was among the countries with the highest share (32%) of certified national production (Potts et al. 2014), though industry representatives report that producers are moving away from VSS adoption in order to focus on high-quality specialty coffee.

Guatemala

Guatemala's history has been equally dominated by coffee production, though these structures have also contributed to many of its problems. The development of coffee estates—which dominate its sector—led to the expropriation of many indigenous communal lands and forced its former residents into more marginal plots higher up in the mountains. Only recently has a renaissance of smallholder agriculture taken place as high-quality coffee is being developed in exactly those altitudes where indigenous families settled after their expropriation. In response to this shift in demand, the coffee institution ANACAFE which traditionally advocated for the preferences of estate holders and coffee barons is starting to support smallholders more (Fischer and Victor 2014). A further difference to the previous two cases is that state involvement in the coffee business is minimal. Those programs that do exist are marred by corruption and misappropriation; for instance, almost half of the funding to overcome the coffee rust crisis in 2012–2013 was used for roads and other infrastructure projects before it could be allocated to

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coffee farmers (Luxner 2015). In contrast, some coffee areas of Guatemala such as Huehuetenango have had access to ample development assistance by both private NGOs and foreign ODA such as USAID's Rural Value Chains Program that targets over 12,000 people in total (USAID 2016). In addition, for its size Guatemala is an important sourcing country for several certification schemes. In 2012, it provided 7% of Rainforest Alliance and 2% of UTZ Certified coffee. Overall, around 13% of Guatemalan coffee output is certified (Potts et al. 2014).

Based on these characteristics, and the associated differences in power structures, institutional support and the involvement of external actors, we expect to find significant differences in the adoption of voluntary sustainability standards across the three countries.

Methods

In a first step, we conducted nineteen anonymous semi-structured expert interviews of forty-five to sixty minutes each with representatives of international roasters, multinational and regional traders, and local cooperatives, institutions and non-profit organizations in the three countries under analysis (Guatemala, Costa Rica and Colombia) and tested our hypotheses about the relative importance of relational, institutional and geographical determinants of certification in the particular country contexts. Furthermore, we identified clear and distinct pathways toward certification and gauge their respective importance across different VSS.

In a second step, we tested whether the qualitative results can be quantitatively observed. We constructed a database of certificate holders of the four most prominent sustainability labels in the coffee sector (Fairtrade Labeling International, Fair Trade USA, Rainforest Alliance and UTZ Certified) in three leading countries regarding certification volume, namely Guatemala, Costa Rica, and Colombia. Our baseline dataset is an up-to-date map of the geographical location of certificate holders based on the certification organizations' online maps (FLOCERT 2016; Fair Trade USA 2016; Rainforest Alliance 2016; UTZ Certified 2016). To this, we added size information (number of farmers and/or certified coffee hectares, as available), altitude, information about multiple certification, and coded the certificate holder information according to their most probable pathway to certification[1]. Using these maps, we tested our hypotheses on the importance of location as well as of the presence of infrastructure. We also compared regional volumes of certified products with regional production information (MAGA 2015; INEC 2015; FNC 2015) to identify whether certified producers are over- or underrepresented in certain regions, and compared the average farm size of certified farmers with country-level means. Using the VSS adoption pathway information, we examined which pathway contributes most to certified volume. We finally tested whether the pathways are significantly different in the total area and area per producer that is certified, as well as in the altitude of production which correlates with greater quality, through the use of ANOVA analysis.

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[1] This was approximated by using the certificate holder's name and/or openly available information on the certification pathway.

Results

Qualitative Analysis

The expert interviews yielded five alternative, and in some cases complementary, pathways toward VSS adoption that are schematized in the following chart. First, they can be differentiated by their main motivating force: increased demand for certified products stemming from downstream supply chain actors (the demand-driven pathway) or increased supply provided by upstream producers (the supply-driven pathway). Increased demand can be managed either by green coffee exporters that source more certified coffee, or directly by the roasters through a vertically integrated supply chain. On the other hand, upstream producers' motivation to participate in a certified value chain can be stimulated by national- and regional-level institutions with clear political goals, or have emerged organically in cooperatives and coffee estates.
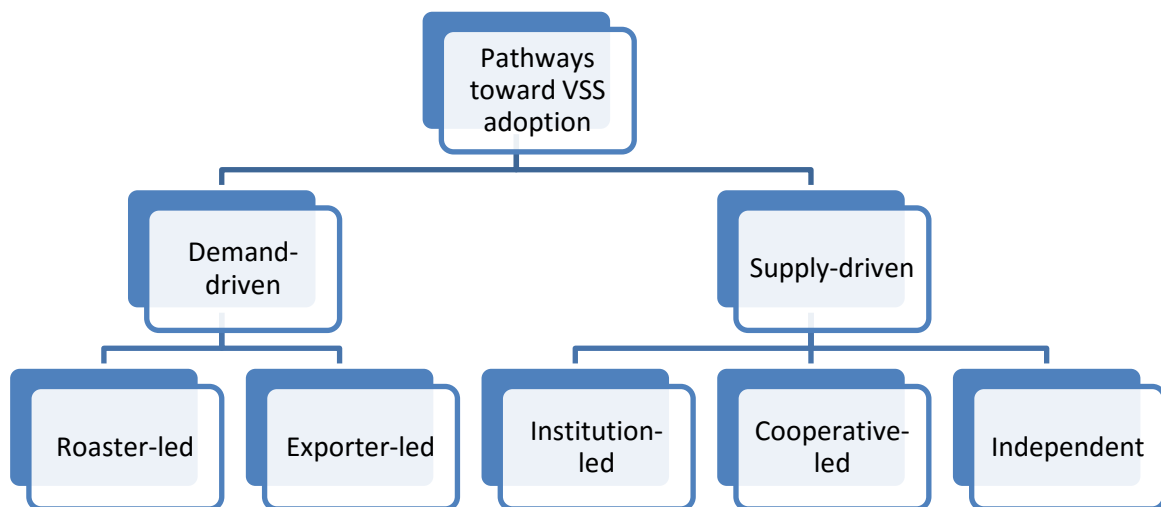
Figure 1. Pathways toward certification

The following describes the identified types in more detail, based on information gathered in the anonymous interviews.

Roaster-Led Initiatives

The high-priced, specialty coffee segment is the fastest growing market in high-income countries where demand is otherwise saturated (ICO 2014). Hence, recently more emphasis is put on sourcing sustainable coffee directly from select geographical regions whose flavor profiles match certain expectations. Whether through official collaborations between roasters and third-party VSS, or the use of VSS as a reputation management tool, increasingly roasters take more direct control for this high-quality segment of their supply chain. The local cup quality and flavor profile is key in selecting suppliers, and maintaining and improving these aspects is the main priority for buyers. Thus, excessive farm management changes—such as large changes in shade cover—are discouraged, even if they were to enhance sustainability. Participation in the schemes

is contingent on farm location, strict quality controls and compliance with the certification requirements. Typically, the roaster commissions technicians to assist farmers with achieving these criteria, and also takes on audit costs, either directly or through the collaborating exporter. This close relationship carries the threat of supply chain captivity, particularly for participants in group certifications administered by the roaster. Interestingly, however, when achieving single-farm third-party certification as well as managing quality-related practices, estates in these regions gain considerable market power since frequently competing roasters source from the same regions. Indeed, in interviews, roaster representatives expressed frustration with their inability to have sales guaranteed from farmers linked to them despite the upfront certification investments.

Exporter-Led Initiatives

In the non-specialty coffee segment, roasters typically source through green coffee traders where the only specification for certified coffee is a country of origin, the certification type and a standardized quality measure. In this case, location is only a factor as far as it concerns accessibility and proximity to an exporter's coffee mill, in the case of unprocessed delivery. Rather, exporters try to fulfill known or expected demand for certified coffee in the most cost-effective way possible. This includes identifying single estates or groups of farmers that are very close to certification criteria and convincing them to join the program. Since exporters typically only bear auditing costs, but do not help with implementation expenses, it is paramount that prospective participants already have proper infrastructure, such as water treatment facilities, in place before being considered for inclusion in the scheme. Sometimes, exporters are also the nominal certificate holder for a group of farmers to reduce costs; at other times, the certificate is in the name of the farm but associated costs are borne by the exporter. Similar to roasters, exporters highlight the need to minimize their risk of lost investment via defection; in this case, they base their outreach strategies mainly on pre-existing relationships that have created trustful and loyal buyer-seller bonds. Since traceability is vital for certifications to remain credible, it is easier for exporters to turn toward large estates rather than disparate groups of smallholders. Finally, as intermediaries between final demand and supply, exporters may be one cause of the current oversupply of certified coffee if they incorrectly overestimate their share of demand and engage in competition amongst each other, the results of which decreases the marketable amount of certified coffee of their respective suppliers.

Institution-Led Initiatives

Frequently overlooked in discussions on sustainability in the coffee sector, coffee institutions such as the Costa Rican *Instituto del Café (ICAFE)*, Guatemala's *ANACAFE* or the Colombian *Federación Nacional de Cafeteros* (FNC) can be a powerful force for change in contexts where they are endowed with sufficient resources and influence. Their strategies and focus areas differ between countries, as does their reach. Typically, they maintain a minimum structure of extension services, they may be involved in exporting activities, and many have a marketing arm that tries to position their country's coffee in niche markets. Some institutions such as the FNC have a clear goal of moving the sector toward VSS adoption and provide capacity-building trainings, extension activities and even hold the certificate for groups of farmers. They may also assume the auditing fees. Other institutions such as ANACAFE use VSS as one possible avenue

of market access, or pursue alternative strategies, such as ICAFE, which aims to position Costa Rica as a sustainable origin *per se* that does not require third-party verification. When coffee institutions pursue a sustainability strategy that includes VSS, they have a significant advantage due to their closeness to both farmers and markets, their relative impartiality within the negotiation process, and the resources and networks available to them. They are also valuable collaboration partners with some of the previously described actors. However, in deciding where to focus their efforts, political considerations may outweigh more objective criteria, and the level of motivation of regional offices can play a big role in the success of the national strategy.

Cooperative-Led Initiatives

As organizations that coordinate previously isolated farmers, first-level cooperatives can also be a powerful driver of change without external impetus. The economies of scale achieved by cooperative activities apply to the certification process; furthermore, they are the preferred organizational model for some certification schemes such as Fair Trade and thus at a competitive advantage in this market. Most frequently, they choose schemes with requirements that are the current modus operandi, for instance producers that are *de facto* organic due to a lack of access to inputs or their convictions (e.g. indigenous communities). But also visionary and worldly leaders can bring about incremental change in hitherto isolated communities (Raynolds et al. 2004). In the case of small producer groups, collaboration and assistance from local and international NGOs is often necessary to achieve the required level of capacity-building and investment to achieve certification, and to cover auditing fees up front. Larger cooperatives can more easily assume these costs themselves, but tend to leverage these investments by pursuing multiple certifications at a time. This again contributes to oversupply in the market place and to instable demand, making cost-benefit analyses of maintaining the certifications very difficult.

Independent Certification

Finally, single farms may also choose to pursue VSS certification without the inclusion in any of the aforementioned channels. This is most frequently the case when farms already comply with the certification requirements, for instance larger estates with good management practices and a strong sense of environmental responsibility. These farms tend to have had at least some exposure to world markets, and frequently hold multiple certifications as well as direct trade relationships to roasters. According to expert interviews, even when offered certification support by exporters some of these independent farms prefer to stay untethered and pay their own way. This, however, makes them more vulnerable to changes in demand and certification procedures and costs, since they need to cover their out-of-pocket expenses with the received price premiums.

Based on these descriptions, the identified pathways can be differentiated in their stylized form according to the following characteristics:

Table 1. Characteristics of pathway types

	Roaster-Led	**Exporter-Led**	**Institution-Led**	**Cooperative-Led**	**Independent**
Goals and Implementation					
Primary motivation	Risk management	Higher market share	Rural development	Better prices	Better prices
Selection criteria	Quality (geographical cluster)	Readiness Vicinity Access Reliability	Political interests Local impetus Readiness	Local motivation De facto practices Visionary leader	Personal conviction De facto practices
Strategy	Mass roll-out	Selective integration	Stakeholder collaboration	Group-level roll-out	Isolated improvements
Assistance Support	Implementation and audits	Audits	Implementation and audits	Reliance on third-party (NGO)	None
Relationship	Long-term	Variable	Long-term	Variable	Variable
Outcomes					
Geographical integrity	Yes	No	Yes	Sometimes	No
Additionality	Yes	No	Medium	Medium	Medium
Guaranteed market	Yes (conditional on quality)	Sometimes	Sometimes	Mostly no	Mostly no
Threats for farmers	Captive supply chain	Loss of roaster demand	Change of political strategy	Loss of leadership No market	No market Cost increases

On the one hand, one can differentiate the pathways by their goals and implementation methods. The primary motivation of supply chain actors to engage in VSS activities is a first large difference: roasters and exporters do it to protect their reputation and expand their market shares, institutions focus on the larger rural development problematic, and cooperatives and independent farms just aim to improve their total coffee income. These motivations in turn influence the selection of which producers may participate in which channel: the demand-driven channels focus on quality and relative advancement in certifiable practices, while the self-selection of the supply-driven channels is based on the conviction of local leaders, farm owners and the current practices. Roll-out strategies and the available assistance equally diverge. Finally, producers may have longer-term relationships to downstream buyers, or their export channels may change importantly year to year.

On the other hand, these differences in implementation can have important implications for the effectiveness of sustainability standards and other related outcomes. The geographical integrity

of certified production areas—important for ecosystem protection— is given more frequently in region-specific roll-outs, such as roaster-driven and institution-driven pathways, than in more scattered and opportunistic certification dissemination. The additionality of practices is only given where they did not previously exist, which strongly depends on the selection criteria of participating farmers. Guaranteed market access is necessary to benefit from the price premiums linked to VSS. And the existence of threats to participating farmers may endanger the long-term sustainability of such schemes. In particular, interviewees agreed that it is increasingly seldom to encounter farmers that pursue certification independently and pay for it out of pocket, due to increasing implementation costs and plateauing or decreasing premiums. This causes frequent entry and exit in various certification schemes depending on buyer demand and exporter incentives.

The next section will evaluate whether these and other tendencies can be observed in the on-the-ground data.

Quantitative Analysis

Geographical Distribution of Certificate Holders

Figures 2 to 4 show the regional distribution of the main four sustainability schemes (Fairtrade Labeling International, Fair Trade USA, Rainforest Alliance and UTZ Certified) in our focus countries according to their classification. Cooperative-led schemes are represented in yellow, exporter-led groups in dark blue, independent certificate holders in purple, institution-led groups in turquoise, and roaster-led certificate holders in green. The underlying shading represents the relative coffee area per administrative area; the darker the shading, the more coffee is planted in that district. From this analysis, it is apparent that there are certain regions that exhibit greater certification activity than other parts of the countries. In Colombia, the coffee belt of Caldas, Risaralda and Quindío seem to be overrepresented compared to its production volume. In Costa Rica, the provinces of Alajuela and San Jose seem to be most popular with certification schemes, while in Guatemala, the leading coffee producing regions of San Marcos and Santa Rosa show relatively fewer certificate holders than for example the provinces of Huehuetenango or Chimaltenango despite the latter's lower production volumes. It is also visible that roaster- and exporter-led certification tend to cluster in select areas, while independent certificate holders are scattered across the countries. Green circles highlight the roaster-identified focus areas, while exporter-led groups are gathered in blue circles.
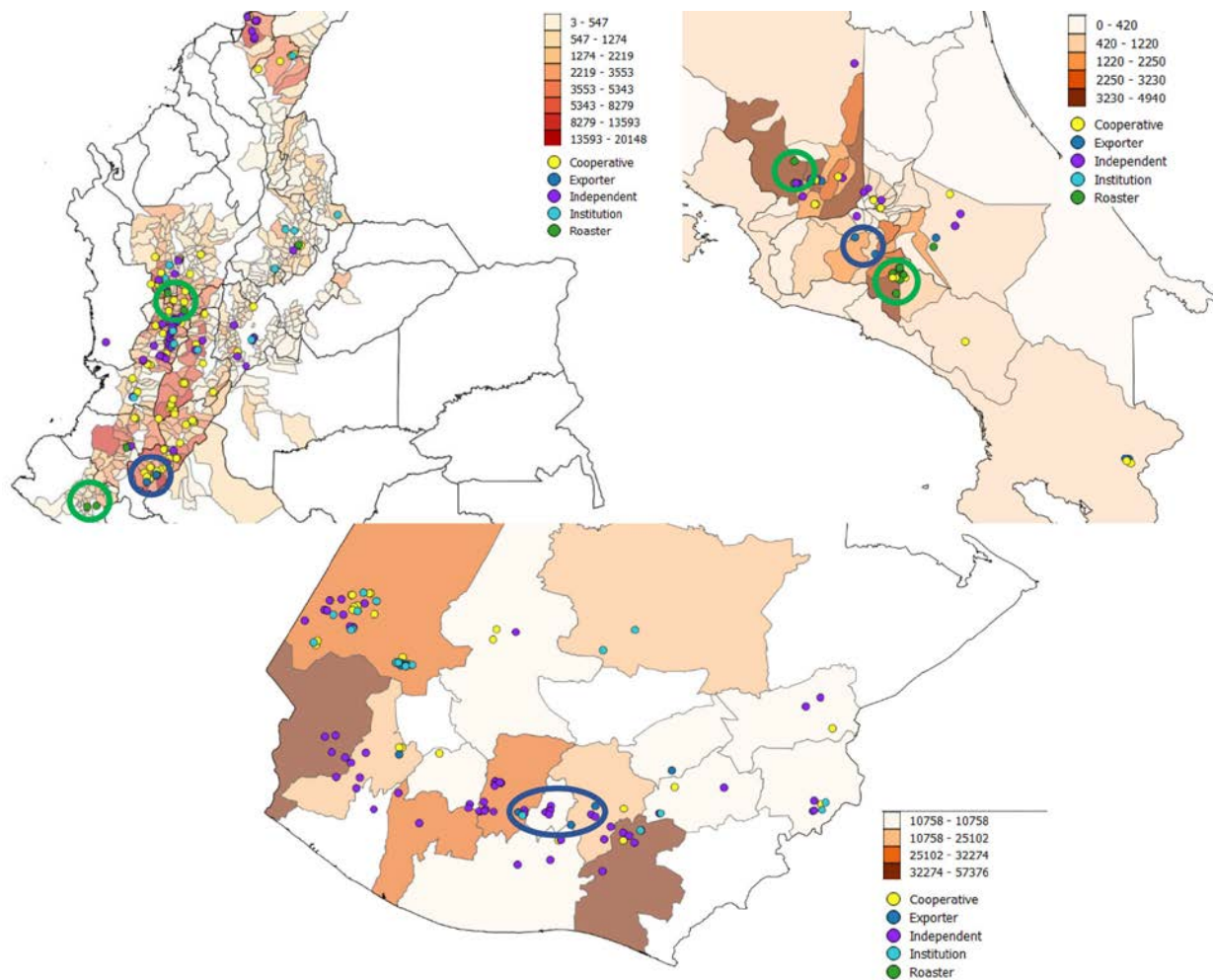
Figure 2. Geographical distribution of coffee certifications and relative coffee production (in ha) in Colombia, Costa Rica and Guatemala

Using the cleaned data, and national production information gathered from census and coffee institution information (FNC 2014; INEC 2015; MAGA 2015), the most prominent examples of over- and underrepresentation of certification are shown in Table 4.

Both in Guatemala and Costa Rica, the comparative shares roughly reflect the impression we reached from interpreting Figures 2 to 4. Notably, however, the shares of Rainforest Alliance and UTZ Certified distribution (first column) do not necessarily correspond to the member-based cooperative activity focused around Fair Trade certification (second column). This supports the hypothesis that the motivations for participation are different between the two groups, which loosely correspond to the demand-driven and supply-driven models. In Colombia, this phenomenon is even more pronounced—despite the presence of comparatively few certificate holders, Santander and Huila actually lead as sources of certified coffee, whereas Tolima for instance lags behind.

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Table 2. Comparative over-[1] and underrepresentation[2] of certified coffee by provinces.

Province	Share of Certified Coffee Area	Share of Cooperative Activity	Share of National Production Area
Colombia			
Caldas[1]	12%	19%	8%
Huila[1]	21%	15%	16%
Santander[1]	12%	4%	5%
Tolima[2]	3%	3%	12%
Costa Rica			
Cartago[1]	23%	–	13%
San Jose[1]	58%	50%	36%
Alajuela[2]	15%	14%	30%
Guatemala			
Huehuetenango[1]	30%	54%	8%
Chimaltenango[1]	12%	–	8%
Quetzaltenango[1]	1%	28%	7%
San Marcos[2]	10%	–	16%
Suchitepequez[2]	4%	–	9%

The mapping analysis also evaluated the importance of infrastructural access using road maps. Results were inconclusive: while many certificate holders are located close to major roads, this information pertains to where they are registered (for instance, some were also located in the countries' capitals where no coffee is produced) and is not necessarily correlated with the accessibility of individual farmers. More research on this correlation is required on the basis of farm-level location data and will be addressed in subsequent papers. In change, the importance of relative size and quality characteristics is further explored in the next section.

Contribution of Different VSS Adoption Pathways to Overall Certified Supply

When differentiated by certification pathway, as done in Table 3, we observe that independent farms and cooperatives still account for the majority of certificate holders. Mirroring the structure of the countries' coffee sectors, Guatemala has more independent estates that are certified than cooperatives, while the reverse is true for Colombia. In Costa Rica, though the majority of farmers are organized in cooperatives, independent certificate holders outweigh cooperatives. This may be because the supply-driven pathways tend to be stronger in this country, and cooperatives arrive at a negative cost-benefit balance when becoming certified

independently. Roaster-led certified groups are explicitly present in Colombia and Costa Rica, whereas roasters tend to partner with exporters in Guatemala. Institutional support is apparent in certified groups in Colombia and Guatemala, but not in Costa Rica.

Table 3. Summary statistics on percentage of certificate holders (FLO, Fair Trade USA, Rainforest Alliance and UTZ Certified) by country and VSS adoption pathway

Pathway	Colombia	Costa Rica	Guatemala	Total
Cooperative	49.2%	11.8%	14.7%	31.1%
Independent	35.2%	44.1%	60.8%	46.2%
Exporter	3.1%	17.6%	7.8%	6.8%
Institution	8.6%	–	16.7%	10.6%
Roaster	3.9%	26.5%	–	5.3%

However, the mere number of certificate holders does not tell the entire story. To understand where most certified coffee volume comes from, we used detailed certified area data from two of the leading schemes (Rainforest Alliance and UTZ Certified), and supplement it with producer number data regarding the cooperative-focused sustainability standards (FLO and Fair Trade USA). We exclude multiple certified hectares and producers, which account for an important share of supply. From the data, it is also apparent that Fair Trade USA and UTZ Certified are used more frequently as secondary label in farms that hold multiple certifications (with 72% and 42% of certified farmers holding another certification, respectively), whereas the FLO and Rainforest Alliance certifications more often stand-alone (36% and 20%).

Overall, we are able to identify Rainforest Alliance and UTZ Certified areas corresponding to 50,521 ha in Colombia, 22,659 ha in Costa Rica and 28,279 ha in Guatemala. Furthermore, 88,553 producers pertain to a fair trade cooperative in Colombia, 33,683 in Costa Rica and 16,618 in Guatemala. These numbers compare favorably to previous information, as far as it is available (see section 4 on country information). Of these grand totals, in Colombia, 20% of both total certified area and producers can be clearly identified as non-additive (i.e. the certification of already certified hectares/cooperatives); in Costa Rica, this share is only 2% of area but 30% of cooperative members; and in Guatemala, 10% of area and 30% of cooperative producers. This is a tentative estimate, since producers may form part of differently named groups that cannot easily be associated; nevertheless, it reflects the stronger focus on multiple certification in Colombia, and in general in cooperative-led schemes, driven by supply-side interests, and the lower prevalence of multiple certification in demand-driven schemes such as those dominating the Costa Rican and Guatemalan sustainable coffee supply.

The distribution of volumes by pathway categories differs markedly from the distribution by certificate holder numbers. Due to the schemes' entry requirements, most FLO and Fair Trade USA certificate holders are cooperatives, but there is more variance in Rainforest and UTZ Certified certificate holders, which strongly reflect the respective institutional context. In Colombia, where the FNC has been extraordinarily proactive in promoting certification amongst its members and collaborating with supply chain stakeholders, institution-led and roaster-led pathways have significantly contributed to the coffee area certified according to the Rainforest

Alliance and UTZ Certified standards.[2] In Costa Rica, institutional support has been less vigorous, and hence 77% of certified coffee area supply is attributable to roaster- and exporter-led initiatives, with only one cooperative entering the top contributors. In Guatemala, in turn, individual estates still dominate the certification landscape, though they may also have received financial or logistic assistance by exporters to achieve certification.

Table 3. Distribution of Rainforest Alliance and UTZ Certified producers and certified area according to country and VSS adoption pathway.

Pathway	Colombia		Costa Rica		Guatemala		Total	
	Certificate Holders	Certified Area	Certificate Holders	Certified Area	Certificate Holders	Certified Area	Certificate Holders	Certified Area
Cooperative	38.7%	33.3%	13.9%	9.7%	12.9%	7.0%	25.0%	20.7%
Independent	42.9%	14.7%	44.4%	13.5%	61.4%	54.6%	50.4%	25.5%
Exporter	3.4%	4.8%	16.6%	22.7%	7.9%	19.2%	7.0%	12.8%
Institution	10.1%	25.0%	–	–	17.8%	19.2%	11.7%	17.8%
Roaster	5.0%	22.2%	25.0%	54.1%	–	–	5.8%	23.1%
Total	119	50,521 ha	36	22,659 ha	101	28,279 ha	256	101,459 ha

Area Size of Certificate Holders and Certified Groups

As Table 4 shows, size matters. The data indicate that the current supply of certified coffee—as approximated by the certified coffee area under production— is highly skewed by a small number of certificate holders with very large areas. Their makeup again depends on the country context: roaster- and exporter-led groups dominate in Costa Rica, single estates in Guatemala, and a mix of cooperatives and roaster-led groups are the biggest contributors in Colombia. In Guatemala, the 10% largest certificate holders contribute 35% of total area; in Costa Rica, they contribute 47%, and in Colombia even 58% of total certified coffee area.

On the other hand, the institutional support in Colombia and positive spill-over effects may have aided smaller producers to enter the certification landscape: over 38% of Colombian certificate holders hold less than 100 hectares, while only 25% of certificate holders in Guatemala and 29% in Costa Rica do so. When performing the same type of analysis with Fair Trade producers, we can see that 61% of Colombian cooperatives and producer groups had more than 200 members, 56% of Guatemalan cooperatives had over 350 members, and 91% of Costa Rican groups had over 450 members. In comparison, Colombia has the greatest share of small- to medium-sized cooperatives that participate in Fair Trade distribution channels of all countries. In Costa Rica and Guatemala, in turn, smaller groups may turn to other ways of value-addition beyond certification.

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[2] It should be noted that cooperatives are frequently the on-the-ground implementers of FNC policies, such that it is impossible to strictly divide cooperative-led and institution-led certification other than by certificate holder name, which is what we have done here.

Size also matters for the average area per producer, though it differs by country. As presented in Section 4, Costa Rica and Colombia tend to be dominated by smallholder coffee farmers, which makes independent certification difficult and economies of scale, such as those inherent in externally organized group certifications, attractive. Specifically, in 2014 the average coffee area of a Colombian coffee farmer was 1.4 hectares, while Costa Rican farmers possess on average 3.2 hectares (FNC 2014; INEC 2015). On average, Guatemalan farmers also hold around 3 hectares (USAID 2010), but the population is much more dispersed, with a larger number of medium- to large-scale coffee estates and a comparatively weak institutional support system. Breaking these numbers down, individual farms and those in groups with less than ten members hold on average 156 hectares, with the largest individual certified farm (in Guatemala) holding 990 hectares. In group certifications, as expected average farm sizes are smaller, but still above country averages with a mean of 5.3 hectares per person. On the other hand, where area information coexists with producer numbers for FLO and Fair Trade USA certification—which is unfortunately only true for a subset of cooperatives –, we see that mean farm size is 2.9 hectares, more in line with country averages than the mainly demand-driven standards.
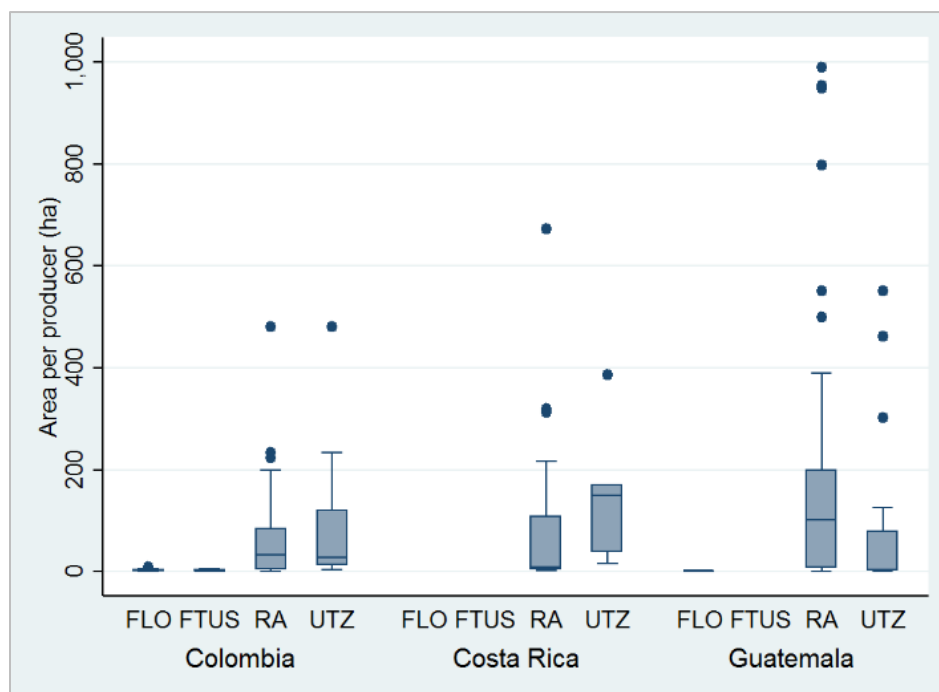
Figure 3. Box plots of certified coffee area per person by country and VSS

We can also differentiate the pathways of certification according to size. Table 5 shows that externally influenced certification paths—roaster-, exporter- and institution-led certification— take significant advantage of economies of scale by grouping farmers with as much as 5,000 collective hectares of land into one group certification. There was a statistically significant difference between the mean size of the different pathway groups as determined by two-way ANOVA (with country being the second independent variable).[3] Yet, they do it in different

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[3] Statistically significant main effect of pathway on area: $F_{(4, 231)}$: 20.38, p=0.000, as well as interaction between pathway and country on area: $F_{(6, 231)}$: 3.00, p=0.007. A Tukey HSD pairwise comparison test showed that in particular the roaster-led pathway has a statistically different effect on size compared to all other pathways.

ways. Exporter-led group certifications tend to gather few larger producers together, while institution- and roaster-led groups include large numbers of smaller producers. Here again, average farm size was statistically significantly different between the pathway groups as determined by two-way ANOVA[4].

Table 5. Mean, minimum and maximum size by certification pathways

Pathway	Mean Size	Minimum Size	Maximum Size	Average Farm Size
Cooperative	1011 members	17 members	10'000 members	2.9 ha
Independent	212 ha	5 ha	1413 ha	157 ha
Exporter	724 ha	17 ha	4168 ha	90 ha
Institution	609 ha	77 ha	3566 ha	5.3 ha
Roaster	1903 ha	96 ha	5084 ha	3.7 ha

Quality

The differences in geographical distribution that were found in Section 6.2.1. may be due to differing primary selection criteria, one of which is quality. In specialty coffee, quality is strongly correlated with altitude (Wilson and Wilson 2014), making it an appropriate proxy to test for. When comparing the average altitude between pathway categories, it is apparent that means are significantly different between independent and externally influenced certifications. In particular, roaster-led initiatives clearly focus on a narrow ideal band of altitude, having the smallest variance around the mean, while self-selected certified farms have a broader distribution of altitudes with a lower mean. This significance holds even after controlling for country selection, as apparent in two-way ANOVA analysis[5].

Table 6. Mean, maximum and minimum altitude by certification pathway

Pathway	Mean Altitude	Minimum Altitude	Maximum Altitude
Cooperative	1340 m	19 m	3651 m
Independent	1346 m	42 m	3703 m
Exporter	1521 m	724 m	2356 m
Institution	1555 m	144 m	2953 m
Roaster	1643 m	1073 m	2534 m

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[4] Statistically significant main effect of pathway on average farm size: $F_{(4, 229)}$: 8.41, p=0.000, as well as interaction between pathway and country on average farm size: $F_{(6, 229)}$: 2.95, p=0.009. A Tukey HSD pairwise comparison test showed that in particular, the exporter, institutional and roaster-led certification pathways differed in farm size.

[5] There was a statistically significant main effect of pathway on altitude: $F_{(4, 358)}$ = 3.52, p=0.008; as well as a statistically significant main effect of the respective country: $F_{(2, 358)}$ = 9.79, p=0.000.

Yet, a general trend toward high quality coffee can be observed in all certifications and pathways. According to our data, 42% of FLO and Fair Trade USA producers in these three countries have farms at above 1400 m (which qualifies for "Strictly Hard Bean" status, one normalized quality characteristic), with 24% reaching above 1600 m. Furthermore, 51% of the total coffee area of Rainforest Alliance and UTZ Certified coffee grows at above 1600 m, supporting the hypothesis that quality attributes and requirements coincide with certification, and that these characteristics may be blended in with sustainability characteristics when determining the premium price paid.

Discussion

Putting the Results into Context

The results of this study both confirm the two guiding theories and provide a more nuanced understanding of their applicability. The proportional importance of exporter- and roaster-driven group certifications presented in Section 6.2.2. highlight the significance of the Gereffian demand-driven model of global supply chain governance when characterizing the global coffee sector. Yet, the structural influence of the coffee institutions and the pre-existing distribution of land in the agricultural sector are important preconditions that shape the space in which this global value chain actors exert power. Thus, in Colombia collaboration with the FNC is of prime importance that can be seen within the certification landscape; while the Guatemalan set-up continues to benefit the traditional landed coffee elite most.

Furthermore, the example of Costa Rica shows that macroeconomic developments and sector-specific opportunity costs need to be taken into account when using governance cost theories to explain the decision to participate in VSS. For instance, despite favorable infrastructural and socio-economic preconditions, individual Costa Rican coffee farmers are turning away from VSS and toward quality premiums, and VSS schemes are dominated by externally-led groups. Still, the predicted focus on above-average farm and group size as well as high quality can be observed very well in this dataset.

In general, when examining the current distribution of certificate holders in Costa Rica, Guatemala and Colombia, one can conclude that the incentive structure rewards either large, advanced, already sustainable farms due to their reliability and the low implementation costs, or farms located in select geographical areas well-known for particular flavor profiles. This research is in line with the results from Guedes Pinto et al. (2014) on Rainforest Alliance-certified farms, though the Brazilian coffee industry operates on an even larger scale. In particular, we identified a trend of certified production areas toward high altitudes with better quality characteristics. Furthermore, the search for other attributes such as reliability and financial stability may precondition supply chain actors to eschew working with those smallholder farmers who were initially targeted by VSS.

Policy Implications

The comparative cases of Colombia, Costa Rica and Guatemala also show that the presence of a strong institutional or supply chain actor committed to VSS is necessary for the inclusion of

smaller actors and farmer groups. In all three countries we found a strong concentration of certified area and producers in large, externally driven groups, while smaller players likely struggle to achieve positive cost-benefit outcomes of VSS participation. This transformation of the sustainability marketplace toward efficiency and cost minimization runs counter to public perception in consumer countries and has the potential to create disenchantment with sustainability schemes in the long run. Yet, a surprising result was the important contribution of roaster-led groups made up of relatively small farms in concentrated clusters that allow for geographic connectivity. Constituting only 6% of Rainforest Alliance and UTZ Certified certificate holders, they nevertheless contributed 23% of the total certified area; exporter-led groups (7% of certificate holders) added another 13%. It is thus high time for public actors to recognize the essential role of private entities in the role-out of VSS systems and acknowledge connected benefits as well as address potential drawbacks for farmers such as selectivity issues and supply chain captivity. Working together with multinational trading and roasting firms in the form of public private partnerships can harness their logistic and market advantages while ensuring that small-scale farmers are included in diversified and fair value chains. Additionally, the study highlighted the importance of active coffee institutions for a broad-scale roll-out of VSS among smallholders. Governments wishing to see a stronger presence of VSS in their agricultural value chains should therefore consider investing more in VSS-specific extension services that introduce farmers to and train them in the stringent certification criteria.

Limitations and Steps Forward

When combining a number of databases, it is always possible that errors in the underlying data influence one's results. In this particular case, the GPS information of certificate holder locations has proven unreliable in some instances and was corrected according to the best information available; nevertheless, last outliers may remain in the dataset. Furthermore, altitude data was derived from the available GPS coordinates of the certificate holders, not participating farmers directly. There is thus a chance that the real mean altitude of these farms differs slightly from our estimate, though these errors are likely to average out since our estimation technique is the same for all observations. As mentioned, the classification of pathway types was done according to certificate holder name and public information linked to these certificate holders. This method provides a lower bound for the amount of institutional, exporter- and roaster-led support, since it is possible that individual farms or cooperatives received significant financial and capacity-building assistance from these sources but obtained the certificate in their own name. Finally, the topographical and environmental characteristics of the three countries under investigation are particular to the study region, such that results might not be generalizable to other coffee-growing countries outside of Central America.

Considering the stated limitations above, further work is necessary to investigate whether the above results regarding certificate holders hold at farm-level. Furthermore, it would be interesting to compare the prevalence of different certifications and certification pathways in country contexts where quality characteristics have yet played a minor role, due to location or institutional shortcomings.

Acknowledgements

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Farmers' Perceptions of Building Trust

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Abstract

Trust is an integral part of maintaining any successful business relationship, especially within agriculture. Yet, there is minimal research on how to best build and enhance a trusted relationship. To identify how sales representatives can deepen trusted relationships with farmers, a novel, best-worst survey approach is used. Results show that sales representatives should focus on their own personal development to build more trusted relationships as opposed to things largely outside of their control. Farmers did not care as much about age, years working, or even the reputation of the sales rep's employer. In short, our research shows that agricultural sales representatives can build more trusted relationships with farmers.

Keywords: trust, agribusiness, sales, human capital development.

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Introduction

Trust is an integral part of maintaining any successful sales relationship, and without trust, a business transaction would likely not occur. These statements certainly hold true in agriculture. Wilson (2000) defines trust as the cohesion in agricultural transactions, which then creates the value of relationships between parties. Having assurances that each party will honorably uphold their end of a contract under any-and-all unforeseen circumstances, generates value for both parties (Wilson 2000). Thus, in agriculture, farmers find value in working with sales representatives they trust.

While the literature is very clear on the value of a trusted relationship, there is minimal research focused on farmers' perceptions of building trust with sales representatives. That is, how should agricultural sales representatives approach building trust with their farmer customers? Do certain characteristics of a sales representative project or demonstrate trusted characteristics? What performances and/or attributes do farmers perceive as signs that a sales representative can be trusted? Knowing the answer to these questions would help agricultural sales representatives deepen their relationships with farmers.

Furthermore, answers to these questions would benefit sales representatives in many industries. A few example industries where sales representatives are utilized include agricultural lending, machinery and equipment, grain and livestock, agronomy, and various other industries tied directly to crop and livestock production. While the farmer perceived value of trust may vary between these industries, that is not the purpose of this research. Knowing farmers' perceptions of how to build a more trusting relationships would benefit all agricultural sales representatives, regardless of industry.

The focus or objective of this paper is to identify farmers' perceptions of the most effective ways a sales representative can increase their own trustworthiness with farmers. In order to meet this objective, trustworthiness or trust must be clearly defined. Trust is often defined as the dependability, confidence in actions and motives, and faith associated with an individual (similar to that of Wilson above). However, this definition is somewhat nebulous and creates complexities when trying to isolate ways to build a more trusted relationship, especially when trying to elicit responses in a survey. Given the research will focus on asking farmers about their perceptions of building trust in an online survey, the definition of trust must be clearly defined and understood.

A single definition of trust is not used in this paper because sales relationships tend to be complex and multi-faceted. Maister, Green, and Galford (2000) layout four related and straight forward trust attributes that provide a clear and tractable definition of trust. Furthermore, Rempel et al. (1985), Swan et.al (1988), Moher and Speckman (1994), and Chong et al. (2003) provide additional support about the validity of these four key components of trust. Therefore, in this study, trust is defined by the four key components of (1) credibility, (2) reliability, (3) intimacy or how well one knows the customer and his or her goals, and (4) self-orientation or showing one has the customer's best interest at heart. Each of these components was straightforward and provided a clear way to understand farmers' perceptions of how agricultural sales representative could best build a more trusting relationship.

To identify these perceptions, a novel survey technique is employed. A best-worst survey or max-diff survey approach was completed by farmers. Using this survey approach allowed farmers to choose among statements that most and least represent each component of trust (credibility, reliability, intimacy, and self-orientation). One reason the best-worst survey was preferred over a ranking survey approach is because the research can arrive at preferred rankings for each statement *and* the relative "representativeness" of each statement compared to all other statements. That is, the magnitude of importance of each statement can be estimated via a conditional logit model.

Results showed that agricultural sales representatives should focus on their own personal development to build more trusted relationships as opposed to things largely outside of their control. Through the best-worst analysis, farmers did not put as much emphasis on the age of the sales representative or the number of years the sales representative had been working in the industry. Even the reputation of the agricultural sales representative's current employer was not a vital way to demonstrate credibility, reliability, intimacy, or self-orientation. Farmers' identified that agricultural sales representatives can, in fact, deepen their trusted relationships by working on personal and professional development.

Literature Review on Defining and Building Trust

Building trusted relationships is critical to maintaining successful business relationships. Below is a discussion of articles, studies, and publications which focus on the necessity of general trust, value of trust in agribusiness, and processes aimed at building trust.

The literature of trust in various disciplines often defined trust through perceptions and behaviors. Trust has been the perceived credibility and benevolence behind an individual's behavior and actions (Larzelere and Huston 1980). Coleman (1990) expands on the behavioral approach, emphasizing that individual's behaviors will prompt different reactions in uncertain situations. Based on an individual's perceived gains and losses, one will be internally motivated, creating an influence over their reactive decisions and overall trustworthiness.

In agriculture, trust is in many ways, a form of social capital. As explained by Wilson (2000), social capital, or trust, includes the benefits or advantages resulting from "one person or group's sense of obligation towards another." This sense of trust simplifies business transactions and frees time for both parties, becoming a vital player in the industry. The scarcity of time as a resource across agribusiness managers and business development makes trust a highly valued component of business (Wilson 2000). As most agribusiness firms are comprised of trusted relationships between workers, sharing information within or outside the firm can increase productivity and competitive advantage (Wilson 2000).

Building trust has also been the focus within the agribusiness, agricultural cooperatives, and supply chain literature. Sykuta (2006), Österberg and Nilsson (2009), and, Batt and Rexha (2000) all focus on how building trust impacts business decisions and perceptions in agriculture. For instance, Sykuta (2006) found that farmers prefer to market with cooperatives rather than investor-owned firms because of the honesty and competence in which cooperatives exhibit. Österberg and Nilsson (2009) found that farmers perceive successful cooperatives as being

transparent and trustworthy, primarily because the board of directors consists of farmers. From a sales perspective, Batt and Rexha (2000) found that certain seed suppliers exhibit characteristics like maintaining communication and showing their investment in the customer operations in efforts to become the preferred seed supplier.

Yet, in order for two or more parties to experience a strong trusted relationship, a foundation must be based on the trustor's perceptions and expectations about the motives and actions of the trustee. There are vast literature by Zucker (1986), Shapiro, Sheppard, and Cheraskin (1992), Lyons and Mehta (1997), and Rousseau et al. (1998) focusing on classifications and methods of establishing trust in different business and personal circumstances. The research conducted by Doney and Cannon (1997) is directly applicable to the present research and worth further discussion. They identified five processes of how trust can develop in business relationships: calculative, prediction, capability, intentionality, and transference processes. These process are valuable for this research as they show different perspectives and perceptions that farmers may have when building trusted relationships with their agricultural sales representatives. Furthermore, they connect to the four trust components used in this research.

Building Trust through the Calculative Processes

Calculative processes include estimating the costs and rewards associated with staying in a current relationship (Lindskold 1978). By analyzing the risk associated with doing business with a sales representative that may cheat the system, the farmer is assessing the self-orientation of the representative. So, a representative that decides to cheat is highly self-oriented (Akerlof 1970).

Since the costs are higher, and there are greater relationship-specific investments, there are some key factors that enable this trust-building process. Doney and Cannon (1997) argue that these perceived factors influencing trust include the sales representatives company reputation, size, willingness to customize sales, and confidential information sharing. Additionally, the length of the relationship with the company and salesperson are considered important factors.

Building Trust through the Prediction Processes

The prediction process illustrated by Doney and Cannon (1997) takes another perspective to assess the other party's "credibility and benevolence" through multiple, repeated interactions or outside information about the party's behaviors, motives, and promises. Swan and Nolan (1985) also identified that making repeated promises and following through with them will allow a salesperson to develop the confidence of the buying firm, or in this case, the farmer. This increases the salesperson's credibility, reliability, and enhances the trust building process.

The focus of this process encompasses the salesperson's individual likability, similarity, and frequent contact rank as significant factors in the trust building process (Doney and Cannon 1997). Another crucial component to increasing trust through this process is reliant on the longevity of relationship between the farmer (buyer) and the seller. This process relates directly to the credibility and reliability component of trust in the present research.

Building Trust through the Capability Processes

The capability process, is more qualitative, in that it analyzes the individual's ability to meet the needs of the other party. That is, being able to evaluate the sales representative's level of integrity (Doney and Cannon 1997). Certainly, this process relates to the credibility trust component, but it also relates to the intimacy component. That is, in order to truly know the needs of the other party, the sales representative's relationship must be close with the farmer.

Integrity is crucial because, if the trustor does not have trust in the trustee's word and fully understand their needs and goals, then there is no ability to gain that level of trust. Thus, the main factor in achieving trust through the capability process is to provide the capabilities and resources necessary to complete the task. Concentrating on the ability to fulfill stated promises, a salesperson's expertise and power will be highly influential (Doney and Cannon 1997). By exhibiting those two qualities, the salesperson would quickly be able to gain the trust of their clients through a more intimate connection of knowing his or her goals and objectives.

Building Trust through the Intentionality Processes

The intentionality process is where trust emerges through the assessment and interpretation of a party's motives (Doney and Cannon 1997). Determining intentions is key, as groups and individuals who are motived to help others will be trusted more than those who may hold destructive motives (Lindskold 1978). This is also a common factor of gaining trust when the two parties share similar values and norms, promoting a sense of intimacy (Maister et al. 2000). Therefore, this process relates directly with the intimacy and self-orientation component of trust used in the present research.

The intentions of the salesperson are highly evaluated in the intentionality process. For that reason, the willingness to customize sales according to customer needs, provide frequent contact with the buyer, and share information are drivers of increasing a trusted relationship (Doney and Cannon 1997). Yet, the salesperson's likeability and similarity are still deemed highly important factors in the trust-building process.

Building Trust through the Transference Processes

Lastly, trust can be developed through a transference process, which utilizes a third party. It has been suggested by Gulati (1995) that companies with past alliances were more trusted when entering new alliances, based on third party reviews. Although the third party plays a more passive and central role, they provide the other two parties a mutual level of trust that can be identified (Coleman 1990).

However, it should be noted, that this process can work in two ways. If a new sales representative for a highly respected firm is working with a farmer who has had good interaction with the business historically, some of that trust will relay to the new sales representative. Conversely, negative experiences with the organization in the past can expose the presence of general distrust for the new sales representative. Therefore, it will be important to consider the reputation of the supplier firm and salesperson.

Best-Worst Survey Construction

In order to determine Kansas farmers' perceptions on the best ways for agricultural sales representatives to build trusting relationships, an online survey was created where farmers selected statements associated with trust in a best-worst format. Respondents were shown statements used to define the each of the four trust components: credibility, reliability, intimacy, and self-orientation. From the list of statements, the respondent selected which statement most represents the trust component (is most important) and which statement least represents the trust component (least important) of trust. Figure 2 shows an example best-worst survey question as seen by the farmer respondents. As will be described later, each statement was shown an equal number of times to each respondent and was matched with other statements in a manner to maximize the design efficiency of the survey. Finally, socioeconomic and demographic information were collected as well. The full survey is available from the authors upon request.

The best-worst analysis was first introduced by Finn and Louviere (1992) and has several advantages over alternative methods of importance measurements (Scarpa et al. 2011). One alternative, Likert scale rankings, is where the respondent would score the importance on a scale of 1 to 5, with 1 being the least important and 5 being the most important. Although this method provides a numerical score of importance, it neglects to force the respondent to pick between two or more relatively important topics (Lusk and Briggeman 2009). It would be easy for a respondent to indicate that all of the statements are highly important rather than providing a true ranking of importance or representativeness. Another potential issue with a Likert scale format is understanding that individuals will interpret the scale differently. This problem stems from the lack of a common reference point across all respondents.

Another alternative was asking the respondents to rank the statements. Though this method would provide analysis on the comparative value of each statement, it would not provide a magnitude of representativeness over the other statements. That is, respondents on average could rank one statement clearly first over the other statements, but there is no indication of how much more important that factor is to farmers. Furthermore, it would be difficult and cumbersome for respondents to rank multiple items. Therefore, a best-worst survey to accomplish the objective of this study is the most appropriate approach.

Before identifying the optimal survey design, it is first important to identify the statements that best illustrate each of the four trust components. Figure 1 lists the seven statements that best demonstrate how an agricultural sales representative can build the trust attributes with a farmer. All of the statements are derived from and are related to the literature. In particular, the work of Deutsch (1962), Swan et al. (1988), Mohr and Speckman (1994), Doney and Cannon (1997), Maister, Green, and Galford (2000), Chong et al. (2003), and Darian et al. (2004) provide support for each statement and its relation to the four trust components. Given the vast literature on trust, the most salient and tractable statements were used so as to avoid duplication and to make the survey design feasible for a farmer to complete.

Credibility	*How Well One Knows the Customer and His or Her Goals (Intimacy)*
▪ Does their homework on me and my operation ▪ Does not lie or exaggerate ▪ Years working in the industry ▪ Is passionate and loves their topic ▪ Reputation of the company they work for ▪ Well researched and knowledgeable of topic ▪ When they don't know, they say so	▪ Ability to be candid and upfront about situations ▪ Stays in contact via calls, visits, etc. ▪ Not afraid to make conversation ▪ Finds the fun and fascination in my operation ▪ Understands my goals, mission, and values ▪ Years working with me ▪ Shares a common interest
Reliability	*Showing One has the Customer's Best Interest at Heart (Self-Orientation)*
▪ Sends meeting materials in advance ▪ Are always transparent ▪ Makes sure meetings have clear goals, not just agendas ▪ Reputation of the company they work for ▪ Adapts to changing circumstances and situations ▪ Makes specific commitments and delivers on them ▪ Follows through on actions requested by me	▪ Asks open-ended questions to understand me better ▪ Listens without distractions ▪ Reflective listening, summarizing what they've heard ▪ Allows me to fill the empty spaces in conversations ▪ Asks me to talk about what's behind an issue ▪ If communication fails, they take most of the responsibility ▪ Focuses on defining problem, not guessing the solution

Figure 1. The trust component statements utilized in the best worst block design

Figure 2. Example survey questions for credibility

Survey Design

The best-worst survey follows a Balanced – Incomplete Block Design (BIBD). To create a BIBD survey, (1) the number of times each statement appears through all questions is equal, and (2) the number of times a pair shows up in the same block is equal too. Mathematically, these are expressed by (1) $\frac{b*k}{a}$ and (2) $[\frac{b*k}{a}] * [\frac{(k-1)}{(a-1)}]$, where b is the number of questions asked, k is the number of statements in each question, and a is the number of statements available for each trust component. Therefore, considering survey fatigue for the respondent and that each trust component has seven statements, the BIBD has seven total questions for each trust component with four statements presented in each question. So, the respondent would be selecting the most and least representative statements among four total statements, and would do this exercise seven total times within each trust component.

It is also important that the statement pairings maximize the D-efficiency through an orthogonal design. For further clarification, when D-efficiency is 100, the design used is considered orthogonal and balanced. A D-efficiency of 0 indicates that at least one of the parameters cannot be estimated. In this particular survey design, the design yielded a D-efficiency score of 87.5, which is similar to other best-worst survey designs.

Best-Worst Conditional Logit Model

Analyzing the best-worst survey is primarily done through the estimation of a conditional logit model (CLM). The CLM is used for three primary purposes. First, the CLM is based on the widely accepted random utility theory, which provides a theoretical basis for why farmers selected the statements as most representative and least representative. Next, is to identify if the statements within each trust component are statistically different from the other statements. Finally, the CLM allows for the calculation of a magnitude of representativeness share that is used to determine which statements best demonstrate a particular trust component.

When responding to each best-worst question, farmers are essentially choosing two statements that maximize the difference between one that most represents trust and the one that least represents trust. That is, each farmer has an underlying scale of representativeness that each statement falls on for a particular trust component. So, following Lusk and Briggeman (2009), there are J number of statements that represent a given trust component, which means in the main effects design there would be J (J-1) possible best-worst combinations that the farmer could choose from each question (in our case, forty-two possible best-worst combinations). Therefore, each farmer will always select the one combination that maximizes the difference between the most representative statement j relative to the least representative statement k.

A random utility framework can be used to illustrate this underlying scale of representativeness. Assume that farmer i will choose statement j that maximizes the representativeness of the trust component on a representativeness scale. Further assume that the λ_j is the scale parameter on this scale for farmer i, and the latent unobserved level of representativeness for farmer i is shown as $R_{ij} = \lambda_j + e_{ij}$, where e_{ij} is a random error component.

From this framework, the probability that a farmer will choose one statement over another statement can be presented. Assume that farmer i chooses statement j over statement k as the most representative and least representative combination out of a J choice set. Therefore, the probability to be estimated is the difference between R_{ij} and R_{ik} is greater than all other $J(J-1)-1$ statements within the choice set. Now, if the e_{ij} random error component is IID type 1 random variates and with the IIA property, then the probability results in McFadden's conditional logit specification for the choice probabilities as:

(3) $P(j$ is chosen most representative and k is chosen least representative$) = \dfrac{e^{\lambda_j V_{ji}}}{\sum e^{\lambda_j V_{ki}}}$

Therefore, the probability to be estimated is that statement j is chosen over statement i. In the equation, λ_j represents the specific location of the value j on the "representative" scale. This location on the "representative" scale is directly reliant on the probability that state j will be selected over the other statements. The estimated λ_j provides the representativeness of the value j relative to a statement that was normalized to zero to serve as the dummy variable or base case. This CLM does take into consideration the assumption that all of the statements in the sample would be able to hold the same level of representativeness.

Once the CLM is estimated to arrive at the λ_j values, the share of representativeness for statement j is calculated to determine which statement is the most important through a representativeness share as,

(4) *Representative Share* $= \dfrac{e^{\widehat{\lambda_j}}}{\sum_{k=1}^{j} e^{\widehat{\lambda_j}}}$

Given this equation, we can calculate a "share of representativeness" for each of the statements within each component of trust. The exponents of the conditional logit estimates are used to develop the representativeness of each statement on a scale of 0 to 1. This allows for the analysis of the magnitude of representativeness of each statement. Therefore, if one statement has a share value of 0.3 compared to another statement's share of .1, the former statement is three times as important as its counterpart. This provides the ultimate magnitude of importance relative to the base case and the other statements in the best-worst analysis.

In addition, the best-worst survey design also allows the researcher to analyze the data using a simple count method. What this means, is that the researcher can count the number of times that a statement is selected as "most" or "least" representative. When selected as "most" representative, the statement will be given a value of 1, while a statement selected as "least" representative will be given a value of -1. If the statement is not selected as most or least representative, the statement will receive a value of 0. Given each statement is shown four times throughout the seven questions, the representative score range is from -4 to +4.

Data Collection

An online survey was created and distributed to Kansas farmers. The survey was open for one month, August 2015, and the survey took approximately thirty minutes to complete. For a respondent to access the survey, they would have to provide two positive responses; (1)

indicating that they were a Kansas farmer and rancher and (2) provide a password given through a distributed flyer and email. After completing the survey, respondents were mailed a $50 Visa gift card.

Kansas farmers and ranchers were notified about the survey through a distribution of flyers via e-mail and mailings. A flyer was created and sent out by mail and email to the entire Kansas Farm Management Association (KFMA) membership by mail, Kansas cooperative farmer-directors in the Arthur Capper Cooperative Center's (ACCC) database, and other extension and economists by e-mail. A total of 2,858 flyers and emails were distributed in Kansas. The survey was targeted towards Kansas farmers and ranchers primarily through KFMA. The reason is because Kuethe et al. (2014) demonstrated that the KFMA database was representative of all Kansas farmers and ranchers. There was a total of 193 completed responses, with KFMA members representing 75% of the sample size.

While the response rate may appear low, it was mitigated by that fact that the sample of farmers who responded are very similar to the farmers within the KFMA data. Comparing the 2014 KFMA data to the survey sample of farmers, illustrates these similarities. The average total liabilities were $537,305 in the KFMA and $529,585 in the survey. Average assets from the KFMA data and survey were $2,313,939 and $2,627,264, respectively. When looking at the total acres farmed or ranched, KFMA reports an average of 2,198 acres per farm and survey respondents reported an average of 2,544 acres. Overall, the demographic information provided by the respondents is very similar to KFMA members.

Best Worst Results

The Conditional Logit Model (CLM) results showed that almost all of the estimates derived from the trust statements were statistically significant. Furthermore, the representative scores that show the magnitude of importance yield some striking results that should help agricultural sales representatives build stronger credibility, reliability, intimacy, and self-orientation with their farmer-customers. In short, farmers identified the most representative statements of each trust component that agricultural sales representatives can use to build trusted relationships. This is especially interesting because often, younger sales representatives may feel disadvantaged in building trust because of their age—something outside of their control. Yet, farmers clearly place a larger value on statements that are directly within their control of the sales representative. Support for these assertions are found in the results below:

Credibility with farmers is best established and built by the agricultural sales representative being honest and knowledgeable about the products and/or services. Comparing the highest CLM representativeness share of .281 to the lowest share of .028 in Table 1, shows that "does not lie or exaggerate" is ten times more representatives of credibility than "years working in the industry." Also highly reflective of credibility is "when they don't know, they say so" (.243), and being "well researched and knowledgeable of topic" (.238). Thus, indicating farmers find more credibility in sales representatives who portray knowledge and integrity in the field of work.

These results suggest that the factors outside the control of the sales representative have a smaller influence on building credibility. The low representativeness shares of "years working in

the industry" (.028) and the "reputation of the company they work for" (.059) demonstrates that farmers do not believe these external factors are the best methods for building credibility. Credibility is more reliant on the direct words and knowledge of the sales representative.

Table 1. Conditional logit estimates and representative shares for credibility

Credibility Statements	CLM Estimates	Representative Share
Does not lie or exaggerate	2.316*	0.281
When they don't know, they say so	2.170*	0.243
Well researched and knowledgeable of topic	2.151*	0.238
Does their homework on me and my operation	1.216*	0.094
Reputation of the company they work for	0.750*	0.059
Is passionate and loves their topic	0.732*	0.058
Years working in the industry	Base	0.028

Note. Statistical significance at the one percent level is represented by a *.

Using a count method described earlier, representative scores can also be calculated and shown through a histogram. Recall that the count method assigns a score to each statement when it is selected "most" representative (1), "least" representative (-1), or not selected at all (0). Since each statement is shown in 4 questions, the scores can range from -4 to 4 for reach respondent. Then the collected data can be illustrated on a graph or histogram.

Given farmers vary in personality, desires, and needs; there will be differences in how to build trust with them. The results from the histograms in Figure 3 support the results in Table 1 while also identifying variation across different respondent preferences. Overall, "does not lie or exaggerate", being "well researched and knowledgeable of topic", and "expressing when you don't know" are collectively important ways to increase and represent credibility. This is demonstrated through the heavily right skewed histograms and further supported the research by Darien et al. (2004) that identified the salesperson's knowledge as a high decision factor associated with customers making a purchase.

Farmers also agree that "years working in the industry" and "is passionate and loves their topic" is not as significant in gaining credibility. These histograms are more left-skewed, which suggest that farmers view these statements as not essential to deepening credibility.

With all of this said, it should be noted that farmers' representative scores vary significantly. That is, even though the representative shares show certain statements are far more important in terms of magnitude, not all farmers agree based on their calculated representative scores. For example, consider "Does their homework on me and my operation." There is a wide distribution of representative scores across farmers. That is, some farmers find this statement to be very representative of credibility, while others do not. These results highlight the importance of knowing the farmer on an individual basis and addressing their needs.
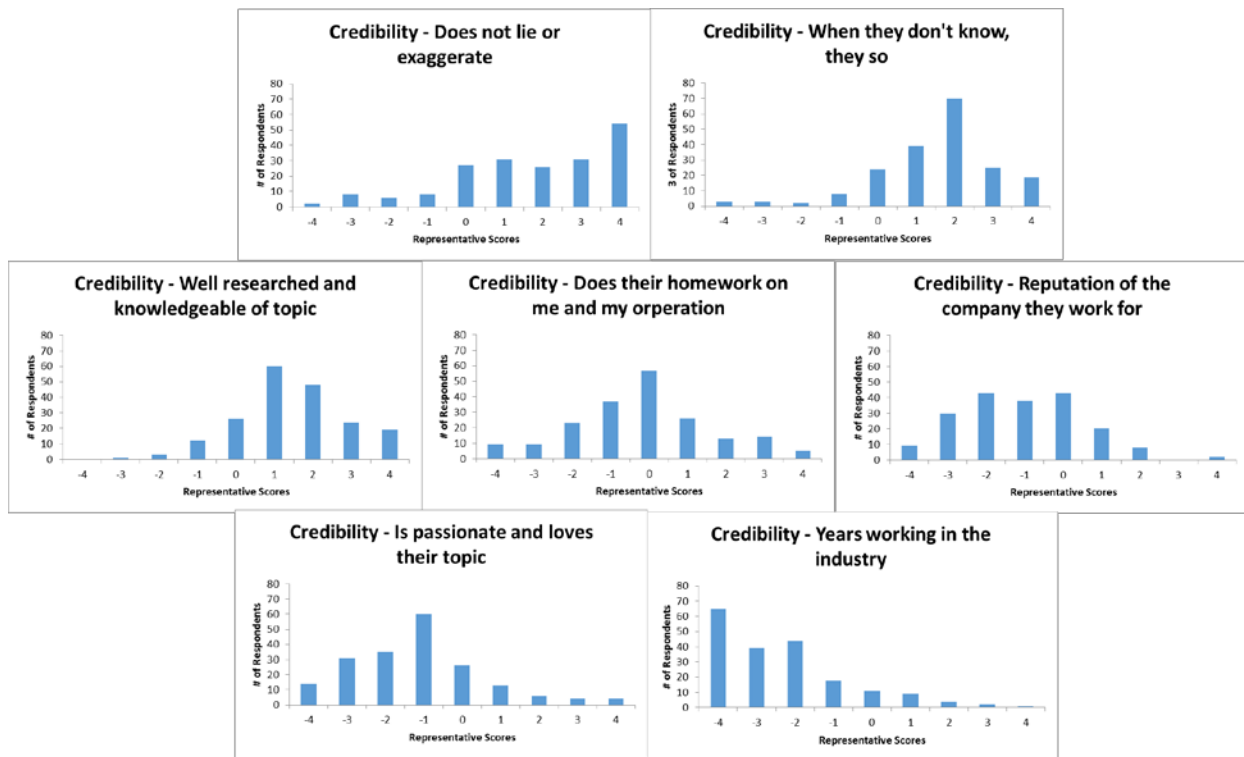
Figure 3. Credibility histograms reporting frequency of statement being always selected as "Least" representative (-4) to always being selected as "Most" representative (4) by each respondent.

Reliability with farmers and ranchers can best be demonstrated by following through on the services and/or products as discussed with their customers. These results tie directly to Darien et al. (2004) who found that customers feel a 'salesperson' respect for the customer' was the important attribute considered in decision making when contemplating a purchase. The results show that "following through on actions requested by me" was most representative of reliability. With a representative share of .452 in Table 2, follow through was approximately eight times more representative of reliability than "sending meeting material in advance", which was the lowest share statement. Following closely behind, "makes specific commitments and delivers on them" had a share of .341.

Table 2. Conditional logit estimates and representative shares for reliability

Reliability Statements	CLM Estimates	Representative Share
Follows through on actions requested by me	3.361*	0.452
Makes specific commitments and delivers on them	3.078*	0.341
Adapts to changing circumstances and situations	1.679*	0.084
Are always transparent	1.295*	0.057
Make sure meetings have clear goals, not just agendas	0.645*	0.030
Reputation of the company they work for	0.228**	0.020
Sends meeting materials in advance	Base	0.016

Note. Statistical significance at the one percent level is represented by a *

The least representative statements of reliability include "make sure meetings have clear goals, not just agendas", "the reputation of the company they work for", and "sends meeting materials in advance." Although they are indicators of reliability, they do not hold the same magnitude of importance when trying to establish the characteristic with Kansas farmers and ranchers.

The histograms created for the reliability emulate the results from the Conditional Logit Model. The heavily right skewed histograms in Figure 4 for "follows through on actions requested by me" and "makes specific commitments and delivers on them," shows the relevance of these factors and significant agreement amongst farmers. In fact, the histogram for "follows through on actions requested by me" shows that either no farmers selected the statement as "least" representative or if they did, they also selected it as "most" representative in another question canceling out the scores back to a zero. Thus, indicating the important role follow through has on establishing relatability.
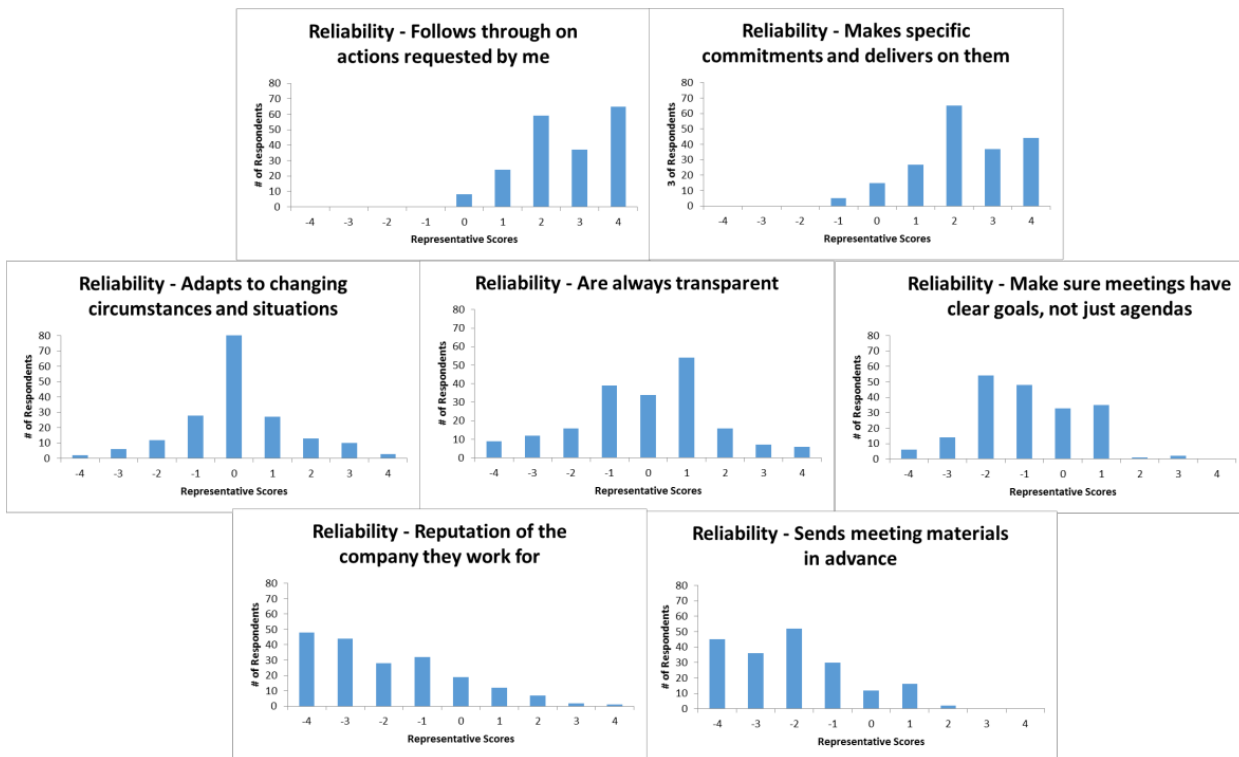
Figure 4. Reliability histograms reporting frequency of statement being always selected as "Least" representative (-4) to always being selected as "Most" representative (4) by each respondent.

The distribution of "adapts to changing circumstances and situations" and "are always transparent" emphasize the importance of knowing the farmer. Since there is vast variation within the distribution of responses, there was little agreement across the sample on the importance on these characteristics when working to establish reliability. As a result, when it comes to these statements relative to reliability, farmers have wide varying opinions. With that

said, there is general agreement across all of the reliability statements that sales representatives should not overpromise and under deliver.

Intimacy centers around the sales representative's ability to connect with the farmer and their operation. This communication is necessary for a sales representative to provide the right service to the farmer. Without this connection, the wants and needs of the farmer will not be properly translated to the sales representative. Furthermore, as the farmer becomes more connected and trusting towards the sales representative, the more the farmer will trust the company of the sales representative as a whole (Zaheer et al. 1998).

The results show that "understands my goals, missions, and values" is the most vital way to establish intimacy. In fact, the representative share of 0.335 is approximately eleven times more representative than the base case statement of "not afraid to make conversation" as shown in Table 3. Farmers feel that this common connection and understanding of their values will help the sales representative better address current and future needs.

Table 3. Conditional logit estimates and representative shares for intimacy

Intimacy Statements	CLM Estimates	Representative Share
Understands my goals, mission, and values	2.401*	0.335
Able to be candid and upfront about situations	2.255*	0.289
Stays in contact via calls, visits, etc.	1.714*	0.168
Years working with me	1.123*	0.093
Shares a common interest	0.562*	0.053
Finds the fun and fascination in my operation	0.025	0.031
Not afraid to make conversation	Base	0.030

Note. As presented in the survey, intimacy is how well one knows the customer and his or her goals.
Statistical significance at the one percent level is represented by a *.

Having straightforward, honest communication is greatly valued by farmers. Being "able to be candid and upfront about situations" and "stays in contact via calls, visits, etc." are relatively representative of an intimate connection with scores of 0.289 and 0.168, respectively. The difference in the representative share shows the significance in having meaningful and relevant conversations with the farmer when needed.

Interestingly, "finds the fun and fascination in my operation" was the only statement in the best worse analysis that did not prove to be statistically significant. That is, the CML estimate did not prove to be different from the base statement of "not afraid to make conversation." This finding is in direct contradiction to the findings of Maister, Green, and Galford (2000) who argue this statement as a way to build strong, intimate connections.

The histograms reiterate the importance of taking time to "understand the goals, missions, and values" of farmers when trying to establish an intimate relationship (Figure 5). Demonstrating a desire to learn enhances the conversations in conducting business, allowing for mutual growth and success. The research visually shows that a sales representative's "[ability] to be candid and

upfront about situations" and "stays in contact via calls, visits, etc." is also viewed as a positive trait by most Kansas farmers, but not all.
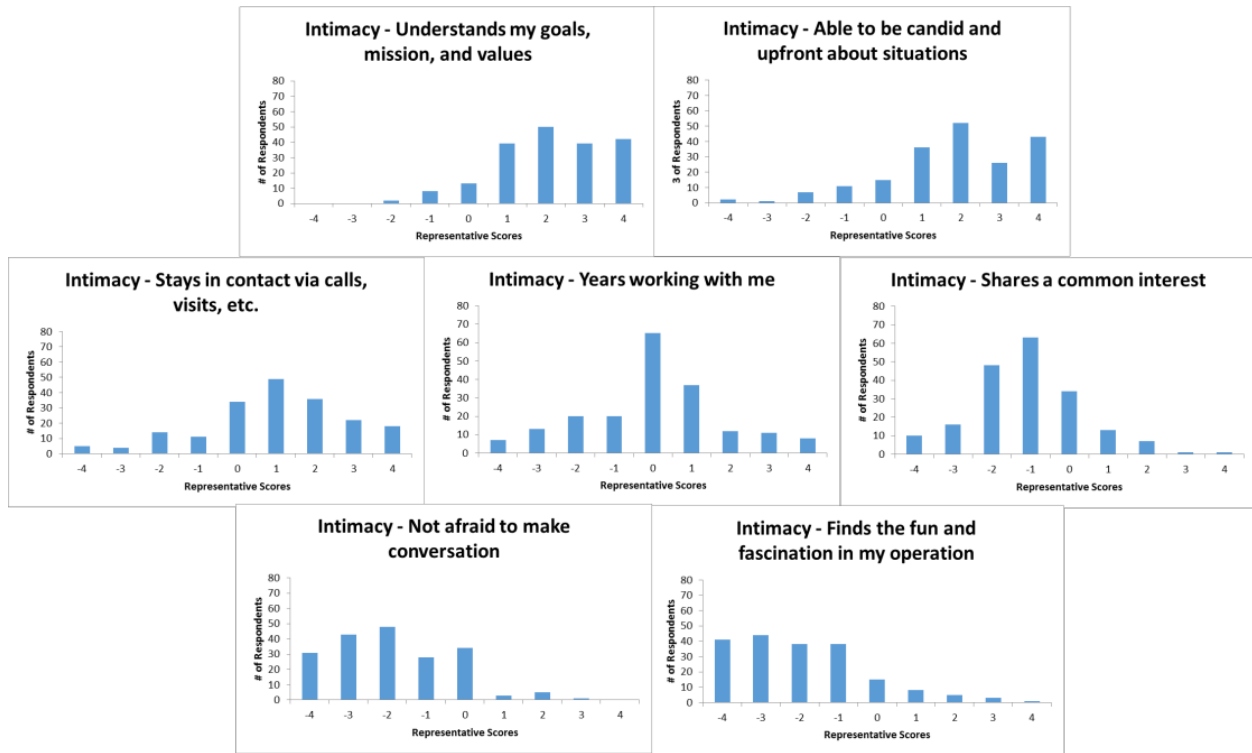
Figure 5. Intimacy histograms reporting frequency of statement being always selected as "Least" representative (-4) to being always selected as "Most" representative (4) by each respondent.

The left skewed histograms of statements like "not afraid to make conversation" and "finds the fun and fascination in my operation" illustrate the common lack of magnitude these factors have on building intimacy. Although they are still important in establishing trust, a majority of farmers associated these statements with "least" representative out of the options provided.

"Years working with me" is the one statement that has the most fluctuation across farmer respondents. As shown in the histograms, some farmers find it very important while others do not feel it has very much influence. This further reiterates the importance of knowing the personal needs of each farmer as a sales representative.

In general, Kansas farmers feel that establishing intimacy is greatly reliant on understanding their personal and operational goals and values. It is also relatively important to maintain candid, upfront conversations about situations as they arise and continue the discussion around the needs of the operation. Although it is important to communicate, not being afraid to make conversation is not something many farmers value. Moreover, it is crucial have informative and worthwhile dialogue.

Self-orientation, for sales representatives, is about showing the appropriate focus in the relationship with farmers. That is, exhibiting behaviors that stress the desires to address the needs of the client rather than their personal motives. To achieve this, both words and actions are found to be beneficial to establishing this appropriate focus.

The results stress the value of a sales representative who "focuses on defining the problem and not guessing the solution." In Table 4, this statement's representative share of 0.364 is over 18 times more representative of self-orientation than "allows me to fill the empty spaces in conversation. Furthermore, the second most representative statement, "listens without distractions," has only half the magnitude as "focusing on defining the problem, not guessing the solution." Thus, sales representatives should spend time not "selling solutions" but rather talking and understanding the issues or problems for a given farmer.

Table 4. Conditional logit estimates and representative shares for self – orientation

Self-Orientation Statement	CLM Estimates	Representative Share
Focuses on defining the problem, not guessing the solution	2.911*	0.364
Listens without distractions	2.188*	0.177
Asks open-ended questions to understand me better	1.983*	0.144
Asks me to talk about what's behind an issue	1.904*	0.133
Reflective listening, summarizing what they've heard	1.769*	0.116
If communication fails, they take most of the responsibility	0.827*	0.045
Allows me to fill the empty spaces in conversations	Base	0.020

Note. As presented in the survey, self-orientation is showing one has the customer's best interest at heart. Statistical significance at the one percent level is represented by a *.

With that said, farmers do not feel it is necessary for sales representatives to take full responsibility of miscommunication or force conversation to show they care. "If communication fails, they take most of the responsibility" and "allows me to fill the empty space in conversation" only have representative shares of 0.045 and 0.020, respectively. Therefore, the magnitude of representation for self-orientation is far below other contributing factors.

The histograms further emphasize the importance "focuses on defining the problem, not guessing the solution," as a majority of the farmers identify with higher representativeness scores. Figure 6 also shows that establishing positive self-orientation is highly reliant on the individual farmer's preferences. This is shown through the vast variation and distribution shown in several of the histograms. For example, "listens without distractions," "asks open-ended questions to understand me better," and "asks me to talk about what's behind and issue" were in fact valued by some farmers in establishing self-orientation.

Ultimately, for a sales representative to better establish appropriate self-orientation with a Kansas farmer, it is vital to focus on defining the problem rather than guessing the solution. As Doney and Cannon (1997) illustrate, gaining trust and showing your focus on the farmer may be part of a larger mix necessary for the sale to take place. Therefore, self-orientation may not be a sale "winner", but it is considered a strong sale "qualifier" (Doney and Cannon 1997). Practicing active listening while free from distractions will exemplify your motives to help the farmer fix any issues or concerns they have at the time. Asking and learning about the farmer will help one show they have the farmer's interest at heart.

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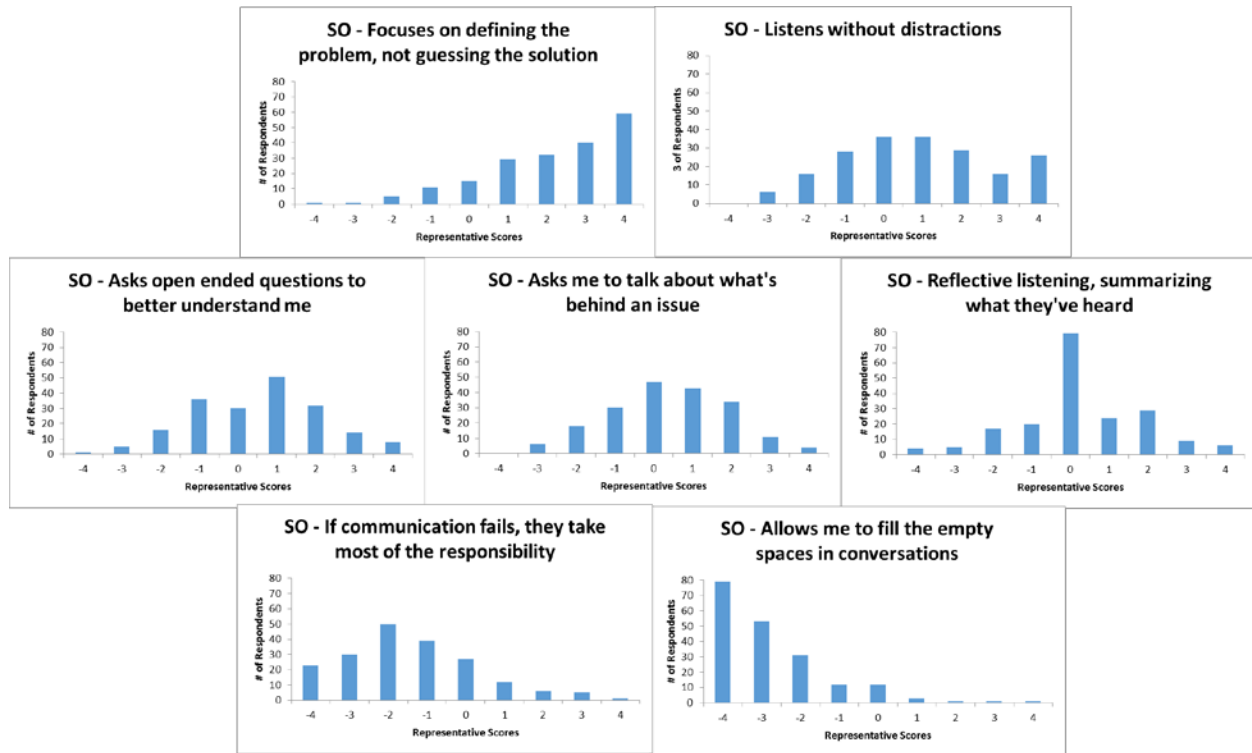
Figure 6. Self-orientation histograms reporting frequency of statement being always selected as "Least" representative (-4) to being always selected as "Most" representative (4) by each respondent.

Conclusions

Building trust is important for any agricultural sales representative. Trust is often at the center of any successful business relationship and exploring trust has been the focus of many research studies. The focus of this paper is to identify ways that agricultural sales representatives could deepen and improve trust with farmers. Using a unique best-worst survey approach, farmers' preferences for how to best build trusting relationships were discovered. The key findings all centered around a unifying theme: sales representatives are well positioned to build more trusted relationships because the best ways to do it, is well under their control.

To build trust with farmers, agricultural sales representatives should focus on improving themselves both professionally and personally. Sales representatives should focus on being more knowledgeable in their specific area, exemplify dependability, and demonstrate their desire to help their farmer-customers. To do so, sales representatives need to improve and constantly work on their communication skills. They should also take time to understand the goals and missions of the operation while working with the farmers to clearly define potential problems. While these statements seem straightforward and easily done, they are worth spending some time working on because more often than not, sales representatives focus on selling solutions and not identifying what is the real issue faced by their customer.

It should be noted that this study can and should be conducted in other areas of the world and with other types of producers. Our sample was specific to Kansas. While it is not clear if these findings would hold with other farmers outside of Kansas, some of the general findings likely would hold. For example, results showed that not lying or exaggerating was the best way to demonstrate credibility. It is likely this result would hold across other farmers. Nevertheless, further research into the applicability of these findings across the globe would be worthwhile.

While this study did illuminate methods and ways to build trust, there is still areas for future work. One extension would be to examine the economic value farmers place on these trust components. Knowing that information would assist agricultural sales representatives in focusing their efforts to build trust in ways that are valued by farmers who are willing to pay a premium for those specific qualities. Furthermore, it would be interesting to explore if these statements vary across different types of agribusiness and lending industries. That is, do farmers' perceptions of how to best build a trusted relationship somehow influenced by the industry of the particular sales representative? Regardless, the current study did identify tangible and attainable ways agricultural sales representatives can improve trust with farmers.

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External Knowledge Sources as Drivers for Cross-Industry Innovation in the Italian Food Sector: Does Company Size Matter?

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Abstract

Knowledge and competencies traditionally rooted in industries external to the food sector's boundaries are gaining momentum and foster innovation in the food domain. In Italy, food companies collaborate with other firms in open and cross-industry innovation (CII) projects to achieve a competitive advantage. The paper aims to shed lights on eventual drivers for CII in the food sector in a twofold manner: (i) exploring to what extent external knowledge sourcing affects innovation and (ii) seeking to understand to what extent different means of external knowledge sourcing might differ according to the company size. To this end, probit models have been run on a sample of 703 Italian food companies from the CIS 2010 and 2012. Empirical evidence shows that in the Italian food industry innovation relies on different external knowledge sources. Acquisition of machinery and equipment allows food companies to transfer external know-how inside the firm boundaries. Product innovation benefits of external R&D activities as well as of information provided by competitors and consultants. Process innovation relies mostly on acquisition of technology (machinery and equipment) as well as on information provided by input suppliers.

Keywords: SMEs, CIS, food industry, innovation type, cross-industry, Italy

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Introduction

Small and Medium-sized enterprises (SMEs) build the backbone of the European food sector, with a turnover of 528 billion € (49.6% of European food turnover) and 2.9 million employees (63.3% of European food employment) (FoodDrinkEurope 2015). Despite its strength and robustness, the food sector is currently facing several opportunities and threats that affect the competitive performance of firms (Carraresi and Banterle, 2015), like, for example, decreasing transportation costs, trade flow liberalization and increasing raw material price volatility (European Commission 2009). Moreover, as a recent study of Nestlé[1] illustrates, there is a growing share of consumers, which seek health-promoting or more sustainable foods which allow for market growth and successful product differentiation, hence, above average returns. Nevertheless, new food technologies, like Pulsed-Electric fields or High Pressure Processing, allow for safer and more efficient food production, which requires larger up-front investments SMEs most likely cannot afford. Indeed, food SMEs have both a lower market and bargaining power than large companies, respectively in horizontal and in vertical markets (European Commission 2009). Solutions to increase SME competitiveness may include major investments into their innovation activity, which is essential for their whole business performance (Tepic et al. 2014). Nonetheless, SMEs often lack resources and qualified personnel for R&D and are usually relatively traditional with limited capabilities for exploring new technologies and areas of consumption (Banterle et al. 2011; Dries et al. 2014). These elements constitute barriers that hamper food SMEs from innovating and being competitive.

However, a means to foster their innovation capacity and to shorten the time to market is to collaborate with other companies through an "open innovation" approach based on knowledge and resource sharing (Chesbrough 2006; Dahlander and Gann 2010; Tepic et al. 2014). Indeed, according to market changes, innovation is currently shifting from closed firm-level patterns to collaborative and open-mode ones (Granieri and Renda 2012). For example, the level of interaction of different members of the supply chain is increasing by making use of an integrated model of innovation based on cooperation along the chain to overcome knowledge and competence gaps during the innovation process (Menrad 2004; Lew and Sinkovics 2013).

Moreover, beyond chain collaboration, knowledge, competencies and entire technology platforms traditionally rooted in industries external to the food sector's boundaries are increasingly becoming important and foster innovation in the food domain. Thus, **cross-industry innovation** (CII), defined as "the application of established knowledge or technologies of partners from outside a firm's own value chain" which "provides a specific inter-organizational setting in which to pursue exploratory innovation" (Enkel and Heil 2014, 243), can be observed in different convergence settings where the food industry is involved in, e.g. nutraceuticals at the border of foods and drugs (Bröring 2010) or with the bioenergy sector (Golembiewski et al. 2015). Consequently, in order to create innovative technological solutions, food companies seem to increasingly depend on knowledge coming from outside their own domain (Malerba 2002; Eckhardt and Shane 2003; Robertson and Patel 2007; Di Stefano et al. 2012; Costa et al. 2015; Dingler and Enkel 2016). However, since innovation patterns and technological change make sectors different according to the essence of the dominant technology, innovation paths result to

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[1]http://www.nestle.de/zukunftsstudie

be very sector-specific (Malerba 2004). Thus, a firm able to combine its internal know-how with external knowledge (Kogut and Zander 1992) traditionally belonging to different sectors (Bierly and Chakrabarti 1999) is more encouraged to implement innovation. That explains why the notion of CII is getting momentum in both academia and industry. CII represents a way through which firms can acquire external knowledge in their own organization impacting positively on their innovation activity (Cohen and Levinthal 1990; Enkel and Gassmann 2010; Lew and Sinkovics 2013; Enkel and Bader 2015; Dingler and Enkel 2016). Furthermore, this activity can benefit from resource complementarity of the different sectors involved (Lew and Sinkovics 2013). That is, the more the sectors are different in terms of resources and competencies the more they are pushed to interact with each other and to bring together different knowledge areas, in order to enhance the opportunities for innovation (Gassman and Zeschy 2008; Enkel and Gassmann 2010; Enkel and Bader 2015). Resource complementarity is a relevant issue also in fostering collaboration processes between small and large companies when it comes to pursuit innovation (Harrison et al. 2001; King et al. 2003). Finally, "complementary resources between firms will often motivate vertical alliances, where firm operations emphasize different stages of the value chain and, as such, exhibit resource profile differences" (King et al. 2003, 597).

Study Domain and Research Questions

Given this background, the capability of firms to acquire and internalize external knowledge can build the basis for engaging in CII; namely, innovation might be affected by collaboration and information stemming from other industries. The increasing importance of knowledge coming from outside the own sector gets also confirmed by Capitanio et al. (2010) who states that this holds true for Italy as well. Here, innovation is considered as strategic for the companies to face growing competition from emerging countries and the large market penetration potential from other developed countries. Furthermore, the Italian food industry is also increasingly depending on new technologies developed outside the food industry (Capitanio et al. 2009 and 2010). Indeed, even though engaging in a systematic literature review is not in the focus of the paper, we have tried a rough publication research within Web of Science in order to filter the results dealing with CII in the food domain. The database gave us back only one article where cross-industry is seen as an area of development of an adaptive extension platform for the Australian and New Zealand dairy sectors (Murphy et al. 2013). This does not mean that the topic is not debated in the scientific literature, but rather that it still does not exist as an acknowledged empirical framework of CII applied to the food industry. Articles analyzing this issue in the food sector are using several terms to define innovation across different industries, but rarely they refer to CII.

Moreover, the Italian food industry, likewise the entire EU sector, is also dominated by SMEs, which can collaborate (rather than compete) with other firms in open and CII projects by sharing capabilities and knowledge, leading to potential growth (Fukugawa 2006; van de Vrande et al. 2009). Nevertheless, despite their huge contribution to the food industry, SMEs have received much less attention in the academic innovation management literature than large companies (Saguy and Sirotinskaya 2014).

Against this backdrop, the paper seeks to contribute to the notion of CII in the food sector in a twofold manner. First, we explore to what extent external knowledge sourcing, which builds the basis for engaging in CII, affects innovation. This motivates:

***Research Question 1**–What is the impact of different means of external knowledge sourcing (building the basis for CII) on product and process innovation?*

Second, this paper seeks to understand to what extent different means of external knowledge sourcing might differ according to the company size. Indeed, small and large firms are recognized as being different in their innovation behavior, especially due to the pivotal role of technological innovation to achieve a competitive advantage in many sectors (Hamilton 1985) and to the consequent need for companies to somehow face their differences in resource endowments and capabilities (King et al. 2003). Diversity among company sizes concerning innovation has been highlighted by several authors in the past (King et al. 2003). Both small and large firms can have an advantage in innovation, but it has different sources: normally, small firms can generate outstanding inventions and product innovations (but often are limited in resources to exploit them), whereas large companies are better in processing, demonstrating that both can complement each other to enhance innovation (King et al. 2003). The resource complementarity leads to cooperation as both small and large companies perceive it and try to cooperate in order to acquire the missing knowledge. This phenomenon has been explored in the past by Acs and Audretsch (1988) and is also part of the acknowledged theoretical approach of "relational view" (Dyer and Singh 1998). Nevertheless, almost no studies in the literature investigate what is happening in the food sector, concerning the effect of knowledge sourcing on innovation and its role in promoting CII. Thus, here, we are interested to elucidate the particularities of SMEs vs. large enterprises in the food sector, which lead us to:

***Research Question 2**–Do means of external knowledge sourcing (the basis for CII) differently affect innovation according to company size?*

To answer these questions, Italy has been taken as a case study, as the structural organization of its food industry reflects the European one, with a preponderance of SMEs (ISTAT 2011). Company data coming from the Community Innovation Survey (CIS) 2010 and 2012 are used to carry out a firm size comparison relatively to different external knowledge sourcing and innovation.

The remainder of the paper is organized as follows: in the next section, we provide a conceptual framework on external knowledge sourcing, supported by the literature review, which helps the reader to understand its relationship with innovation and its role as a probable precursor for CII. Then, in the methodology, we provide an exhaustive explanation concerning the data, the variables, their measures, and the model used. The estimation of the model leads us to the results of the paper which are presented and discussed according to the research questions and contrasted with previous literature. These results are summarized in the conclusions, also providing useful managerial implications.

Conceptual Framework

According to our introductory background and study domain, we assume that different means of external knowledge sourcing might be precursors of CII, namely build the basis for collaboration among companies in different sectors aimed at innovation (Dingler and Enkel 2016). Indeed, CII seems to depend on the level of knowledge heterogeneity among firms belonging to different industries, also called "cognitive distance" (Nooteboom 1999; Nooteboom et al. 2007; Enkel and Heil 2014). Therefore, the more the companies are putting efforts into acquiring external knowledge to create innovation, the more they are likely to end in CII processes. To this scope, some variables from the CIS 2010 are useful to investigate the relationship with innovation and can be considered the drivers for CII. The variables that have been chosen for this purpose concern external R&D, the acquisition of machinery and equipment, cooperation, new methods of organising external relations (e.g. alliances, partnerships, etc.), the acquisition of external knowledge (e.g. patents, know-how, etc.), the search of general information from suppliers, consultants and competitors.

External R&D

External R&D is defined as the engagement of the company in creative work performed by other firms and/or public or private research organizations. External R&D is profitable for product and process innovation. Indeed, a previous study underlines that R&D is "a necessary complement to openness for ideas and resources from external actors" (Dahlander and Gann 2010, p. 701). Also, external R&D is helpful when the internal R&D department has limited resources that can be in this way complemented (Chesbrough 2003). Likewise, R&D needs cooperation agreements enabling firms to merge external R&D with the existing one (Sagarra-Blasco and Arauzo-Carod 2008), and to share and/or acquire new knowledge (Veugelers and Cassiman 2005; Ruben et al. 2006).

Acquisition of Machinery and Equipment

This variable defines the engagement of the company in "acquisition of advanced machinery, equipment or software to produce new or significantly improved products and processes" (tab. A). When it comes to realizing innovations across sector boundaries, the acquisition of technology is unavoidable, especially in technology-push processes. To this end, it is necessary for the companies to exit the borders of their sector to purchase equipment and machinery that are aimed at improving the implementation of innovation and the overall competitiveness (Lee et al. 2010).

Cooperation

Cooperation includes active participation among companies or institutions on innovation activities. It may be intended as a way to get external knowledge into the company (Bröring and Herzog 2008). Cooperation affects innovation activities as it allows to exploit the resource complementarity, especially between small and large firms, even belonging to different sectors. Indeed, while small firms are more inclined than large ones to follow technological discontinuities and approach even uncertain markets, large companies possess the needed capabilities to put a new idea into practice (King et al. 2003). Therefore, small firms are usually more facilitated in getting external technology (e.g. from government organizations, universities,

research institutes), but they need large firms in order to exploit this external R&D (Freeman and Soete 1997; King et al. 2003). That is why cooperation represents a direct consequence and is almost unavoidable when it comes to CII.

Acquisition of External Knowledge

The increased need for customized products gearing the demand for innovation leads firms to acquire external knowledge from related industries (Bröring and Herzog 2008). The acquisition of external knowledge encompasses the purchase or licensing of inventions (patented or not), know-how, and other types of knowledge from other companies or organizations. Actually, previous scholars already pointed up the importance of external knowledge as a resource for innovation, as it does not decrease when is shared (Freeman 1991; Antikainen et al. 2010). Indeed, the majority of innovations are realized when companies cross the boundaries of different knowledge domains (Leonard-Barton 1995; Carlile 2004; Antikainen et al. 2010).

New Methods of Organizing External Relations

Whenever a company engages in acquiring knowledge from outside its boundaries, there is a consequent need to adapt its organizational procedures accordingly. These procedures are represented by alliances, partnerships, outsourcing or sub-contracting, and other practices that companies have to manage for the acquisition of external knowledge and/or technology. As Schumpeter (1934) already asserted, the introduction of innovation always requires a firm to change in managerial practices. Furthermore, there is also evidence that organizational procedures can increase product and process innovation and lead to a superior performance (Schmidt and Rammer 2007; Mol and Birkinshaw 2009; Doran 2012). In particular, alliances arise when there is resource complementarity among companies (King et al. 2003), and this is often verified in the case of CII, and also they allow a higher control and access over the external resources the firm is acquiring (Haspeslagh and Jemison 1991; Das and Teng 1998).

External Information from Suppliers, Competitors, Consultants

Getting information from suppliers, competitors, and consultants – even stemming from other industries - allows companies to generate new ideas and innovations by merging this information with their internal know-how. (Rosenkopf and Nerkar 2001; Katila 2002; Lefebvre et al. 2015). Indeed, diverse information sources (from suppliers, competitors, consultants) are complementary and, if merged with the existing knowledge, allow to create new knowledge useful for innovation (Tether and Tajar 2008; Lee et al. 2010). Therefore, companies should always look for external information which can then be embodied into innovation (Köhler et al. 2012; Costa et al. 2015). Through the acquisition of external information, companies demonstrate an open-minded behavior, being increasingly able to scan the market and identify those opportunities which allow them to be more efficient in implementing innovation and decrease the risk of product failure (Stewart-Knox and Mitchell 2003; Avermaete et al. 2004; Wei and Wang 2011).

Methodology

The need to collect a comprehensive set of data on the multi-faceted nature of innovation activities has led to the widespread use of firm-level innovation surveys. The dataset used in the

paper is based on the two Community Innovation Surveys (CIS) carried out in Italy in 2010 and 2012, referred to innovation activities undertaken during the period 2008–2012. The CIS is a biennial national data collection survey based on the OECD's Oslo manual to gather information on the extent of innovation in European firms across a range of industries and business enterprises. It is widely recognized as a unique instrument for understanding innovation and for benchmarking performance by sector and country.

The sample, supplied by the Italian National Institute for Statistics, contains 37,026 observations and is highly representative of the population of Italian manufacturing firms. The sub-sample for the food industry (ATECO[2] 10–11) has 703 observations and therefore represents 1.2% of the average number of food companies for 2008–2012 (that is 58.265) according to Eurostat statistics. Moreover, it is constituted by 82.5% of SMEs and 17.5% of large companies; in that regard, it should be noted that large companies are overrepresented, since they usually correspond to less than 1% of food firms in Italy according to Eurostat statistics.

In order to address the research questions, variables related to innovation (product and process) and those referred to external knowledge sourcing (proxy for CII) are selected from the CIS surveys and constitute respectively dependent and independent variables; moreover, the variable CIS12 is introduced to account for differences in data collecting and time between the two different surveys (Table 1). Furthermore, definitions of variables according to the CIS questionnaires and descriptive statistics are reported in Table A1 and A2, respectively (see the Appendix).

Table 1. List of variables

Dependent Variables	CIS Code	Scale of Measurement
New or significantly improved goods introduced	INPDGD	0: No
New or significantly improved methods or manufacturing or producing goods or services introduced	INPSPD	1: Yes
Independent Variables	**CIS Code**	**Scale of Measurement**
External R&D	RRDEX	
Acquisition of machinery/equipment/software	RMAC	
Cooperation	CO	0: No
Acquisition of external knowledge	ROEK	1: Yes
New methods of organizing external relations with other firms or public institutions	ORGEXR	
External information: from supplier of equip. material, etc.	SSUP	0: not used
External information: from competitors or other companies	SCOM	1: low 2: medium
External information: from consultants, commercial labs	SINS	3: high
CIS12 sample	CIS12	0: No 1: Yes

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[2] ATECO is the acronym for "Attività Economiche", namely the classification of Italian economic activities (for further details, please see http://www.istat.it/it/strumenti/definizioni-e-classificazioni/ateco-2007). It is the Italian translation of Eurostat's NACE Rev. 2, which in turn stands for "Nomenclature statistique des activités économiques dans la Communauté européenne" and is the classification of economic activities made by European Community (http://ec.europa.eu/eurostat/statistics-explained/index.php/Business_economy_by_sector_-_NACE_Rev._2). In our paper we make reference to the categories ATECO 10 (Food industries) and ATECO 11 (Beverage industries), which correspond respectively to NACE 2.1 and NACE 2.2.

According to the empirical literature (Ciliberti et al. 2015; Nieto and Santamaria 2007), an extension of probit known as bivariate probit has been performed to estimate models as it takes into account the categorical nature of the dependent variables as well as the fact that product and process innovation (and, as a consequence, the error terms of the models performed) are likely to be correlated (Greene 2012). More in detail, the study applies the same two basic models to analyze the relationships between types of innovation and drivers related to external knowledge sourcing in the food industry, by comparing SMEs and large companies. The bivariate probit model has the following specification:

$$Z_{i1} = \beta'_1 x_{i1} + \epsilon_{i1}; \quad y_{i1} = 1 \text{ if } z_{i1}>0, \quad y_{i1} = 0 \text{ if } z_{i1} \leq 0,$$

$$Z_{i2} = \beta'_2 x_{i2} + \epsilon_{i2}; \quad y_{i2} = 1 \text{ if } z_{i2}>0, \quad y_{i2} = 0 \text{ if } z_{i2} \leq 0,$$

$$(\epsilon_{i1}, \epsilon_{i2}) \sim N(0, 0, 1, 1, \rho).$$

To summarize, the bivariate probit model is used for: all food companies (models 1.1 and 1.2), food SMEs (models 2.1 and 2.2) and large food companies (models 3.1 and 3.2). They were estimated with Stata 12 routine, using the standard maximum likelihood procedure.

Results

The correlation coefficient (ρ) between the residuals of each of the two probits resulted highly significant in all the models run. It shows that the error structures of the equations are correlated and that therefore the bivariate model is the most appropriate one as well as the correct specification rather than separate (univariate) probit estimation. Moreover, the Wald test also indicates high joint significance of the variables for both models.

Estimates highlighting the impact of different external knowledge sourcing activities on innovation activities, according to the type of innovation and company size are reported in Table 2. Going into detail, model 1.1 shows that external R&D activities (RRDEX) as well as the acquisition of machinery and equipment (RMAC) positively affect product innovation (INPDGD), since coefficients are respectively +0.397 and +0.492. Moreover, external information provided in particular by competitors (SCOM) and suppliers (SSUP) and, to a lesser extent, by consultants and commercial labs (SINS) is significantly able to foster product innovation activities. Coefficients are, indeed, respectively +0.206, +0.151 and +0.117. Last but not least, also the acquisition of external knowledge (ROEK) and methods of organizing external relations (ORGEXR) with other firms or public institutions (by means or alliances, partnerships, etc.) have a significant and positive impact on the introduction of new products (+0.354 and +0.281, respectively). As concerns process innovation (INPSPD), model 1.2 reveals that the acquisition of machinery and equipment (RMAC) strongly induces the introduction of new processes (+1.078). Furthermore, food companies also highly rely on information from suppliers of equipment and materials (SSUP; +0.443) as well as on acquisition of external knowledge (ROEK) in order to develop new processes (+0.468).

Table 2. The bivariate probit regression models

	All Food				SMEs				Large			
	Model 1.1		**Model 1.2**		**Model 2.1**		**Model 2.2**		**Model 3.1**		**Model 3.2**	
	INPDGD		INPSPD		INPDGD		INPSPD		INPDGD		INPSPD	
RRDEX	0.397	**	0.231		0.315		0.518	**	0.399		-0.321	
RMAC	0.492	**	1.078	***	0.553	***	1.203	***	0.268		0.818	**
CO	0.164		0.336		0.224		0.435	*	-0.515		0.066	
ROEK	0.354	*	0.468	**	0.517	**	0.614	**	-0.296		-0.217	
ORGEXR	0.281	*	0.099		0.223		0.034		0.993	**	0.431	
SSUP	0.151	**	0.443	***	0.088		0.402	***	0.323	**	0.515	**
SCOM	0.206	**	0.038		0.140	*	0.033		0.591	**	0.055	
SINS	0.117	*	0.064		0.129	*	0.072		0.402	**	0.114	
CIS12	0.441	***	0.006		0.492	***	-0.002		0.355		-0.051	
Overall Model Fit												
Log pseudolikelihood	-665.145				-540.383				-106.220			
Number of observations	703				580				123			
Wald test of full model: χ2	446.970***				328.54***				60.89***			
Wald test of rho: χ2	17.639***				122.466***				371.448**			

*<0.100, **<0.050, ***<0.001
Source. Author's calculation based on CIS10 and CIS12 data

The remaining models (2.1-3.2) highlight how relationships between external knowledge sourcing and innovation differ according to food company size. Starting from SMEs, it should be noted that in both models 2.1 and 2.2 external knowledge sourcing inducing SMEs innovation activities are partly the same of those analyzed in model 1.1 and 1.2, due to the high relevance of SMEs in the sample. More in detail, model 2.1 shows that product innovation (INPDGD) is significantly and positively affected by RMAC (+0.553), ROEK (+0.517), SCOM (+0.140) and SINS (+0.129). Furthermore, model 2.2 illustrates that the introduction of process innovation (INPSPD) is fostered by RMAC (+1.203), ROEK (+0.614) and SSUP (+0.402), like in model 1.2, with a significant contribution also of RRDEX (+0.518) and of the collaboration with other enterprises or institutions (CO, +0.435).

Concerning large food companies, model 3.1 points out that they significantly rely on methods of organising external relations with other firms or public institutions (ORGEXR, +0.993), as well as on information provided by competitors (SCOM, +0.591), consultants (SINS, +0.402) and suppliers (SSUP, +0.323), to develop new products. Moreover, model 3.2 reveals that both the acquisition of external technology (RMAC, +0.818) as well as information from suppliers (SSUP, +0.515) have a positive impact on process innovation activities.

Furthermore, since the main purpose of the present paper is to shed lights on the role played by different external knowledge/technology sources according to company size, further elaborations are provided in order to better point out significant differences between SMEs and large companies. To this aim, Wald-type tests of nonlinear hypotheses were performed in order to assess the existence of significant differences between the coefficient of the estimated models. Table 3 reports the results of Wald-type tests of nonlinear hypotheses. It shows that according to the type of innovation, some significant differences among SMEs and large companies exist.

Table 3. The Wald-type tests of nonlinear hypotheses:
SMEs vs. large companies

	INPDGD Model 2.1 vs 3.1		INPSPD Model 2.2 vs 3.2	
RRDEX	0.04		4.020	**
RMAC	0.66		1.200	
CO	2.45		0.680	
ROEK	2.4		3.110	*
ORGEXR	5.05	**	1.170	
SSUP	1.68		0.470	
SCOM	4.280	**	0.010	
SINS	1.420		0.050	
CIS12	0.14		0.020	

*<0.100, **<0.050, ***<0.001
Source. Author's calculation based on CIS10 and CIS12data

As concerns product innovation (INPDGD), it should be noted that there is a significant difference in the way the new methods of organizing external relations with other firms or public institutions (ORGEXR) trigger the introduction of new products. Indeed, according to models 2.1 and 3.1, large companies take more advantage than SMEs from such relations in order to develop innovative products. Likewise, a significant difference between large companies and SMEs concerns the role played by the information provided by competitors (SCOM); indeed, results highlight that the former more effectively rely on such information source than SMEs, corroborating the empirical evidence of models 2.1 and 3.1.

With regard to process innovation (INPSPD) the comparison between models 2.2 and 3.2 outlines a couple of significant differences between large companies and SMEs, as concerns the role played by external R&D activities (RRDEX) and the acquisition of external knowledge (ROEK) in triggering the adoption of new processes. Indeed, according to the above-mentioned models, results of the Wald tests confirm that *extra moenia* R&D differently affect process innovation, since SMEs are more able than large companies in exploiting such activities in order to introduce new processes. Likewise, existing knowledge acquired from other enterprises or organizations differently affects the ability to develop new or significantly improved processes of SMEs and large companies. Biprobit models point out that the former rely more than the latter on external know-how from other enterprises or organizations to carry out process innovation activities.

Discussion

Henceforth empirical findings are discussed in the lights of existing literature, according to the research questions which the present work is based on.

As concerns RQ 1 (*What is the impact of different means of external knowledge sourcing on product and process innovation?*), models 1.1-1.2 show that in the Italian food industry both types of innovation rely on different external knowledge sources. As a consequence, the ability to internalize external knowledge of food companies is increasingly impacting positively on

innovation and such a phenomenon suggests that CII gains momentum. On the basis of the previous literature, empirical findings confirm that competencies and technologies external to the food industry are becoming decisive in order to stimulate innovation, therefore building the basis for the CII (Malerba 2002; Costa et al. 2015).

More in detail, with regard to product innovation (INPDGD), model 1.1 shows that food companies greatly benefit from the acquisition of machinery (RMAC), external R&D activities (RRDEX) as well as from acquisition of external knowledge (ROEK), in order to increase their stock of knowledge. This result confirms that such an innovation takes advantage of sharing and absorbing new knowledge from outside the firm (Veugelers and Cassiman 2005; Ruben et al. 2006; Dingler and Enkel 2016). In practice, the acquisition of equipment has become unavoidable, and therefore companies have to exit the borders of their sector to enhance their competitiveness (Lee et al. 2010). The combined effect of engaging in external R&D activities and purchasing input and knowledge from other industries trigger a process that help companies face competition in diversified markets (Klevorick et al. 1995; Lee et al. 2010). Furthermore, the development of new products in the Italian food industry is also induced by new methods of organizing external relationships (ORGEXR), confirming that new organizational procedures (e.g. alliances and partnerships) are useful and also necessary to acquire knowledge from outside company and sector boundaries, as in the case of CII, due to the resource complementarity of industries involved (King et al. 2003). Last but not least, information provided by suppliers (SSUP), competitors (SCOM) and consultants (SINS) is able to foster the introduction of new products because it can help companies to decrease the risk of product failure as well as to scan the market and identify new opportunities (Avermaete et al. 2004; Stewart-Knox and Mitchell 2003; Wei and Wang 2011).

Regarding process innovation (INPSPD), findings from model 1.2 show that it is strongly induced by the acquisition of technology (machinery and equipment) from outside sectorial boundaries (RMAC). Indeed, this type of innovation is notoriously technology-pushed and, to this end, it takes advantage of the technology transfer process that allows knowledge absorption often embodied into new materials (Lee et al. 2010). In that regard, the fact that information provided by suppliers (SSUP) is also significantly able to foster the development of new processes substantiates the fact that information sharing is essential in the technology transfer processes as it leads to an increase in trust and commitment in the relationship between supplier and buyer (Lee et al. 2010). Lastly, model 1.2 also highlights that acquisition of external knowledge (ROEK) is an effective way to improve the innovation output and allows to funnel different streams of knowledge towards successful innovations (Ahuja and Ritala 2001). Most importantly, this finding could be a clear signal of CII, since purchasing and/or licensing patents and know-how from other industries is almost unavoidable to get external knowledge and develop a new process.

With regard to RQ 2 *(Do means of external knowledge sourcing differently affect innovation according to company size?)*, empirical evidence show that, apart from the well-known differences between product and process innovation, some interesting dissimilarities emerge in the way external knowledge (and technology) sourcing affects innovation according to company size. Interestingly, even though the acquisition of external knowledge (RRDEX) significantly affect product innovation (INPDGD) in the general model, it is not significant neither for SMEs

nor large food companies. These counter-intuitive findings stem from the small sub-sample sizes that represents one of the main limitation of the present study. Notwithstanding, it should be noted that both large food companies and SMEs benefit of technology and knowledge from outside sectorial boundaries (though with different intensity) in order to carry out innovation. This fact confirms that, even though large companies and SMEs are recognized as being different in their innovation behavior (Hamilton 1985), for both there is an increasing importance of knowledge and technology coming from outside the food sector in order to share capabilities and achieve competitive advantage (Capitanio et al. 2010).

More in detail, with reference to product innovation (INPDGD), SMEs rely more on the acquisition of equipment and machinery (RMAC), whereas empirical evidence showed that large companies are significantly more able to benefit from organizational procedures aiming to reinforce external relations (ORGEXR) as well as to absorb information mainly from competitors (SCOM). This difference could be explained by the fact that, on the one hand, for SMEs it is easier to purchase equipment in order to "exit" the borders of the food industry, get the knowledge embodied into these inputs and take advantage of the technology transfer process (Lee et al. 2010), whereas, on the other hand, large companies are more willing to change managerial practices as well as they have more resources to invest in adapting organizational procedures, like an "open innovation department", in order to acquire knowledge from outside their boundaries (King et al. 2003). This capability can induce innovation and might lead to superior performance (Schmidt and Rammer 2007; Mol and Birkinshaw 2009; Doran 2012). Accordingly, large food companies show a greater ability to access to different sources of information which are external to their boundaries, so as to merge their internal know-how with that of competitors and consultants. Such an aptitude makes them more efficient in developing innovation, since, according to Tether and Tajar (2008), diverse information sources merged with existing know-how allow to create new knowledge useful for innovation.

As concerns process innovation activities (INPSPD), the differences between SMEs and large companies lie in the fact that these latter are significantly more inclined to take advantage of external R&D (RRDEX) and external knowledge (ROEK) in order to reduce risks linked to the innovation process and to fill knowledge gaps. In addition, SMEs rely more on collaboration activities (CO), whereas both SMEs and large food companies rely on information from input suppliers (SSUP). A plausible explanations could be that, since SMEs usually lack the needed resources and capabilities to put new ideas into practice, they are more willing to get external technology by engaging in external R&D, purchasing patented inventions and collaborating with other firms or institutions in order to complement their missing resources and competencies (Ahuja and Katila 2001; King et al. 2003). On the other hand, large companies prefer to acquire information coming from suppliers so as to merge it with their internal know-how and incorporate such an external knowledge into new processes. In addition, according to Lee et al. (2010) large companies also benefit from information sharing that is essential since it contributes to increase trust between suppliers and buyers when new equipment is acquired (especially in the case of high asset specificity). Last but not least, the technology-driven nature of the process innovation is substantiated by the fact that the acquisition of machinery and equipment (RMAC) represents a key driver in fostering the introduction of new processes both for large companies and SMEs. This type of innovation is indeed closely linked to a technology transfer process as, according to Lee et al. (2010), new knowledge is often embodied in the new material, and this

latter is acquired in order to absorb it. Mostly, the acquisition of technology is unavoidable, especially in technology-push processes in order to improve innovation performance and overall competitiveness.

Concluding Remarks

This paper represents an attempt to evaluate the role that external knowledge and technology sourcing is playing in product and process innovation in the Italian food industry—a sector dominated by SMEs and few large (multinational) companies—since it enables information and capability sharing to better profit by the resource endowment differences, thus facilitating the implementation of CII. Both types of companies could also benefit from a stronger technology transfer process across convergent sectors, in order to overcome the existing "cognitive distance" by reciprocally exploiting resource complementarity. It follows that the ability to acquire knowledge from outside the company boundaries as well as to collaborate with external partners and establish stable relations along the supply chain can make the difference in orienting companies towards a CII pathway. Such a route could be mainly covered by food firms that are more open to external inducement and more able to convert them in innovation, gaining then competitive advantage.

Empirical findings offered interesting insights on the role played by external knowledge sourcing on both types of innovation. Results highlight that in the Italian food industry product and process innovation takes advantage of the acquisition of machinery and equipment and external knowledge, which allow food companies to transfer know-how from outside to inside firm boundaries. Notwithstanding, product innovation in the food sector largely benefit from external R&D activities, that complement those carried out internally, as well as of organizational arrangement aimed to foster external relations and to exploit external knowledge and source of information. On the other hand, a technology-driven activity, like process innovation, relies mostly on tight collaboration with external partners, acquisition of know-how from other enterprises and on information provided by suppliers of input.

More interestingly, the paper allows focusing on peculiarities and differences between SMEs and large food companies. Our empirical analysis points out that there are some interesting analogies according to company size in the way external knowledge sourcing affects innovation. First, the technology transfer process linked to the acquisition of advanced equipment plays a key role both for SMEs and large companies' process innovation activities. Second, information from consultants plays a significant role in fostering the development of new products irrespective of company size. In this case, knowledge transfer allows firms to have deeper market knowledge, decrease the risk of failure, and implement product innovation more effectively when introducing new products (Avermaete et al. 2004; Wei and Wang 2011). Third, another common feature is that process innovation is relevantly induced by the information exchange between buyers and suppliers that allow merging internal know-how with knowledge stemming from other industries (Lefebvre et al. 2015). Information sharing, moreover, improves relationships between contracting parties and leads to an increase in trust and commitment (Lee et al. 2010). With regard to the main significant differences between SMEs and large companies empirical evidences highlight that, whereas the former strongly rely on acquisition of external R&D and knowledge in order to foster process innovation, the latter are willing to introduce new

organizational methods to manage external relationships, as well as are able to use information provided by suppliers in order to trigger the introduction of new products.

In conclusion, the paper points out that, in the Italian food industry, in order to develop new products and processes both SMEs and large firms used to internalize external knowledge and R&D activities and acquire technology from outside as well as relied on information provided by suppliers, competitors, and consultants.

Findings offer interesting insights to practitioners since they shed lights on the relevance of different external knowledge sourcing activities as well as contribute to revealing main strategies of information and technology transfer adopted by food companies. Since the capability to internalize knowledge from outside the firm boundaries and rapidly convert it into innovation could increasingly represent a strong competitive advantage in order to face the agri-food market challenges in the next decades, outlining drivers which can constitute the basis for CII might help managers and stakeholders to focus on specific strategies according to company size and other relevant features.

It seems quite evident from our findings that managers and stakeholders should formulate strategies aimed at innovating their products and/or processes by investigating opportunities also in other sectors. Both large companies and SMEs can gain an advantage by investing time and resources in acquiring knowledge and technology from outside the boundaries of the food sector. Therefore, especially in the Italian food sector, companies should be more aware that innovation is fundamental to survive in the market, and also that collaborations and partnerships are necessary to complement resource and capability gaps. Finally, together with market-driven innovation, information from suppliers, competitors, and consultants as well as knowledge embodied into equipment coming from other sectors can lead to successful ideas and inventions to be put in practice.

Main limitation of the study is due to the fact that empirical analyses are based on a sample that is not properly representative of the whole Italian food industry, as well as to the limited number of large companies in the sample. Therefore caveats that stem from the biased composition of the CIS sample according to size must be considered for a more appropriate interpretation of results. Furthermore, the availability of panel data could have enabled a more thorough analysis of the dynamics that have affected the relationship between external sources of knowledge and innovation in the last decade, but it is well-known that the CIS does not provide time-series data. Moreover, it has to be considered that data about effective CII activity are not available, and the capacity to acquire external knowledge sources is used as a precursor for CII. Therefore, results are a subjective view of the authors concerning this issue and want to provide a scenario behind innovation activities of food firms in Italy, but cannot ensure that CII is really in place. Also, at present, the paper does not investigate other types of innovation, such as market or organizational innovation, which may help to depict a complete overview of food firms' innovation activities and related drivers.

All these things considered, it follows that additional research is strongly recommended to explore such a relevant topic, in order to fill the knowledge gap of CII in the agri-food sector as a whole.

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Appendix

Table A1. Definition of variables according to CIS 2010 and CIS 12 Surveys Questionnaires

Variable (CIS code) *	Question
INPDGD	During the three years 2008 (2010) to 2010 (2012), did your enterprise introduce new or significantly improved goods?
INPSPD	During the three years 2008 (2010) to 2010 (2012), did your enterprise introduce new or significantly improved methods of manufacturing or producing goods or services?
RRDEX	During the three years 2008 (2010) to 2010 (2012), did your enterprise engage in external R&D (creative work performed by other enterprises (including other enterprises or subsidiaries within your group) or by public or private research organizations and purchased by your enterprise)?
RMAC	During the three years 2008 (2010) to 2010 (2012), did your enterprise engage in acquisition of advanced machinery, equipment or software to produce new or significantly improved products and processes?
CO	During the three years 2008 (2010) to 2010 (2012), did your enterprise co-operate on any of your innovation activities with other enterprises or institutions? (e.g. innovation co-operation is active participation with other enterprises or non-commercial institutions on innovation activities. Both partners do not need to commercially benefit. Exclude pure contracting out of work with no active co-operation.).
ROEK	During the three years 2008 (2010) to 2010 (2012), did your enterprise engage in acquisition of other external knowledge (e.g. purchase or license patents and non-patented inventions, know-how, and other types of knowledge from other enterprises or organizations for the development of new or significantly improved products and processes)?
ORGEXR	During the three years 2008 (2010) to 2010 (2012), did your enterprise introduce new methods of organising external relations with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc.)?
SSUP	During the three years 2008 (2010) to 2010 (2012), how important to your enterprise's innovation activities were information sources from suppliers of equipment, materials, components, or software?
SCOM	During the three years 2008 (2010) to 2010 (2012), how important to your enterprise's innovation activities were information sources from competitors or other enterprises in your sector?
SINS	During the three years 2008 (2010) to 2010 (2012), how important to your enterprise's innovation activities were information sources from consultants, commercial labs, or private R&D institutes?

Note. (*) The variable CIS12 is a control variable not included in the CIS questionnaires.

Table A2. Relative and absolute frequency by company size

Variable (CIS code)	Value	ALL (n=703)		SMEs (n=580)		LARGE (n=123)	
		Rel. Freq.	Abs. Freq.	Rel. Freq.	Abs. Freq.	Rel. Freq.	Abs. Freq.
INPDGD	0	0.514	361	0.557	323	0.309	38
	1	0.486	342	0.443	257	0.691	85
INPSPD	0	0.543	382	0.576	334	0.390	48
	1	0.457	321	0.424	246	0.610	75
RRDEX	0	0.885	622	0.912	529	0.756	93
	1	0.115	81	0.088	51	0.244	30
RMAC	0	0.444	312	0.469	272	0.325	40
	1	0.556	391	0.531	308	0.675	83
CO	0	0.890	626	0.921	534	0.748	92
	1	0.110	77	0.079	46	0.252	31
ROEK	0	0.888	624	0.890	516	0.878	108
	1	0.112	79	0.110	64	0.122	15
ORGEXR	0	0.818	575	0.834	484	0.740	91
	1	0.182	128	0.166	96	0.260	32
SSUP	0	0.378	266	0.417	242	0.195	24
	1	0.095	67	0.095	55	0.098	12
	2	0.329	231	0.312	181	0.407	50
	3	0.198	139	0.176	102	0.301	37
SCOM	0	0.586	412	0.617	358	0.439	54
	1	0.229	161	0.219	127	0.276	34
	2	0.132	93	0.112	65	0.228	28
	3	0.053	37	0.052	30	0.057	7
SINS	0	0.457	321	0.490	284	0.301	37
	1	0.211	148	0.178	103	0.366	45
	2	0.235	165	0.234	136	0.236	29
	3	0.098	69	0.098	57	0.098	12
CIS12	0	0.613	431	0.634	368	0.512	63
	1	0.387	272	0.366	212	0.488	60

The Role of Conflict in Farmers' Crop Choices in North Kivu, Democratic Republic of the Congo

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Abstract

Cropping choices under uncertainty caused by weather, input prices, and ecological conditions have been addressed in contemporary literature. However, uncertainty arising from violent conflict on farming choices lacks substantial academic attention. In this research we address the ramifications of conflict on household cropping choices, building on the notion of "conflict resistant" cropping systems introduced in Kibriya et al. 2014 and King et al. 2013. We argue that farming households' preferences change under conflict as they revert to a cropping system that minimizes losses. This novel concept is solidified by formulating a definition through rational choice theory. The theoretical expectations are verified through data obtained from 2300 smallholder farming households in North Kivu, DRC. A case study and propensity score matching methods are employed to demonstrate that conflict-affected households focus more on low-value crops that are less frequently stolen in order to maximize the probability of survival.

Keywords: conflict resistant farming, North Kivu, farmer adaptation

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Introduction

Researchers have considered how farmers choose crops to hedge against uncertainty caused by weather and prices (e.g. Dercon 1996; and Morduch 1990). Few studies have extended the analysis to uncertainty arising from conflict. Most of the existing literature on violent conflict either addresses ecological (Gillingham et al. 2003; Hocking et al. 2012; and Hill 2000) or human security (Barnett et al. 2007 and Hussein et al. 1997) issues. In case studies by Kibriya et al. (2014), King et al. (2013), and Price et al. (2014), a number of crops and cropping systems were identified as 'conflict resistant'—a term which implies that these crops are less likely to be impacted adversely by conflict (e.g. through theft, destruction, underproduction, lack of markets, etc.). The work suggested the value of a deeper understanding of farmer crop choices with respect to the threat of conflict. Information from farmers about conflict resistant crops and cropping systems can guide extension workers to improve food security in conflict regimes, and guide scientists and policy makers to direct research that improves the conflict resistance of crops and cropping systems or the viability of crops already identified as such. Along the following lines, we investigate the influence of violent conflict on farmers' crop choices in DRC. We argue that farming households' preferences shift under conflict as they revert to a conflict resilient cropping system. We solidify the novel concept of conflict resistant cropping choices and systems by defining it through rational choice theory. Following, we verify our theoretical expectations through a case study and quantitative analysis of a household survey. Our regression results are verified through a propensity score matching method that conclusively shows that cropping choices of conflict-affected households focus more on low value yet high-security products that maximize the probability of survival.

Literature Review and Discussion of Definitions

Although commonly practiced through much of the developing world, the concept of conflict-resistant cropping choices is relatively novel in academia. "War resistant" crops were discussed in Zilverberg's 2007 MS thesis on "Agriculture, Technology, and Conflict," based on his field research in post-conflict Santa Cruz del Quiché, Guatemala. He noted that during times of war, farming households' cropping choices are altered to produce crops that are difficult to be destroyed and can be cultivated without much risk (Zilverberg 2007).

Price observed during fieldwork in DR Congo in 2014 that food acquisition from farmers by guerilla fighters and the regular military occurs in several ways. Fighters typically roam in small groups and may steal clandestinely or at gunpoint. Larger groups may requisition food from village leaders, or order the community to vacate their farms or homes at harvest time so that their crops might be taken. Other groups purchase food but conduct roadblocks or extortion at mining sites. "Conflict resistant" crops are those crops that provide the best return to the farmer under such conditions. More generally, they are crops which best support bare-minimum food security in households that are exposed to armed conflict.

Existing literature on cropping decisions under conflict in North Kivu is limited, but Vlassenroot and Raeymaekers have touched on the subject in extensive work on the history and political economy of eastern DRC. They note for example that in Masisi, North Kivu, during conflict farmers' crop choices demonstrate "a significant shift from extensive to intensive cultivation and

from perennial crops to low-risk and seasonal crops" (Vlassenroot 2008). In this context, they describe agricultural decision-making as "increasingly guided by the minimizing of risk rather than the maximizing of profits. In addition, the diversification of crops [is] in accordance with tenure security, which explain[s] the reduction of perennial crops" (Vlassenroot 2008). They go on to note that the disappearance of local support structures which "assist and guide local farmers" (e.g. agronomists) has further negative impacts on farmers' production and their ability to survive on the basis of their agricultural success.[1]

Among the few instances in the literature where farmer decision-making under conditions of conflict is quantified, Rockmore (2014) uses a large dataset from northern Uganda to examine cropping and livestock holdings. He shows that in areas where rebel activity is reported, farmers keep less livestock, with a more pronounced negative effect on large animal holdings (i.e. cows) and a potentially positive effect on pig holdings. He also finds that in areas with rebel activity, fewer households choose to cultivate cassava, beans, and maize, while more households cultivate millet.

Previous work by Kibriya, Partida, King, Price (2012) has laid out a set of crop characteristics which are associated with conflict-resistance. Building upon their work, conflict resistance can be conveyed through a combination of several different properties, including (1) low visibility, (2) harvesting or transport difficulty for looters, (3) production in home gardens or infields as opposed to outfields (4) extensive processing requirements, (5) quick damage recovery, (6) continual production, (7) market complexity, and (8) annual (vs. perennial) growth pattern. Farming households under conflict will tend to forgo crops that are of high nutritional value and are easily marketable, and choose instead to cultivate crops with some combination of these characteristics. Thus we offer a definition of a 'conflict-resistant cropping system' as *the cultivation of a set of crops with some combination of the above characteristics, on the part of a smallholder in response to conditions of widespread active civil conflict*.

Hypotheses

The primary objective of this study is to explore the conditions (i.e. the specific categories of conflict) under which crop theft in particular occurs, and how farmers' choices of crops are influenced by the incidence of conflict. We also aim to further clarify attributes that impart conflict resistance to crops and cropping systems. A secondary objective is to learn what factors might moderate the effects of conflict on crop choice, such as ease of converting crops to cash through market access. Standard choice theory[2] infers that farming households' will alter their

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[1] See Rockmore 2014 for a particularly extensive review of the literature on agricultural decision-making and exposure to insecurity and violence.

[2] Standard rational choice theory suggests that individuals have preferences among the available choice alternatives that allow them to state which option they prefer. These preferences are based on three axioms: a. completeness (the agent can always say which of two alternatives they consider preferable or that neither is preferred to the other); b. transitive (if option X is preferred over option Y and option Y is preferred over option Z, then X will always be preferred over Z); c. consistency (the agent will follow the same pattern/rationality unless the underlying conditions change). In this research a rational farmer is assumed to take account of available information, probabilities of conflict events, and potential costs and benefits in determining their cropping choices, and act consistently.

cropping behavior due to exposure to violent conflict. This behavior is likely to be facilitated through market access[3] and technology.[4] Our main hypotheses in this study are:

H₁: Conflict-affected farming households revert to conflict-resistant cropping systems.

H₂: Farmers who have better access to markets and technology will be more equipped to practice a conflict-resistant cropping system.

Survey and Sampling Methodology

Data for this study was collected from North Kivu, DRC in August and September of 2014.[5] We randomly chose thirty-six villages from Beni, Lubero and Rushuru regions of North Kivu[6] using a randomized grid-based strategy and interviewed approximately 2200 rural farming households. The sampling methodology was designed to ensure each village in the selected regions has equal selection likelihood. High-resolution maps from the United Nation's Office for the Coordination of Humanitarian Affairs identify villages in each region. For the grid-based sampling methodology, each region was divided into 5kmx5km squares. In order to be included in the sample space, a grid square had to have at least one village in it. We identified 626 populated squares in the three territories considered, and numbered those squares consecutively—Beni 1:190, Lubero 191:462, and Rutshuru 463:626. Gridding methodology is appropriate because population density is not known and cannot be incorporated in the sampling procedure.

R statistical software was used to generate sixty-five random numbers to select squares for village sampling.[7] Squares that could not be surveyed due to geographic, safety or other concerns are replaced with the next number. Village selection uses proportional weighting within each square. One village was chosen at random from each grid square selected. The unit of analysis is the individual farming household. Each household in the selected villages was surveyed, whenever possible. Enumerators were instructed to ask for the individual responsible for farming. If the individual is not available, enumerators proceed to the next house and return later.

The surveyor was prepared to gather specific information on household demography, input availability and usage, crop choices, market access, empowerment and social voice, and conflict within the society. The main dependent variable for this research is the cropping system of farming households. To collect specific information on the household cropping system the surveyor gathered detailed information on the types of crops each household chose and the reasoning behind such choices. Households were asked to categorize between crops grown for home consumption and cash crops. Additionally, they were asked to specify which crops they had ever had stolen

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[3] Market access in this specific study refers to be able to access local enterprises to buy or sell crops and inputs. It encompasses communication facilities such as: cell phones, radio, cycles and social cohesion such as: NGO and co-operative assistance.

[4] For this study technology refers to seeds, fertilizer, irrigation facilities, pesticides and herbicides available to farming households.

[5] The survey was validated and approved by the Institutional Review Board.

[6] Safety and logistical considerations eliminated the other territories in North Kivu from initial consideration.

[7] R 10.3 for Mac Maverick, seed set to 2301. The numbers were selected without replacement.

from their fields, and which crops they had *never* had stolen from their fields. Given the regions and villages the households belonged in, we also asked questions on ethnicity and recorded data on the administrative unit (*groupement*) in which the household was located. Market access was determined by their access to credit and local trade. Information on empowerment and social cohesion were acquired through households' connection to village leadership and extent and type of interaction with fellow farmers. We also gathered information on their co-operative membership status and whether they had any contracts with a crop buyer enterprise.

Empirical Strategy

We initiate our analysis through a qualitative understanding of the farming households in the three surveyed regions of North Kivu and a quantitative estimation of their choices. These choices are set within the agroecological and sociopolitical context of each territory. We then explore the prevalence of both conflict and crop theft in each region, including discussion of the correlations between the incidence of each. The first section concludes by illustrating our hypothesis that farmers shift away from high-conflict crops and toward more conflict-resistant crops when local insecurity increases.

In the second section of the empirical study, we focus on a short case study of a subset of the surveyed regions of North Kivu, which introduces and illustrates our quantitative analysis. In the case study, we discuss the agronomic and ecological attributes of specific crops and cropping patterns of the geographical areas in question. The case study also reveals and verifies the choices adopted by farmers by examining the prevalence of conflict and cultivation of different crops in segregated survey areas. While the initial T-tests and the regression and PSM analysis in Section Three provide a measurable understanding of patterns, the case study aims to provide a more intuitive explanation of farmer choices.

In the third section, we perform a regression analysis that will quantify the consequence of conflict on cropping system choice. Given the cross-sectional nature of our dataset, we cannot control for unobserved heterogeneity within households, nor can we find a suitable and valid instrument that would be partially correlated with our explanatory variables, but uncorrelated with unobserved heterogeneity. To mitigate any bias this might introduce and in order to capture at least some heterogeneity across groups of households, we include ethnic and *groupement* fixed effects instead and estimate the following equation:

$$(1)\ crop\_choice_{ij} = \alpha + \beta_1\ VAR_{ij} + \beta_2\ groupement_j + X'\beta_3 + \varepsilon_{ij}$$

Where $crop\_choice_{ij}$ refers to the cropping decision of household i belonging to *groupement* j; for the *groupement* fixed effect. For this estimation we divided the cropping choices into three groups: a. conflict resistant food crops; b. conflict resistant cash crops and c. crop diversification. The conflict resistant food and cash crops refer to each household's responses on the crops they deemed most unlikely to be stolen and their propensity to produce them. The crop diversity variable is derived from the number of crops individual households chose to produce. X is a vector of the mentioned control variables, referring to: conflict incidence, education, income, social cohesion, access to technology, co-operative membership and access to market. ε_{ij} refers to the innovation term. In all regressions, we used robust standard errors. Since the dependent

variable is categorical and ordinal, an ordered probit model was used to estimate the main equation.

While the randomly selected population and categorical regression analysis may eliminate bias, the incidence of conflict or crop choice may be correlated with the other variables which we consider controls. A randomized controlled trial would be ideal but impossible to implement since "conflict" cannot be inserted as a treatment. In this situation, the best empirical setup will be a quasi-experimental design. OLS estimations may produce overestimates of the impact of conflict on crop choices. Overestimation of the effects may occur because many attributes that create conflict may be the same characteristics that do not allow farmers to cultivate certain crops. Therefore, we also chose to employ Propensity Score Matching (PSM) to isolate the effect of conflict on different cropping choices.

Matching methods group and match individual observations based on a single variable (Dehejia and Wahba 1999; Dehejia and Wahba 2002). By matching pairs of farming households with the same characteristics from control and treatment groups, we can make a comparison between treatment and control groups while reducing selection bias. For our quasi-experimental estimation, we use PSM as proposed by Rosenbaum and Rubin (1983). PSM refers to the conditional probability (given a vector of covariates X) of being assigned to treatment. Propensity score accounts for the multidimensional covariates and compresses them into a single dimension, facilitating the matching process (Abadie and Imbens 2009). Hence, the key advantage of PSM is that by using a linear combination of covariates for a single score, it balances treatment and control groups on a large number of covariates without losing a large number of observations. The pair-matched individuals in control and treatment groups with the same propensity score are essentially comparable since their only difference is whether they have been assigned to the treatment or the control group.

More intuitively, a propensity score is the probability of a unit (i.e., farming household choosing crops that are conflict resistant) being assigned to a particular treatment (i.e., experiencing conflict), given a set of observed variables, such as household demographics and access to different facilities. Propensity scores reduce selection bias by equating groups based on the selected variables. In the case of a binary treatment T (T=1 if experienced conflict, and 0 otherwise), an outcome Y (specific cropping choices), and background variables X, the propensity score is defined as the conditional probability of treatment given background variables. The treatment assignment is, then, (conditionally) unconfounded if potential outcomes are not dependent on the treatment, conditional on background variables. In technical terms, we obtain the average treatment effect (ATE) as the mean difference in outcome between the treated and the control households, and the average treatment effect on the treated (ATT) which is the average effect from treatment for those who actually experienced conflict. To check the robustness of the PSM estimation, several matching algorithms are implemented: nearest neighbor, radius ('caliper'), and kernel (Caliendo and Kopeining 2008; Imbens 2015).

In the nearest neighbor matching method, each conflict-affected household is matched with a conflict-free household with the closest propensity score. The propensity score is the probability of a household experiencing conflict given a set of specified control variables. The radius approach matches each conflict-affected household with all non-conflict-affected households whose propensity score falls in a predefined neighborhood. In kernel matching, each conflict-

affected household is matched with a weighted average of all conflict-free households, with weights declining with the distance between propensity scores.

Results– Part I

There is considerable agroecological and sociopolitical heterogeneity across the province of North Kivu, though individual territories can be characterized as somewhat unique from each other. The eastern reaches of all three territories considered are endowed with rich soil (with volcanic derivatives in the south and young fertile Mollisols in the north), while the low-altitude western regions have more acidic and nutrient-poor soils. Three staple crops, beans, cassava, and maize, are the most commonly cultivated crops across all three territories, though they are present in varying relative proportions across the territories (See Table 2).

Beni territory is lower-altitude than the other two territories (generally less than 1200m), with localized rebel activity which increased significantly in the period immediately following the completion of the fieldwork for this study. Households grow more bananas than either of the other territories considered, along with cocoa, coffee and oil palm as cash crops. The territory is relatively ethnically homogenous, being populated largely by the Nande ethnic group.

Lubero territory is generally high-altitude (above 1200m - though the sparsely-populated western expanse of the territory is found at a lower altitude), and also has localized rebel activity, primarily in the southern region. In addition to the primary three staple crops, farmers grow rice, vegetables and a significant amount of potatoes. The territory is very ethnically homogenous, with the city of Butembo along the northern border of the territory being recognized as a traditional Nande stronghold.

Rutshuru territory is a mix of middle and higher altitudes, and has much more widespread rebel activity than either of the northern territories, in large part due to an influx of refugees and armed groups following the genocide in Rwanda in 1994, along with a complicated history of population flows from neighboring regions dating back at least to the Belgian colonial era. In addition to the three staple crops, farmers grow soy, sorghum, fruits and vegetables. The territory is ethnically diverse, with a mix comprising primarily the Hutu, Nande and Tutsi ethnic groups.

Over the past five years conflict has generally spread northward from Rutshuru territory.[8] Among the many armed groups active in the province, the FDLR are particularly significant. An ethnically Hutu militia previously localized to Rutshuru territory, the FDLR's activities have spread into southern Lubero and possibly further north. A variety of ethnically Nande local defense groups have sprung up in the areas where the FDLR is active.

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[8] The many layers of conflict in the eastern provinces of the Democratic Republic of Congo are complex and rooted in a combination of historical, political, ethnic and geographical factors which lie beyond the scope of this paper. For an in-depth historical perspective see Hochschild 1999; for a nuanced discussion of recent events see Stearns 2012.

Table 1. Prevalence of conflict per territory

Prevalence of	Beni	Lubero	Rutshuru	"Sub-Region 12"
Community-level conflict	19.8%	22.6%	27.8%	42.5%
Conflict attributed to rebel groups	6.6%	5.1%	11.4%	27.6%
(Correlation coefficient)	0.046	0.240	0.178	0.289

Table 2. Prevalence of crop cultivation per territory

Prevalence of Cultivation	Beni	Lubero	Rutshuru	"Sub-Region 12"
Bananas	55.1%	30.4%	37.8%	4.7%
Beans	85.6%	64.3%	78.8%	52.0%
Cassava	85.3%	70.8%	76.3%	59.1%
Maize	80.0%	68.4%	83.1%	59.1%

Of the twenty-nine crops covered in the survey, only four registered consistently high rates of theft across all regions surveyed: maize, beans, cassava and bananas (See Table 3).[9] On average, theft is substantially more common in Rutshuru territory as compared to Beni or Lubero territories, though maize theft is relatively high everywhere.

Conflict is categorized as "community-level", reported either as conflict with neighbors or family members or "attributed to rebel groups." (See Table 1) In Beni territory, conflict and theft are both low and unpredictable: community-level conflict is not highly correlated with rebel activity, and no conflict is consistently correlated with crop theft (See Table 4). In Lubero, conflict and theft are both relatively localized in the southern sub-region, and there is a high level of correlation between different kinds of conflict, and between conflict and theft across all crops (except bananas, which are not common in Lubero) (See Table 5). In Rutshuru, conflict and theft are both more widespread and generally correlated with each other. (See Table 6).

Table 3. Prevalence of crop theft per territory

Prevalence of Theft:	Beni	Lubero	Rutshuru	"Sub-Region 12"
Bananas	17.2%	10.7%	37.8%	4.7%
Beans	15.4%	17.2%	78.8%	54.3%
Cassava	19.1%	15.9%	76.3%	32.3%
Maize	35.5%	45.8%	83.1%	77.2%

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[9] Defined as greater than 10% of households overall reporting theft of the crop at any point. Note that 'bananas' includes both plantain (more prevalent) and sweet bananas.

Table 4. Test statistics for mean rates of theft by incidence of conflict (Beni Territory)

Beni Territory	Bananas	Beans	Cassava	Maize
Community-level conflict	-9.3209***	2.3523	0.9215	0.7972
Conflict attributed to rebel groups	-1.7270*	1.2547	-3.3226***	-0.0028
N	679	679	679	679

Note. Test statistics are reported for the mean rate of theft for each crop for households not reporting the specified type of conflict as compared with the mean rate of theft for that crop for households who do report the specified type of conflict. *Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

Table 5. Test statistics for mean rates of theft by incidence of conflict (Lubero Territory)

Lubero Territory	Bananas	Beans	Cassava	Maize
Community-level conflict	-1.7563*	-6.3762***	-2.9170***	-2.6656***
Conflict attributed to rebel groups	1.1159	-8.7130***	-4.0566***	-2.0812**
N	679	679	679	679

Note. Test statistics are reported for the mean rate of theft for each crop for households not reporting the specified type of conflict as compared with the mean rate of theft for that crop for households who do report the specified type of conflict. *****Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

Table 6. Test statistics for mean rates of theft by incidence of conflict (Rutshuru Territory)

Rutshuru Territory	Bananas	Beans	Cassava	Maize
Community-level conflict	1.4503	-3.4542***	-3.9476***	-3.7789***
Conflict attributed to rebel groups	1.8929	-3.2135***	0.3442	0.5043
N	894	894	894	894

Note. Test statistics are reported for the mean rate of theft for each crop for households not reporting the specified type of conflict as compared with the mean rate of theft for that crop for households who do report the specified type of conflict. *Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

Tables 7 and 8 provide further emphasis for the point that conflict of both categories across North Kivu as a whole is correlated with higher rates of crop theft. Table 7, in particular, indicates that higher rates of community-level conflict are correlated with increased crop theft in beans, cassava, and maize.

Banana theft is difficult to assess in part because the crop is not cultivated as widely, so the comparison between territories is difficult. In addition, the banana plant has a number of characteristics which confer some degree of conflict-resistance (as defined at the beginning of this paper), potentially confounding analysis which treats it as a conflict-prone crop. Those characteristics include the fact that the banana corm continues to produce new stalks and new bunches even if the farmer is dislocated due to conflict; the relative difficulty in transporting the fruit when harvested (given its bulky nature); and the fact that a farmer's banana field is often

near the homestead. As a result, the analysis that follows does not explicitly categorize bananas as either conflict-resistant or conflict-prone. (Cf. beans, cassava, and maize, which are all categorized as conflict-prone.)

Table 7. Test statistics (and significance) comparing community-level conflict to theft

Incidence of Community - Level Conflict	Theft of: Bananas	Beans	Cassava	Maize
Household level (incidence vs. no incidence)	-4.8284***	-5.3351***	-4.7456***	-4.1990***
Sub-regional level (20-40% vs. <20%)	0.9404	5.7629	7.4434	5.4317
Sub-regional level (41-60% vs. <20%)	-9.2244***	-1.511	-2.3398**	-2.8087***
Sub-regional level (61-80% vs. <20%)	1.2880	-7.0820***	-8.7767***	-4.9856***

Test statistics are reported for the mean rate of theft for each crop for households for the conflict incidence comparison specified. "Household level" is identical to the t-test run in Tables 4–6. "Sub-regional level" describes the overall percentage of households in an individual survey location which report community-level conflict, and compares mean theft in areas with the prevalence rates specified. **Note.*** refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

Table 8. Test statistics (and significance) comparing rebel conflict to theft

Incidence of Conflict Attributed to Rebel Groups	Theft of: Bananas	Beans	Cassava	Maize
Household level (incidence vs. no incidence)	0.8459	-6.4475***	-4.0148***	-1.9883**
Sub-regional level (20-40% vs. <20%)	3.1510	-11.6012***	-5.6008***	-4.0334***
Sub-regional level (41-60% vs. <20%)	0.2498	-3.7996***	-7.6261***	-2.5378**

Note. Test statistics are reported for the mean rate of theft for each crop for households for the conflict incidence comparison specified. "Household level" is identical to the t-test run in Tables 4–6. "Sub-regional level" describes the overall percentage of households in an individual survey location which report conflict attributable to rebel activities, and compares mean theft in areas with the prevalence rates specified. *****Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

Case Study

In mid-April, 2012 parts of Lubero territory started to come under control of the FDLR (Van Damme 2012; see Raeymaekers 2008 for background). This control was localized in the area just south of "Sub-Region 12", around the town of Luofu in southwestern Lubero territory. This area is otherwise substantially similar to the rest of the heavily-populated eastern portion of Lubero

territory, with similar rainfall (in the range of 1,200–1,800 mm/yr), altitude (1,600–2,000 m), history, market access and ethnic composition. This basic similarity allows us to assess the current conditions (post-FDLR incursion) as a natural experiment, in which the rest of eastern Lubero territory (substantially unaffected by the incursion) is taken as a control region.

The uptick in rebel-related and another conflict in Sub-Region 12 is evident in respondents' answers to questions about their experience of conflict in the past 12 months (as of August 2014) (summarized in Table 9). We also see a particularly high incidence of theft[10] in this Sub-Region in comparison to the rest of Lubero territory (see Table 11). Upon further inspection, we note evidence of changing preferences among farmers with regard to crop choice: Across eastern Lubero territory, maize *(Zea mays),* beans *(Phaseolus vulgaris)* and cassava *(Manihot esculenta)* are the most commonly cultivated crops, but fewer farmers in Sub-Region 12 choose to cultivate maize, beans, and cassava, and more cultivate finger millet *(Eleusine coracana)*, taro *(Colocasia esculenta)* and peas *(Pisum sativum)* (see Table 10).

Table 9. Prevalence of conflict by source, in Sub-Region 12 vs. Control Region

Prevalence of Conflict (by source)	Family and Neighbors	Local Chiefs	Government Forces	Rebel Groups
Sub-region 12	42.5%	42.5%	6.3%	27.6%
Eastern Lubero Territory	20.3%	20.8%	0.8%	0.0%
test statistic	-5.050***	-4.896***	-3.669***	-11.840***
N	497	497	497	497

Note. Test statistics are reported comparing the prevalence of conflict for households between the regions specified. *Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

Table 10. Prevalence of cultivation by crop, in Sub-Region 12 vs. Control Region

Prevalence of Cultivation	Beans	Cassava	Maize	Millet	Taro	Peas
Sub-Region 12	52.0%	59.1%	59.1%	37.0%	49.6%	26.8%
Eastern Lubero Territory	67.8%	67.8%	65.1%	0.3%	36.2%	3.8%
test statistic	3.238***	1.799**	1.228	-14.367***	-2.676***	-8.029***
N	497	497	497	497	497	497

Note. Test statistics are reported comparing the rate of theft for each crop for households between the regions specified. *Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

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[10] Note that the prevalence of crop theft is higher than the prevalence of cultivation in some cases. Farmers were asked to specify which crops they cultivated in the previous two growing seasons (approximately 12 months), but the question about theft asked farmers to list crops which had *ever* been stolen from their fields.

Table 11. Prevalence of theft by crop, in Sub-Region 12 vs. Control Region

Prevalence of Theft	Beans	Cassava	Maize	Millet	Taro	Peas
Sub-Region 12	54.3%	32.3%	77.2%	0.0%	0.5%	0.8%
Eastern Lubero Territory	12.2%	13.8%	40.0%	0.0%	0.4%	0.3%
test statistic	-10.824***	-4.725***	-7.625***	–	-0.613	-0.793
N	497	497	497	497	497	497

Note. Test statistics are reported comparing the rate of theft for each crop for households between the regions specified. *Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

Smallholders in North Kivu tend to devote their largest fields to their staple crops - most commonly a combination of beans, maize and cassava - and these fields are often far from the family home. Maize, in particular, is easily harvested and ready for consumption, while beans are the most widespread basic protein source in the region and are ready for cooking at harvest. Two general categories of cassava—'sweet' cassava and 'bitter' cassava, with varying cyanide content—are grown in the region, usually planted together in the same fields. For the rural population the differences between varieties of this staple crop are common knowledge, so 'sweet' cassava is a ready target for foragers and thieves while 'bitter' cassava, with dangerous levels of cyanide and requiring substantial processing (soaking, fermentation, drying, etc.) before consumption, is largely ignored by thieves and foragers.[11]

Peas in North Kivu are prepared in a manner similar to beans, where they are boiled (either fresh or dried), seasoned with oil and salt and served with a carbohydrate such as maize, cassava, taro or rice. They are seen as a rather 'particular' crop, susceptible to both insects and disease, so farmers in the region prefer to plant less and watch the crop closely, leading them to plant the crop in smaller fields close to home. In the presence of conflict, when farmers face greater risk visiting outlying fields, peas planted in fields closer to the home have the potential to take the place of extensive (and risky) bean production as the household's primary protein source. In addition, peas in the high-altitude areas of eastern Lubero are harvested fresh to minimize the risk of insect damage, then sold fresh or dried, so the period from planting to harvest is less than four months, while beans in the same area are harvested after 4–5 months.

Like 'bitter' cassava, taro root contains toxins which require considerable processing (usually peeling and sun-drying) before the root can be consumed safely. In addition, taro is traditionally cultivated on more marginal fields, so farmers who resort to cultivating closer to home in smaller patches of more difficult terrain may choose taro as a culturally appropriate option.

As a small-seeded grain, millet requires considerable investment in drying, threshing and winnowing the harvested crop before it can be consumed, all of which would tend to dissuade potential thieves from the effort of stealing the crop from the field. In addition, millet is an uncommon staple crop in

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[11] Unfortunately the survey did not differentiate between 'sweet' and 'bitter' cassava when measuring cultivation and theft.

the diet of the region, so unfamiliarity with cooking and preparing the grain could be an additional impediment to its theft.[12]

Considering these agronomic and cultural factors, a shift away from easily-prepared and readily-consumed crops such as maize, beans and 'sweet' cassava, and toward millet, taro and peas make sense. As noted in Table 11, though rates of theft are higher in sub-region 12 even for taro and peas, those rates are substantially lower than the rates of theft for the primary staple crops mentioned. In this natural experiment, we see that farmers in areas exposed to higher-than-average rates of conflict act as rational actors: They choose to switch away from conflict-prone staple crops and to diversify their portfolio with crops which are more conflict-resistant.

Results– Part II

Table 12. Regression estimations on the relationship between cropping system choice and conflict

Dependent Variable	Conflict Resistant Food Crops		Conflict Resistant Cash Crops		Crop Diversification	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Conflict Level	0.156***	0.13***	0.07***	0.08***	0.47***	0.44***
Low Market Access	-0.299***	-0.08	-0.26***	-0.10*	-1.48***	-0.82***
Contract with Farmer	-0.406***	-0.19**	0.01	0.01	-1.3***	-0.63**
Empowerment	-0.706***	-0.90***	-0.11	-0.06	-1.99***	-2.0***
Social Cohesion	0.0950	0.08	0.10	0.12**	0.30*	0.37**
Cooperative Membership	0.196	-0.06	-0.16***	-0.10*	0.14	0.86*
Household Size	0.478	0.08	0.01	-0.01	0.1***	0.14***
Income	-3.93^{-10}	-1.10^{-09}	-1.2^{-09}	1.69^{-09}	8.03^{-09}	1.33^{-08}
Education	0.01	0.01	0.01	0.01	-0.01	0.01
Access to Technology	0.280	0.16**	0.22**	0.08	0.78	0.40**
Constant	2.816	1.7***	0.70***	0.69	5.3***	4.49***
Observations	1440	1440	1440	1440	1440	1440
R-squared	.2	.3	.15	.35	.25	.45
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Groupement FEs	No	Yes	No	Yes	No	Yes

Note.*Refers to 10% significance level while ** and *** refer to significance levels of 5 and 1 percent, respectively.

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[12] These findings substantially corroborate those reported by Rockmore (2014), who also found that in areas with rebel activity, fewer households choose to cultivate cassava, beans and maize, while more households cultivate millet.

The first two columns of Table 12 refer to conflict resistant food crops as the dependent variable with and without the *groupement*-specific effects. Table 13 lists and describes all correlates used in the analysis. In both the columns, we find conflict incidence positively affecting households' cropping choices at the 99% confidence level. Households that have lower market access have a statistically significant negative association with producing less conflict resistant food crops. Contract levels of farmers are found to be negatively related to households' choice of conflict resistant crops with 1% statistical significance: Farmers have more incentive to produce profit maximizing crops as opposed to hedging against conflict if they have an existing contract and will be producing more cash crops.

Table 13. Regression variables

Variable Name	Description
Conflict Resistant Food Crops	Crops which are both cultivated by the farmer as food crops for home consumption *and* reported as infrequently stolen
Conflict Resistant Cash Crops	Crops which are both cultivated by the farmer as cash crops *and* reported as infrequently stolen
Crop Diversity	Number of crops each farmer produced
Conflict Level	Number of incidences of conflict each farmer experienced
Low Market Access	From a composite score of farmer's access to local markets
Contract with Farmers	If the farmer had a formal contract with a buyer
Empowerment	Composite score on farmer's voice and influence in his/her village
Social Cohesion	Composite score of farmer's social standing
Co-operative Membership	If the farmer is a member of a co-operative
Household Size	Number of people in the household
Income	Total income in the last two cropping seasons
Education	Number of years of schooling
Access to technology	Composite score on farmers' access to agricultural technology
Groupement	The specific *groupement* in which the farmer is located

Empowerment also appears negatively and significantly related to conflict resistant food crops in both columns. As a household gains more power in the society, it appears that households get more confident and produce less conflict resistant crops. Income, education, size and co-operative memberships do not appear to be statistically significant with any of the conflict resistant food crops. Columns 3 and 4 show the estimates of conflict resistant cash crops as dependent variables with and without *groupement* fixed effects. Similar to conflict resistant food crops we find that conflict incidences are positively related at 1% significance levels. Low market access also depicts comparable results with the first two columns. Surprisingly, contracts with buyers do not have any statistical significance in the choice of conflict resistant cash crops. We attribute this non-significance to the lack of variation in the data as most of the farmers who produced cash crops have some kind of contract with buyers. Empowerment had similar effects because most farmers who practiced cash cropping had some influence on their respective

councils and societies. We again fail to find any significant relationship between conflict resistant cash crop and household size, income and education.

Columns 5 and 6 show the estimates of crop diversification. Conflict incidences are again found to be statistically significant and positively related to crop diversification at 99% confidence intervals. Contracts and low market access are negatively but statistically significantly related to crop diversification at a 1% significance level. Farmers who have contracts with buyers and low market access try to specialize in certain crops. Empowerment has a statistically significant negative relationship while social cohesion has a significant and positive association with crop diversification. Household size contradicts the results of previous columns showing a significant positive relationship with crop diversification. Surprisingly yet consistently, income and education appear inconsequential in terms of households' choice of diversifying agricultural crops—possibly because while it is generally accepted that higher-educated farmers tend to specialize and invest more in fewer crops, under conditions of conflict those same farmers may tend to diversify their cropping choices.

Using Propensity Score Matching, the impact of conflict on farmers' cropping choice remains significant at the 5% level under the nearest neighbor regression method, and at the 1% level under the other methods (caliper=0.005 and kernel) (see Table 14). Figure 1 shows that the density curve for propensity scores of the treated and the control groups align well. Table 15 details the variables used in the PSM estimation.

Table 14. PSM estimations on the relationship between cropping system choice and conflict

Estimation Method	Nearest Neighbor	Caliper (0.005)	Kernel
Coefficient on outcome variable ('Conflict resistant crops')	0.076**	0.083***	0.085***
Number of treated	879	879	879
Number of controls	945	945	945

Note. ** Refers to 5% significance level while *** refers to 1% significance level.
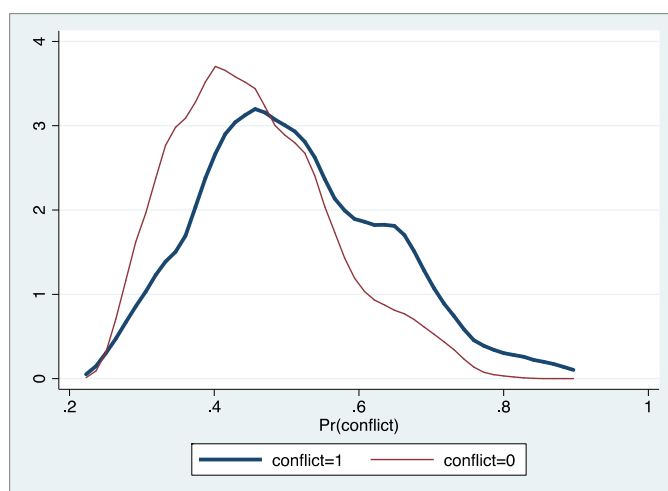
Figure 1. Estimated propensity score density over groups (treated vs. control)

Table 15. PSM regression variables

Variable Name	Description
Conflict Resistant Crops	Defined on the basis of the cropping system identified in the case study results, as the cultivation of at least one of millet, taro or peas in the previous cropping period.
Treatment Variable	
Conflict	Farmer reports exposure to conflict during the six months preceding the survey.
Control Variables	
Low Market Access	From a composite score of farmer's access to local markets
Contract with Farmers	If the farmer had a formal contract with a buyer
Empowerment	Composite score on farmer's voice and influence in his village
Social Cohesion	Composite score of farmer's social standing
Co-operative Membership	If the farmer is a member of a co-operative
Education	Years of schooling of the most highly educated family member
Access to technology	Composite score on farmers' access to agricultural technology
Sub-Region	The sub-region in which the farmer is located.

Discussion

In Part I, we see that in a 'natural experiment' where rebel forces enter a sub-region of a relatively homogenous territory, increased rebel activity is associated with increases in community-level conflict, and that both are associated with increased incidence of crop theft. We also see evidence in the case study that when confronted by increased levels of conflict, farmers make the rational choice to cultivate less of the common, easily-looted maize, beans, and sweet cassava, and more conflict-resistant crops—characterized in this case by crops with a combination of a short, annual growth pattern, being cultivated in gardens or fields close to the home and/or close to population centers, and having extensive processing requirements (drying/threshing for millet, poison removal in the case of taro). The case study clearly indicates that households make rational choices about crop choice when faced with conflict, and choose to cultivate crops which are less prone to theft.

In Part II, we find that the main independent correlate, conflict incidence, positively influences farmer cropping choice for both conflict-resistant cash and food crops and diversification decisions. Table 16 summarizes the signs of associated correlates used in the regression analysis. We conclude that being prone to conflict alters behavior and hedging mechanisms of farming households. Households in North Kivu tend to diversify their crop choice when exposed to conflict incidents. Access to technology appears to provide farmers an advantage in producing more conflict resistant crops, while better market access makes households more inclined to produce crops that are conflict resistant. Social empowerment also appears to have the same effect on conflict-resistant food cropping and crop diversification. However, empowerment and

contracts appear to have no effect on cash cropping, mainly due to lack of variation. Social cohesion does not affect the conflict-resistant food crop choices, though it affects the choice of cash crops and diversification—implying that better-connected farmers alter their cash-cropping behavior due to conflict, but not their cropping behavior for home consumption. A rather surprising finding of this research is that income and education levels do not affect farmer crop choices. We feel that the lack of dispersion in the data due to low-income levels and education across most of the surveyed households contributed to this significant yet perplexing discovery. It is also possible that the well-accepted tendency among higher-educated and higher-earning farmers to specialize in fewer crops confounds our analysis since those same farmers are likely to act rationally under conflict conditions. Access to farmer co-operatives only appears to reduce alteration in behavior in cash cropping. These findings are further corroborated by a Propensity Score Matching approach, demonstrating a strong case for a causal relationship between conflict incidence and the choice to cultivate a set of crops with strong conflict resistance.[13]

These findings cannot necessarily be extrapolated to profit-oriented farming enterprises, given the subsistence nature of the majority of the sample studied—for example, just over 7% of the sample has any sort of contract with a buyer for the purchase of their crops. As noted previously, cropping decisions through much of North Kivu are "guided by the minimizing of risk rather than the maximizing of profits."

Table 16. Summary of results

Explanatory / Dependent	Food Crops	Cash Crops	Diversification
Conflict	+	+	+
Market Access	–	–	–
Contract	–	N/A	–
Empowerment	–	N/A	–
Cohesion	N/A	+	+
Co-op	N/A	–	N/A
Income	N/A	N/A	N/A
Size	N/A	N/A	+
Technology	+	+	+
Education	N/A	N/A	N/A

Note. + Refers to statistically significant positive relationship while refers to a statistically significant negative relationship. N/A implies no association due to lack of statistical significance.

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[13] Issues of reverse causality are extremely unlikely in this case: A causal relationship between the cultivation of millet, taro and peas, and the incidence of rebel activity, would be difficult to substantiate.

Conclusion

Although the study of cropping behavior under extreme conditions is in its infancy, our unique approach and results provide significant insight into farmer behaviors in North Kivu, DRC. The case study using the natural experiment in Sub-Region 12 of Lubero territory lends support to our primary hypothesis, that conflict changes farmer perceptions and cropping behavior. Our secondary results imply that farmers that have better market access will be able to adapt more towards conflict resistant cropping systems. Cohesion in general also increased shock resiliency through adaptation towards more conflict resilient cropping systems. Although household size increased crop diversification, it did not contribute to coping mechanisms through cropping systems. The policy implications that can be drawn from this study are that improving access to markets and information as well as increasing social cohesion can help farming households in conflict-prone agrarian societies such as North Kivu to adopt conflict-resistant farming practices. This, in turn, might help them to cope better with the adverse effects of long-term conflict and social unrest that has become an integral part of their lives and livelihoods. Finally, a better understanding of farmers' cropping choices under conditions of conflict could aid practitioners, policymakers, and potentially even crop breeders and other researchers to better serve the needs of populations under conditions of long-term conflict.

Acknowledgements

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A Segmented Hedonic Analysis of
the Nutritional Composition of Fruit Beverages

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Abstract

Given the increased importance consumers and manufacturers have placed on the functional nutrients found in fruit beverages, as well as the changing federal guidelines on fruit beverage consumption, this study sought to determine whether specific nutrients garner price premiums in fruit beverages sold in the US. Using the National Household Food Acquisition and Purchase Survey, hedonic price models for fruit juice and fruit drinks are estimated to determine whether specific nutrients, product characteristics, packaging type and acquisition characteristics are associated with price premiums. Based on the results from the hedonic price models, three generalizations are made about the price premiums for nutrients and sugar in fruit beverages: (1) all nutrients garner premium prices in fruit juice, (2) sugar and select nutrients garner price premiums in non-diet fruit drinks and (3) all nutrients and sugar are associated with negative price premiums in diet fruit drinks. Findings further suggest that product attributes such as brand, flavor, organic labels, diet labels and package type, and acquisition characteristics such as store type, region, season and payment type are associated with price premiums in fruit beverages.

Keywords: fruit beverages, juice, nutrients, hedonic price analysis, price premium

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Introduction

With the average American consuming nearly 40 liters of fruit beverages every year, the United States is one of the world's largest fruit beverage consumers (Euromonitor 2015; Singh et al. 2015). Fruit beverages can be grouped into two categories: fruit juice and fruit drinks. Fruit juice is defined as pure, 100% juice with no added ingredients, while fruit drinks are fruit beverages containing ingredients other than fruit juice, such as sugar, and often have minimal nutritional value (Mintel Report 2015). On average, fruit drinks contain only 10% fruit juice (Harris et al. 2011).

Currently, a significant shift in fruit beverage consumption is occurring in the US, due largely to concerns over its sugar content. Wang et al. (2008) explain that fruit beverages' sugar content is similar to that of soft drinks and other sugar-sweetened beverages. Studies have further found evidence that fruit beverage consumption is associated with an increased risk for obesity, heart disease and diabetes (Dennison et al. 1997; Wojcicki and Heyman 2012; Imamura et al. 2015; Eshak et al. 2013). Reflecting these concerns, the Dietary Guidelines for Americans have been revised and now recommend abstaining from fruit drink consumption and limiting fruit juice consumption (USDA 2015). As a result, the United States Department of Agriculture has cut back on fruit beverage provisions in food assistance programs such as Women, Infants, and Children (WIC), and has begun regulating fruit beverage sales in schools. Consumers' reactions to these concerns and changing federal guidelines/programs are reflected in the sales declines for fruit juice and non-diet fruit drinks from 2010 to 2015 (Mintel Report 2015; Okrent and MacEwan 2014).

Despite its high sugar content, many nutritionists view fruit beverages as an important source of vitamins and minerals and as a cost-effective way for consumers to meet their daily fruit intake recommendations (O'Neil et al. 2012; Clemens et al. 2015). Among its consumers, fruit beverages are increasingly purchased for their functional attributes i.e. the nutrients they contain (Mintel Report 2014). According to Mintel, over 40% of Americans depend on fruit juice as a source of added nutrients in their diets (2015). Manufacturers have responded to the demand for functional fruit beverages by emphasizing the naturally occurring nutrients in their products and introducing fruit beverages fortified with vitamins and minerals (Siro et al 2008; Bishai and Nalubola 2002).

Given the increased importance consumers and manufacturers have placed on the functional nutrients found in fruit beverages, as well as the changing federal guidelines on fruit beverage consumption, this study seeks to determine whether specific nutrients garner price premiums in fruit beverages sold in the US. Specifically, this study seeks to answer the following questions: (1) which nutrients found in fruit beverages garner price premiums, (2) do the specific nutrients that garner price premiums vary by fruit beverage type and (3) what other attributes of fruit beverages garner a price premium. This study adds to the literature in that it is the first to consider whether specific nutrients garner price premiums in fruit beverages sold in the US. Further, this study is the first to estimate separate hedonic models for fruit juice and fruit drinks, thus allowing price premiums for nutrients to differ between the two fruit beverage types.

Background

US Fruit Beverage Industry

The US is one of the largest consumers of fruit beverages, with 8.4 and 4.2 billion liters of fruit juice and fruit drinks purchased in 2014 (Euromonitor 2015; Singh et al. 2015). According to Mintel, approximately 75% (49%) of US consumers reported drinking fruit juice (drinks) in 2015. Orange (mixed fruit) is the most popular flavor of fruit juice (fruit drink), with a 60% (29%) market share (Euromonitor 2015). Other leading fruit juice (drink) varieties in order of market share include apple, mixed fruit, tomato, grape, cranberry, grapefruit, prune and lemon (citrus, berry, lemonade, grape and apple) (Euromonitor 2015).

The fruit beverage industry in the US is relatively concentrated, with ten major companies accounting for 70% of fruit beverage sales. These companies and their respective market shares are as follows: Coca-Cola Co. (18.2%), PepsiCo Inc (13.4%), Campbell Soup (7.7%), Kraft Foods Group Inc. (6.6%) Ocean Spray Cranberries Inc. (6.5%), Dr. Pepper Snapple Group (5.3%), National Grape Cooperative Association Inc. (3.7%), Citrus World (3.3%), Beverage Holdings (2.4%) and Nestle (2.2%) (Euromonitor 2015).

Nutritional Composition of Fruit Beverages

In the US, sugar-sweetened beverages are the single greatest source of added sugars in the American diet, with fruit drinks alone accounting for 10% of the added sugar consumed every year (Krebs-Smith 2001; US 2015). On average, an eight-ounce fruit drink serving contains thirty-two grams of sugar or approximately 100% of one's recommended daily sugar intake (Harris et al. 2011). A 2014 report by Yale's Rudd Center for Food Policy and Obesity further explains that the average fruit drink sold in the US contains only 10% fruit juice, with the remaining 90% of the drink comprised of water and sugar (Harris et al. 2011). Correspondingly, fruit drinks are described as providing empty calories, in that they are high in energy from added sugars, but low in nutrients such as vitamins, minerals, and fiber (Reedy and Krebs-Smith 2010).

Unlike fruit drinks, fruit juice has historically been viewed as an important source of nutrients in the American diet. A detailed summary of the nutritional composition of seven common varieties of fruit juice is provided in Table A1 in Appendix A. In general, fruit juice is a significant source of Vitamin C, Potassium, Magnesium, Iron and Phosphorus (O'Neil and Nicklas 2008). However, despite being a natural source of vitamins and minerals, all fruit juice varieties have high sugar contents, ranging from 49% of the recommended daily sugar intake for an 8oz serving of grapefruit juice to 119% for grape juice (O'Neil and Nicklas 2008; FDA 2013b).

Federal Programs, Policies and Guidelines Concerning Fruit Beverages

Over the past decade, federal programs, policies, and guidelines have been altered or enacted in response to concerns over the high sugar content of fruit beverages in the US. Issued every five years, the Dietary Guidelines for Americans (DGA) provide consumers with guidance on maintaining a healthy diet and serve to inform food, health and nutrition policy (USDA 2015). The DGA recommendations on fruit beverage consumption have evolved considerably over the

past decade. In 2005, the DGA recommended choosing fruit beverages with little-added sugar (US 2005). By 2010, the DGA specifically stated to abstain from consuming fruit drinks and suggested limiting children's intake of fruit juice, especially if children are overweight or obese (US 2010). In the 2015 DGA, specific limits were placed on added sugar consumption, with no more than 10% of one's calories to be derived from added sugar (US 2015).

In 2007, the USDA's nutrition program for Women, Infants, and Children (WIC) was revised in response to the 2005 DGA's recommendation to choose beverages with little-added sugar (Cole et al. 2011). Established in 1966, the goal of WIC is to provide supplemental foods containing nutrients known to be lacking in the diets of at-risk women and children (Oliveira et al. 2002). Since its inception, fruit juice has been among the items provided by WIC due to its vitamin content. To be deemed WIC eligible, a product must contain only 100% unsweetened, pasteurized juice and contain a minimum of 20 mg of Vitamin C per 100ml of juice (USDA 2016b). In compliance with the 2005 DGA, revisions made to WIC in 2007 include the removal of fruit juice from all infant packages and a nearly 50% reduction in the maximum fruit juice prescription for women and children (Cole et al. 2011).

The USDA has also taken steps to regulate beverages sold in US schools. In July of 2014, the USDA implemented the Smart Snacks in School Standards which defined nutritional standards that all foods and beverage items sold in schools must satisfy (USDA 2013a). The standards effectively banned the sales of SSBs in schools, including fruit drinks. Among fruit beverages, only 100% fruit juice or 100% fruit juice diluted with water and with no added sugar can be sold in schools. The standards also limit the portion size of fruit juice that can be sold to 8oz and 12oz in elementary and middle/high schools respectively (USDA 2013a).

Changing Consumer Demand for Fruit Beverages

Consumers have reacted to the concerns over the sugar content in fruit beverages, as well as the changing federal guidelines and programs, by altering their fruit beverage consumption (Okrent and MacEwan 2014). Fruit juice expenditures in the US declined by 5% from 2010 to 2015, with approximately 34% of consumers who stopped drinking fruit juice doing so because of its high sugar content (Mintel Report 2015; Mintel Report 2014). During the same time period, fruit drink expenditures increased by 6%, driven primarily by the development of products containing fewer calories and less sugar (Mintel Report 2015; Taylor 2014; Okrent and MacEwan 2014).

Among consumers, fruit beverages are increasingly viewed as functional foods (Mintel Report 2014). The Functional Food Center defines functional foods as "natural or processed foods that contain known or unknown biologically-active compounds; which, in defined, effective non-toxic amounts, provide a clinically proven and documented health benefit for the prevention, management, or treatment of chronic disease" (Martirosyan and Singh 2015). According to Mintel, 40% (24%) of US consumers who purchase fruit juice (fruit drinks) look for vitamin or mineral enhanced formulas (Mintel Report 2014). Leading functional ingredients consumers seek in fruit beverages include Vitamin C, Vitamin D and Calcium (Euromonitor 2016). In addition to added nutrients, approximately 43% of fruit juice and fruit drink consumers are interested in no sugar added or low sugar varieties. (Mintel Report 2014).

In response to consumer demand for functional fruit beverages, manufacturers are emphasizing the naturally occurring nutrients in its products and introducing new fruit beverages fortified with vitamins and minerals (Siro et al. 2008; Bishai and Nalubola 2002). Key nutrients manufacturers are fortifying their fruit juice (drink) products with include Calcium, Vitamin D and Vitamin C (Vitamin C and Vitamin E) (Euromonitor 2016). In addition to functional attributes, a main area of focus for fruit beverage manufacturers is sugar reduction in its products (Mintel Report 2015). Manufacturers are conveying the nutritional benefits of their fruit beverages to consumers through the use of front-of-package labels. Detailed in Table 1, common front-of-package nutrition labels on fruit beverages include: good source of vitamins/antioxidants; percent (%) of daily values of vitamins/minerals; natural source of antioxidants; and no added/reduced/less sugar.

Table 1. Top fruit beverage front-of-package nutritional labels

	100% Fruit Juice	**Fruit Drinks**
Vitamin C	% Daily Value Vitamin C ● An Excellent Source of Vitamin C ● With Vitamin C	With Vitamin C ● % Vitamin C Per Serving ● Excellent/Good Source of Vitamin C
Vitamin D	An Excellent Source of Vitamin D ● Plus Calcium & Vitamin D	Plus Vitamin D
Vitamin E	% Daily Value of Vitamin E	Great Source of Vitamin E
Antioxidants	Antioxidant Advantage ● Packed with Antioxidants A & C ● Essential Antioxidants ● Natural Source of Antioxidants	Antioxidants Vitamin C & E ● 100% Daily Value of the Antioxidant Vitamin C
Multiple Vitamins	With Vitamins A,B,C,D,E ● Packed with Vitamins ● Excellent Source of Vitamins	Good Source of Vitamins A, C, E
Calcium	% Daily Value of Calcium ● An Excellent/Good Source of Calcium ● Plus Calcium & Vitamin D	None
Sugar	1/2 the Sugar ● No Sugar Added ● Less Sugar ● No High Fructose Corn Syrup	% Less Sugar ● Reduced Sugar ● No High Fructose Corn Syrup
Fiber	High Fiber ● Good Source of Fiber ● With Fiber	None

Uniqueness of this Study

Given the increased importance consumers and manufacturers place on the functional nutrients found in fruit beverages, as well as changing federal guidelines on fruit beverage consumption, this study seeks to determine whether key nutrients garner price premiums in fruit beverages. Several past studies have considered price premiums for nutrients in foods other than fruit beverages. Looking at breakfast cereal, Morgan et al. (1979) and Stanley et al. (1991) collectively find that protein, minerals, vitamins and sugar garner a premium price, while fiber and calories are associated with a price discount. Similarly, Angulo et al. (2006) and Harris (1997) conclude that meat with greater fat, protein and fiber content commands a premium price. Gulseven and Wohlgenant (2014) further find a price premium for lactose and cholesterol free milk.

Two past studies have analyzed whether nutrients garner price premiums in fruit beverages. Weemaes and Riethmuller (2001) considered the price premium associated with quality attributes, including nutrients, in Australian fruit beverages. Findings include that sugar is associated with a negative price premium and fruit beverages labeled with the Australian Heart Foundation seal garner a price premium. In 2014, Szathvary and Trestini analyzed the effects of nutrition and health claims on the prices of fruit beverages in Northeast Italy. Results suggest that fruit beverages containing a nutrition and/or health claim are associated with a price premium.

This study adds to the literature in that it is the first to consider whether specific nutrients garner price premiums in fruit beverages sold in the US. Building off of Weemaes and Riethmuller (2001) and Szathvary and Trestini's (2014) analysis of select nutrition claims, this analysis seeks to determine the price premiums associated with all key nutrients found in fruit beverages, including Vitamin C, Vitamin D, Antioxidants, Calcium, and sugar. This study is also the first to perform a segmented hedonic analysis of fruit beverages, with separate models estimated for fruit juice and fruit drinks.

Hedonic Pricing Model

Hedonic Price Theory

In their formative works, Lancaster (1966) and Rosen (1974) questioned the traditional notion that consumers obtain utility from goods themselves. Instead, they explain that goods are made up of a set of attributes, and it is these attributes that provide utility to the consumer. This concept serves as the basis for hedonic price theory. Under this theory, the observed prices and quantity of attributes for a specific good define a set of hedonic prices (Rosen 1974). There are three key assumptions made by hedonic theory: (1) consumers are aware of all available versions of a product, (2) there is significant variation within a product segment and (3) it is costless to switch between products (Costanigro et al. 2011).

Hedonic Price Model

Following Rosen (1974), the hedonic price function for a good is defined as follows:

(1) $p(z) = p_i(z_1, \ldots, z_k)$

(2) $z_i = (z_1, \ldots, z_k)$

where z is the product and z_i is a row vector of the attributes for the i_{th} product. Given this price function, consumers choose a bundle of attributes to maximize the following utility function (3) subject to their budget constraint (4):

(3) $U = U(x, z_1, \ldots, z_k)$

(4) $y = x + p(z)$

where y is income and x represents all other goods and has a unit price. Maximization of the utility function subject to the budget constraint results in the following first order condition:

$$(5) \quad p_{z_k} = \frac{U_{z_k}}{U_x}.$$

This first order condition yields the implicit price for a specific attribute, p_{z_k}, and implies that consumers are indifferent between paying the implicit price for an additional unit of an attribute and using the money to purchase all other goods x (Costanigro et al. 2011).

Analogously, producers choose a bundle of attributes and the number of goods to produce containing a particular attribute, $M(z)$, to maximize the following profit function:

$$(6) \quad \pi = Mp(z) - C(M, z; \beta),$$

where $C(M, z; \beta)$ is the producer's cost function and β is a parameter representing the producer's factor prices and production technologies. Maximization of this profit function results in the following first order condition:

$$(7) \quad p_{z_k} = \frac{C_{z_k}}{M}.$$

This first order condition implies that the marginal cost of adding an additional unit of an attribute to a product equals the implicit price of the attribute (Costanigro et al. 2011). Thus, at equilibrium, the market clearing implicit price for a particular attribute represents both producers' costs of providing the attribute and consumers' willingness-to-pay for the attribute.

There are several common issues associated with hedonic models, the most important of which of which is model misspecification. Economic theory provides no guidance on choosing the appropriate functional form for the hedonic price function (Chau and Chin 2003; Halvorsen and Pollakowski 1981). Following Yim et al. (2014) and Teuber and Hermann (2012), the Box-Cox Test was used to determine the appropriate functional form for the hedonic price functions in this study (Box and Cox 1964). Three functional forms were considered: linear, log-linear and inverse square root. Results from the Box-Cox Test suggest that the log-linear functional form outperforms the other specifications and was thus used in this study. Other common issues present in hedonic analyses include heteroscedasticity and multicollinearity (Constanigro et al. 2011). In this analysis, the Breusch-Pagan-Godfrey test and variance inflation factors are used to detect the presence of heteroscedasticity and multicollinearity respectively.

Application of Hedonic Price Model to Fruit Beverages

In this analysis, we estimate hedonic models for 100% fruit juice and fruit drinks. The following hedonic price functions are estimated:

$$(8) \quad \ln(JuicePrice) = \beta_0 + \sum_{j=1}^{4} \alpha_j Nutr + \sum_{k=1}^{14} \beta_k Prod + \sum_{l=1}^{3} \gamma_l Pack + \sum_{m=1}^{15} \delta_m Acq + \varepsilon$$

$$(9)\ \ln(DrinkPrice) = \beta_0 + \sum_{j=1}^{8} \alpha_j Nutr + \sum_{k=1}^{15} \beta_k Prod + \sum_{l=1}^{3} \gamma_l Pack + \sum_{m=1}^{14} \delta_m Acq + \varepsilon$$

where *JuicePrice and DrinkPrice* are the price per ounce for fruit juice and fruit, drink purchases respectively. Attributes of fruit beverages included in the hedonic price function are classified into four categories: (1) nutrients (*nutr*), (2) product attributes (*prod*), (3) packaging (*pack*) and (4) acquisition attributes (*acq*). The variables included in these categories are detailed in Table 2.

The first category of attributes, nutrients, is comprised of the key nutrients found in fruit beverages that are sought by consumers and advertised by manufacturers. These include antioxidants, Vitamin C, Vitamin D, Calcium and sugar[1]. Calcium and Vitamin D are combined into a single variable as fruit beverage manufacturers tend to fortify fruit beverage products with Vitamin D in conjunction with Calcium (Biancuzzo et al. 2010; De Lourdes et al. 2012; Table 1). With the exception of sugar, a price premium is expected for each of these nutrients due to the health benefits they provide consumers, as well as the added costs manufacturers, incur when fortifying fruit beverages. Conversely, we hypothesize that sugar will garner a negative price premium as consumers and manufacturers seek to limit its content in fruit beverages. Interaction terms between the nutrients and a diet (zero or low-calorie) fruit drink dummy variable, are also included in the nutrients category. These interaction terms are included to distinguish between the price premium for nutrients in diet and non-diet fruit drinks.

The second category, product attributes, consists of five variables representative of the products' characteristics: flavor, brand name, private label, diet and organic. In their studies on fruit beverages, Szathvary and Trestini (2014) and Weemaes and Riethmuller (2001) found that price premiums for fruit beverages varied by flavor. In this study, we include the following top-selling fruit beverage flavors: orange, other citrus, berry, apple, lemonade[2], mixed fruit, vegetable[3], grape and other flavors (Euromonitor 2015); orange is the reference flavor. In addition to flavor, dummy variables for brands with a market share greater than 5% in the fruit juice and drink markets are included in the model. Depending on the brands's reputation, prior hedonic analyses have found that brand names garner both positive and negative price premiums (Morgan et al. 1979; Szathvary and Trestini 2014). A dummy variable is also included for private label products, with the expectation that these products are associated with negative price premiums (Sethuraman & Cole 1999). Two additional product attributes are included in the analysis: organic and diet[4]. Past studies have found that organic beverages garner significant price premiums (Szathvary and Trestini 2014; Gulseven and Wohlgenant 2014). Diet fruit beverages are also expected to garner a price premium given their value-added attribute of having fewer calories.

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[1] For brevity, sugar is included in the nutrients variable category despite it classification as a carbohydrate.
[2] A lemonade dummy variable is not included in the fruit juice price functions as no lemonade is 100% juice.
[3] A vegetable dummy variable is included only in the juice price functions as all vegetable beverages are 100% juice
[4] Note that only fruit drinks can be classified as "diet"

Table 2. Definitions and descriptive statistics of variables

Variable	Definition	Unit	Base Variable	Mean (Juice)	Mean (Drinks)
Dependent Variables					
Per Unit Price**	Price per ounce for fruit juice and fruit drinks	$/oz	---	0.07	0.06
Nutrients					
Antioxidants***	Antioxidant content (excluding Vitamin C)	mg/100g	---	0.83	0.16
Calcium and Vitamin D***	Calcium and Vitamin D content	mg/100g	---	31.28	7.4
Vitamin C***	Vitamin C Content	mg/100g	---	30.08	13.08
Total Sugar***	Sugar Content	g/100g	---	10.24	11.63
Product Attributes					
Brand***	Set of ten dummies for top brand names	DV	Other Brands	0.05-0.08	0.05-0.10
Private Label***	Private label product	DV	Non-Private Label	0.21	0.05
Diet	Diet/low-calorie product	DV	Non-Diet	---	0.05
Flavor***	Flavor of fruit beverage: other citrus, berry, lemonade, apple, mixed fruit, vegetable, grape, other flavors	DVs	Orange	0.06, 0.05, ---, 0.17, 0.12, 0.07, 0.06, 0.07	0.02, 0.10, 0.13, 0.02, 0.44, ---, 0.04, 0.14
Organic	Organic product	DV	Non-Organic	0.05	0.06
Packaging					
Package Size*, ***, ***	Set of three package size dummies: oversized (≥ 89oz), standard (59-64oz) and single serve (≤ 24 oz)	DVs	Other Sizes	0.11, 0.13, 0.45	0.13, 0.22, 0.33
Acquisition Attributes					
Low-Access Tract***	Acquisition in low-access census tract at 1/10 mi urban/rural	DV	Non-Low-Access	0.35	0.29
Low-Income Tract***	Acquisition in low-income census tract	DV	Non-Low-Income	0.48	0.59
Region***	Item purchased in the West, South or Midwest	DVs	Northeast	0.26, 0.31, 0.25	0.26, 0.38, 0.19
Season***	Item purchased in fall, winter or spring	DVs	Summer	0.37, 0.04, 0.13	0.33, 0.06, 0.16
Store Type***	Set of four dummies for store type: convenience, club store, discount store and supermarket	DVs	Grocery Store	0.02, 0.04, 0.02, 0.86	0.03, 0.02, 0.05, 0.84
WIC	WIC payment used for acquisition	DV	Non-WIC	0.08	---
Coupon Used	Amount of coupon(s) applied to item purchased	$	---	0.02	0.01
Store Savings**	Amount of store savings applied to item purchased	$	---	0.17	0.14

Note. *Means for fruit juice and fruit drinks differ at the 0.10 level, ** 0.05 level and *** 0.01 level

In the third category of variables, packaging, three variables are included to characterize each fruit beverage's package size: standard, single serve and oversized. In their analysis of soda prices, Fox and Melser (2014) found that the relationship between package size and price is non-linear. In general, single-serving containers of soft drinks cost more per ounce. than standard sized containers (two liters). The authors further find that oversized packages (24 packs) cost less per ounce than standard sized packages. Analogous to the findings of Fox and Mesler (2014), we expect that single-serving fruit beverages will garner a positive price premium and that standard and oversized fruit beverage containers will garner a negative price premium relative to other sizes.

The final category of variables describes the attributes of the acquisition, including where, when and how the fruit beverages were purchased. Store type, region, and census tract characteristics are included to characterize where the fruit beverages were purchased. Szathvary and Trestini (2014) found that fruit beverages sold at supermarkets garner a price premium over other retailer types. Past studies have also found significant heterogeneity in the regional consumption of food products (Morgan et al. 1979; Drescher et al. 2008; Singh et al. 2015). Dummy variables for acquisitions made in low-income and low-access census tracts are also included in the model. Due to a lack of competition from other retailers, food prices tend to be higher in low-access census tracts (Ver Ploeg 2010). Low-income census tracts are also expected to charge higher prices in that they have fewer chain retailers and supermarkets (Ver Ploeg 2009; Powell et al. 2007). Seasonal dummy variables are included in the price functions to account for price variation due to the seasonality of fruit production and demand. We also account for whether WIC was used as payment for fruit juice. Because the size, flavor, and brand that WIC participants can purchase are predetermined, these consumers likely do no not consider price when purchasing fruit juice. Finally, the dollar amount of coupons and store savings applied to fruit beverages are included, with the intuitive hypothesis that coupon usage and store savings are associated with lower prices.

Data

Data Set

The National Household Food Acquisition and Purchase Survey (FoodAPS) data set was used for the analysis in this study (2016a). Funded by the United States Department of Agriculture (USDA) Economic Research Service (ERS) and the Food and Nutrition Service (FNS), FoodAPS is a national survey of 4,826 households. Collected between April 2012 and January 2013, the FoodAPS dataset contains a record of each household's food at home (FAH) and food away from home (FAFH) acquisitions over a one-week period. Entry and exit surveys were administered to households in order to collect demographic and socioeconomic data. The FoodAPS dataset also contains supplemental data on the nutritional composition of all food items purchased, food acquisition characteristics, payment methods and product attributes.

During the one-week acquisition period, 1,852 households in the FoodAPS dataset purchased fruit beverages for at home consumption. These households made a total of 4,166 fruit beverage purchases, of which 42% were fruit juice, and 58% were fruit drink purchases. Fruit beverage items that had a price of zero and were not associated with coupons or store discounts were

removed from the dataset. Each fruit beverage item purchased was then classified as either 100% fruit juice or as a fruit drink based on the percentage of juice it contained and its sugar content. This resulted in a final sample size of 1,362 fruit juice and 1,832 fruit drink purchases.

Descriptive Statistics

Descriptive statistics for the fruit beverage prices and attributes are presented in Table 2. Comparing fruit juice to fruit drinks, we find that fruit juice is slightly more expensive, with an average price of $0.07 per ounce versus $0.06 per ounce for fruit drinks. Of particular interest to this study are the differences in the nutritional composition of fruit juice and fruit drinks. The descriptive statistics reveal that fruit juice has significantly higher levels of all key nutrients in comparison to fruit drinks. In particular, fruit juice contains approximately 500% more antioxidants, 400% more Calcium and Vitamin D, and 225% more Vitamin C than fruit drinks. Despite having different vitamin and mineral contents, fruit juice and fruit drinks contain similar amounts of sugar. On average, fruit juice and fruit drinks contain 10.24 and 11.63 grams of sugar per 100g serving respectively.

Putting these numbers into perspective, Figure 1 presents the percentage recommended daily value (%DV) of key nutrients provided by the fruit beverages in the data set (FDA 2013b). On average, an 8oz serving of fruit juice provides 115%, 7% and 6% of the %DV of Vitamin C, Calcium, and Vitamin D, and antioxidants, while fruit drinks provide 50%, 2% and 1% of the %DV respectively. Comparing sugar content, an 8oz serving of fruit juice contains 73% of the %DV, compared to 83% for fruit drinks.

In addition to nutrients, the descriptive statistics reveal key differences in the product attributes of fruit juice and drinks. The distribution of flavors varies significantly between fruit juice and fruit drink purchases. For fruit juice, orange is the top-selling flavor, followed by apple, mixed fruit, vegetable/other flavors, grape/other citrus, and berry. Mixed fruit is the top selling fruit drink flavor, followed by lemonade/other flavors, orange, berry, grape and apple/other citrus. These distributions are similar to those reported by Euromonitor (2015), suggesting that the fruit beverage purchases in the FoodAPS dataset are representative of all US fruit beverage acquisitions.

We also find that while the market share of the top five fruit juice and drink brands are similar, private label products comprise 21% of fruit juice purchases, but only 5% of fruit drink purchases. According to Abate and Peterson (2005), the narrow price difference between private label and branded juice drinks is a possible explanation for private label products' low market share in the fruit drink segment. Considering packaging, a greater share of fruit drinks are purchased in single serve and oversized packages, 22% and 13%, versus 13% and 11% for fruit juice. Conversely, a greater share of fruit juice purchases are in standard size packages, 45%, versus 33% for fruit drinks.

The characteristics of fruit beverage acquisitions also differ significantly between fruit juice and fruit drinks, with both regional and seasonal heterogeneity. Fruit drinks purchases are more prevalent in the Southern portion of the United States, while fruit juice purchases are more prominent in the Midwest. Where acquisitions are made also varies significantly by fruit

beverage type. While the shares of fruit drinks and juice purchased at supermarkets are similar, a greater share of fruit drink purchases are made at convenience retailers and discount stores, while a greater share of fruit juice purchases are made at club stores. We also find that fruit drink (fruit juice) purchases are more common in low-income (low-access) census tracts. Looking at payment type, 8% of fruit juice purchases were made using WIC benefits. While savings from coupons are comparable, store savings are, on average, 20% greater for fruit juice than fruit drinks.
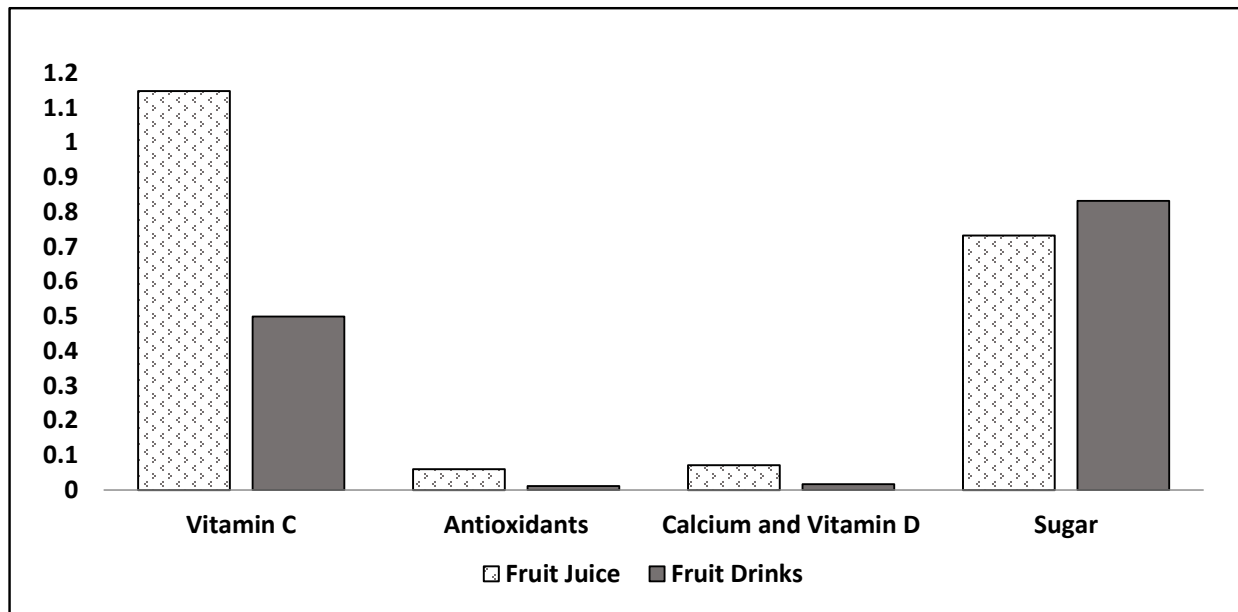
Figure 1. Percent daily value of key nutrients in fruit beverages based on a 2000 calorie diet

Results

Estimates of the log-linear fruit juice and fruit drink hedonic price equations are obtained using ordinary least squares regression techniques and are presented in Table 3. The estimated models explain a significant portion of the variation in fruit juice and fruit drink prices, with r-squared values of 0.64 and 0.62 respectively. Breush-Pagan test results suggest the presence of heteroskedasticity, thus we calculate White-Huber standard errors.

Nutrients

Of particular interest to this study, are the price premiums associated with nutrients and sugar in fruit beverages. The hedonic price estimates in Table 3 show that price premiums for nutrients and sugar vary between fruit juice, non-diet fruit drinks and diet fruit drinks.

Table 3. Fruit beverage hedonic price function estimates

Variable	Fruit Juice (N=1,362)		Fruit Drinks (N=1,832)	
	Coeff.	**SE**	**Coeff.**	**SE**
Nutrients				
Antioxidants	0.05*	0.03	0.01	0.04
Diet*Antioxidants	---	---	-0.36**	0.17
Vitamin C	2.20E-03***	6.33E-03	0.01***	1.32E-03
Diet*Vitamin C	---	---	-0.02**	0.01
Calcium and Vitamin D	4.95E-04**	2.20E-04	0.02***	0.01
Diet*Calcium and Vitamin D	---	---	-0.06***	0.03
Total Sugar	2.75E-04	6.33E-04	0.01***	3.06E-03
Diet*Total Sugar	---	---	-0.06**	0.03
Product Attributes				
Brand 1	0.07	0.06	-0.31***	0.04
Brand 2	0.25***	0.03	-0.08*	0.05
Brand 3	0.15***	0.03	0.39***	0.05
Brand 4	0.05	0.04	-0.01	0.04
Brand 5	0.29***	0.04	0.05	0.05
Private Label	-0.25***	0.03	-0.22***	0.04
Other Citrus	0.21***	0.05	0.10	0.07
Berry	0.18***	0.05	0.23***	0.05
Apple	-0.02	0.04	0.33***	0.13
Lemonade	---	---	0.24***	0.06
Mixed Fruit	0.04	0.04	0.20***	0.04
Vegetable	-0.42*	0.24	---	---
Grape	0.16***	0.06	0.05	0.09
Other Flavors	0.19***	0.07	0.01	0.05
Diet	---	---	1.43***	0.44
Organic	0.30***	0.07	0.86***	0.06
Packaging				
Oversized Package	-0.38***	0.04	-0.53***	0.04
Single Serve Package	0.67***	0.06	0.66***	0.06
Standard Size Package	-0.30***	0.04	-0.06*	0.04
Acquisition Attributes				
Low-Access Tract	9.03E-03	0.02	0.02	0.03
Low-Income Tract	-0.08***	0.02	-0.12***	0.02
Fall	0.04*	0.02	-0.02	0.03
Spring	0.12***	0.03	-0.06*	0.04
Winter	0.01	0.04	-0.12**	0.06
Midwest	-0.08**	0.03	-0.03	0.04
South	-0.06*	0.04	-0.06*	0.04
West	3.43E-03	0.04	0.02	0.04
WIC	0.12***	0.03	---	---
Convenience	0.26***	0.07	0.18	0.12
Club Store	-0.14	0.10	0.02	0.08
Discount Store	-0.42***	0.12	0.03	0.07
Supermarket	-4.20E-03	0.06	-0.01	0.05
Coupon Used	-0.52*	0.32	-0.10	0.09
Store Savings	-0.18***	0.02	-0.15***	0.04
Constant	-2.87***	0.07	-3.82***	0.07
R-Squared	**0.64**		**0.62**	

Note. *, ** and *** denote significance at the 10%, 5% and 1% level, SE refers to White Huber standard errors

Looking first at fruit juice, we find that all nutrients garner a price premium. Adding an additional mg of antioxidants (Vitamin C) to fruit juice leads to a 5% (0.01%) increase in the price per ounce. For a standard 60oz container, this corresponds to a $0.21 and $0.01 premium for an additional mg of antioxidants and Vitamin C respectively. While Calcium/Vitamin D also garners a price premium, the premium itself is extremely small. Adding an additional mg of Calcium/Vitamin D increases the per ounce price of fruit juice by just 0.0005%, or a $0.002 premium for the standard 60oz container. These price premiums for nutrients in fruit juice likely reflect both manufacturers' costs and consumers' willingness-to-pay. For manufacturers, fortifying fruit juice with vitamins and minerals leads to increased production costs. On the demand side, consumers may pay a premium for fruit juice containing more nutrients given their positive health benefits. Unlike nutrients, sugar is not associated with a price premium in fruit juice. This finding is likely the result of the fact that manufacturers do not incur the cost of adding sugar to fruit juice, as juice naturally contains large amounts of sugar (O'Neil and Nicklas 2008). Consumers may also pay a premium price for fruit juice containing more sugar given the growing public concern over the adverse health effects of sugar consumption.

Unlike fruit juice, an additional gram of sugar is associated with a 1% price premium for non-diet fruit drinks. For the standard 60oz container, this corresponds to $0.04 for each additional gram of sugar. This premium is partly attributable to the added costs manufacturers face when adding sugar to non-diet fruit drinks. On the demand side, consumers that prefer the taste of sweeter drinks may also pay a premium for non-diet fruit drinks containing additional sugar.

Also differing from fruit juice, only select nutrients garner price premiums in non-diet fruit drinks; Vitamin C and Calcium/Vitamin D are associated with a price premium, while antioxidants are not. Adding an additional mg of Vitamin C (Calcium/Vitamin D) to a non-diet fruit drink leads to a 1% (2%) increase in the price per ounce. For the standard 60oz container, this corresponds to a $0.04 and $0.07 premium for Vitamin C and Calcium/Vitamin D respectively. As with fruit juice, these premiums likely reflect the costs incurred by manufacturers to fortify the fruit drinks with nutrients, as well as consumers' willingness to pay for nutrients given their positive health benefits. However, the price premiums for Vitamin C and Calcium/Vitamin D in non-diet fruit drinks are larger than those for fruit juice. One plausible explanation for this difference is the fact that fruit drinks contain less naturally occurring nutrients than fruit juice. (Harris et al. 2011; Empty 2015). Thus, to achieve the same level of nutrients, non-diet fruit drink manufacturers must incur higher fortification costs than fruit juice manufacturers.

Differing from both non-diet fruit drinks and fruit juice, nutrients and sugar in diet fruit drinks are associated with negative price premiums. An additional mg of antioxidants, Vitamin C and Calcium/Vitamin D leads to a 35%, 1% and 4% decrease in the price per ounce respectively. For the standard 60oz container, this corresponds to a $1.26, $0.04 and $0.14 discount for an additional mg of antioxidants, Vitamin C and Calcium/Vitamin D. Similarly, an additional gram of sugar leads to a 5% decrease in the price per ounce for diet fruit drinks or a $0.18 discount for the standard 60oz container. Given that manufacturers still incur additional costs when adding nutrients and sugar to diet fruit drinks, these negative price premiums suggest that diet fruit drink consumers pay a premium to reduce nutrients and sugar. Given the nature of diet fruit drinks, consumers intuitively seek to reduce to nutrients and sugar in diet fruit drinks in order to reduce

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the fruit beverages' caloric content; by reducing the nutrient and sugar content of a diet fruit drink, one also decreases the calories in the drink.

Based on these results, three main generalizations are made about the price premiums for nutrients and sugar in fruit beverages:

1. All nutrients garner premium prices in fruit juice

2. Sugar and select nutrients garner premium prices in non-diet fruit drinks

3. All nutrients and sugar are associated with negative price premiums in diet fruit drinks

Product Attributes

In addition to nutrients, several product attributes also garner price premiums in fruit beverages. As found by Szathvary and Trestini (2014), nearly all of the top fruit juice and fruit drink brands garner a price premium, ranging from 15% to 39%. However, fruit drink Brands 1 and 2 have negative coefficients, suggesting that these are discount or value brands. Unlike branded products, private label fruit beverage products are associated with a negative price premium. Relative to branded products, private label fruit juice, and fruit drink products cost 25% and 22% less per ounce respectively. The hedonic price equations also highlight flavors' effect on fruit beverage prices. Relative to orange juice, berry, grape, other citrus and other flavors garner price premiums ranging from 16% to 21%. Conversely, vegetable flavored juice is shown to cost 42% less per ounce than orange juice. Considering fruit drinks, nearly all flavors are associated with higher prices than orange flavored drinks, with price premiums ranging from 20% for mixed fruit to 33% for apple flavored drinks.

The estimation results also indicate that organic and diet fruit beverages are associated with significant price premiums. Compared to non-organic fruit beverages, organic fruit juice, and fruit drinks price is 30% and 86% higher per ounce respectively. This finding is comparable to that of Szathvary and Trestini (2014), who found a 48% price premium for organic fruit beverages sold in Australia. Diet fruit drinks also garner a substantial price premium, with prices 143% higher than those of non-diet fruit drinks.

Packaging

Similar to the findings of Fox and Melser (2014) for soft drinks, we find that fruit beverages sold in single serve packages are associated with higher prices, relative to other package types. Single serve packages garner 67% and 60% price premiums for fruit juice and fruit drinks respectively. Also mirroring the results of Fox and Melser (2014), we find that fruit beverages sold in standard sized and oversized packages are associated with lower per ounce prices than other package types. This negative price premium is greater for oversized packages than for standard sized packages, with oversized packages priced 38% (53%) less per ounce for fruit juice (drinks) and standard sized packages priced 30% (6%) less per ounce respectively.

Acquisition Attributes

Several attributes of the acquisition event also affect the price of fruit beverages. The estimation results indicate there is both seasonal and regional variation in fruit juice and fruit drink prices. Further, while fruit drinks prices appear to be similar across retailer types, the type of store fruit juice is purchased at has a significant impact on its price. Relative to grocery stores, fruit juice prices are 26% higher at convenience retailers and 42% less at discount retailers.

Further, the estimation results confirm that store savings and coupon usage are associated with lower prices for fruit beverages. When store savings are applied to an item, prices decrease by 18% and 15% for fruit juice and fruit drinks. Similarly, fruit juice prices decrease by 52% when a coupon is used; for fruit drinks, the coefficient for coupon usage is negative but not significant. The hedonic price equation estimates further indicate a 12% price premium for fruit juice purchased using WIC benefits. This finding supports this studies hypothesis that because size, flavor, and brand that WIC participants can purchase are predetermined, WIC consumers likely do not consider price when purchasing fruit juice.

Dummy variables for acquisitions made in low-income census tracts also significantly affect fruit beverage prices. Low-income census tracts are associated with fruit juice and fruit drink prices 8% and 12% less than those in non-low-income census tracts. This is likely attributable to retailers charging lower prices in low-income areas where households have less disposable income.

Conclusions

Given the increased importance consumers and manufacturers have placed on the functional nutrients found in fruit beverages, as well as the changing federal guidelines on fruit beverage consumption, this study sought to determine whether specific nutrients garner price premiums in fruit beverages sold in the US. Using the National Household Food Acquisition and Purchase Survey, hedonic price models for fruit juice and fruit drinks are estimated to determine whether specific nutrients, product characteristics, packaging type and acquisition characteristics are associated with price premiums. Based on the results from the hedonic price models, three generalizations are made about the price premiums for nutrients and sugar in fruit beverages: (1) all nutrients garner premium prices in fruit juice, (2) sugar and select nutrients garner price premiums in non-diet fruit drinks and (3) all nutrients and sugar are associated with negative price premiums in diet fruit drinks. Findings further suggest that product attributes such as brand, flavor, organic labels, diet labels and package type, and acquisition characteristics such as store type, region, season and payment type are associated with price premiums in fruit beverages.

This study's price premium estimates for nutrients can provide valuable insight to fruit beverage manufacturers, particularly in their design of future marketing initiatives and new product development. Given the growing concern over the healthfulness of fruit beverages in recent years, manufacturers are employing marketing tools such as front-of-package labels and advertisements to emphasize the nutrients found in fruit beverages. Estimates of price premiums for these nutrients can help fruit beverage manufacturers determine which specific nutrients to emphasize in these marketing initiatives. Assuming that the marginal costs of different nutrients are similar, fruit beverage manufacturers should emphasize the nutrients that garner the largest

price premium. Results from this study suggest that fruit juice marketing initiatives should focus on antioxidants, while non-diet drink marketing efforts should emphasize Vitamin C and Calcium/Vitamin D. For diet fruit drinks, all nutrients are associated with a negative price premium, suggesting that marketing efforts should focus on calorie content instead of nutrient content.

Estimates of price premiums for nutrients can also help guide fruit beverage manufacturers in new product development. In developing a new fruit beverage product, manufacturers must determine whether or not to fortify the product with nutrients and, in the case of fortification, which specific nutrients should be used. Negative price premium estimates suggest that fortification will not lead to increased returns for diet fruit drink manufacturers. However, positive price premium estimates from this study suggest that fruit beverage manufacturers should consider fortifying fruit juice and non-diet fruit drinks with certain nutrients. Fruit juice and non-diet fruit drink manufacturers can compare the price premiums for specific nutrients estimated in this study to their marginal costs of fortification to determine which specific nutrients to use in fortifying their product.

Acknowledgement

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Appendix

Table A1. Percent of the daily value of nutrients in eight ounces of assorted fruit juices. Based on a 2,000 calorie diet.

Nutrient	Apple Juice	Cranberry Juice Cocktail	Grape Juice (Purple)	Grapefruit Juice (White)	Orange Juice	Pineapple Juice	Prune Juice
Energy, kcal	6%	7%	8%	5%	5%	7%	9%
Protein, g	0%	0%	3%	2%	3%	3%	3%
Total sugars, g	76%	94%	119%	49%	63%	109%	109%
Dietary fiber, g	1%	0%	0%	1%	3%	2%	10%
Total fat, g	0%	0%	0%	0%	1%	0%	0%
Vitamin A, RAE	0%	0%	0%	4%	1%	0%	0%
Vitamin E, mg	0%	3%	0%	1%	2%	0%	2%
Vitamin C, mg	4%	100%	0%	156%	143%	42%	18%
Calcium, mg	2%	1%	0%	2%	2%	3%	3%
Phosphorous, mg	2%	0%	3%	4%	4%	2%	6%
Magnesium, mg	2%	1%	6%	8%	7%	8%	9%
Iron, mg	5%	1%	3%	3%	6%	4%	17%
Sodium, mg	0%	0%	0%	0%	0%	0%	0%
Potassium, mg	8%	1%	10%	11%	12%	9%	20%

Sources. O'Neil & Nicklas (2008); FDA (2013b)

Consumer Expectations Regarding Sustainable Food: Insights from Developed and Emerging Markets

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Abstract

This study advances marketers' knowledge about consumer expectations regarding sustainable food in both industrialized (Germany, United States, Switzerland) and emerging economies (Brazil, China, India). Data was obtained through an online consumer survey of 1,179 respondents. Findings show that consumer expectations regarding sustainable food consist of five factors: ethic attributes, naturalness, health-related aspects, terroir, and innovation.

International agri-business marketers can use the outcomes of this study to design well-tailored communication strategies promoting sustainable food. Scholars can build upon the resulting multi-country sustainability scale to reach a less western-biased understanding of consumer expectations of sustainable food in emerging economies.

Keywords: sustainable food; consumer expectations; international marketing; multi-group comparison; invariance analysis

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Introduction

The sustainability of food production and consumption is an issue of growing importance. Many conventional methods of food production and consumption are contributing to the environmental, ethical, and social problems seen around the world (Garnett 2013; Reisch et al. 2013; Verain et al. 2015). This is especially a concern for the agri-food sector and consequently attempts are being made to improve the environmental and/or ethical/social situation along the food supply chain through certification, labelling, and other differentiating strategies which is creating specific markets under the notion of sustainability (Abeliotis et al. 2010; Aikin 2011 and 2014; De Haen and Requillart 2014; Verain et al. 2012).

Because there is no binding definition for the term "sustainable food", the perception of what constitutes sustainable food is thus open to a large variety of interpretations influenced by a multitude of different factors such as culture, values, motives, and the economic or environmental situations (De Carvalho et al. 2015; Grunert et al. 2014; Sautron et al. 2015).

On one hand, there is not a comprehensive scheme for sustainable food—on the other, food labels focusing on single (e.g., environmental or ethical) sustainability attributes are proliferating the marketplace showing the contemporary relevance of sustainability differentiation in the global food sector (Codron et al. 2005, Franz et al. 2010; Grolleau and Caswell 2006, Jahn et al. 2005).

Consequently, adequate and effective communication and differentiation strategies for food products regarding their sustainable contributions become crucial.

This exploratory study, therefore, aims at giving international agri-food market actors better insights into what consumers in industrialized and emerging economies expect from sustainable food. The study uses a unique dataset collected in 2013 from an online consumer survey (N=1,179) in three industrialized (Germany, Switzerland, the United States) and three emerging countries (Brazil, China, India).

Sustainable Food Consumption

Sustainability is increasingly recognized as a major issue for most economies, but especially in the agri-food sector, it has become an important differentiation and communication topic (Codron et al. 2005; Grunert 2011; Reisch et al. 2013, Verain et al. 2012, Vermeier and Verbeke 2006). There is a great number of attributes that enable product differentiation with regard to sustainable food, and that can help agri-food businesses increase the value of commodities (Codron et al. 2005, Dosi and Moretto 2001; McEachern and McClean 2002). Moreover, demonstrated environmental, social and/or ethical responsibility can actively foster a positive corporate image (Carlson et al. 1996; Morris et al. 1995).

Presently, there is, however, no exact shared definition of sustainability. Equally, there is no standard approach for the concept of sustainable food (Johnston et al. 2007; Reisch 2011). Looking at food production, there are, however, already quite a few products that are marketed as more sustainable than others due to their specific attributes such as environmental or ethical aspects. As these are credence attributes, they have to be certified and labeled to enable

consumers to identify them (Caswell and Padberg 1992; Jahn et al. 2005). Until today there is no general sustainable food label available, but certification schemes that focus on environmental, social and/or ethical aspects of food production like eco, organic or fair trade. These market niches are vividly growing over the years (Fair Trade 2013; Sahota 2013). Consumers tend to associate this kind of more sustainable food products with health benefits, environmental benefits or increased fairness towards food producers (von Meyer-Höfer et al. 2015). As concerns about this kind of consumption issues rise globally, products with respective attributes are increasingly in demand (BBMG, GlobeScan and SustainAbility 2012; National Geographic and GlobeScan 2012; SustainAbility and GlobeScan 2012).

Globalization facilitates and accelerates the exchange of information, goods and people across national boundaries and leads to the emergence of increasingly global consumer markets. Thus, besides commonly known global segments for luxury goods, fashion and music there are also global segments for sustainability concerned consumers especially among the growing well-educated middle classes (Craig and Douglas 2006; Court and Narasimahan 2010; Douglas and Craig 2011; Miller 1998; Shermach 1995).

Although sustainable food consumption is gaining importance around the world (Nash 2009), research on the subject is still quite fragmented (Grunert et al. 2014). Most studies analyze single aspects of sustainable food consumption and often concentrate on environmental sustainability. With regard to environment-friendly consumption as well as to the consumption of organically grown food products a well-established body of literature on sustainability exists (Aertsens et al. 2009; Honkanen et al. 2006; Loureiro et al. 2001; Roberts 1996). This is true, despite the criticism of conventionalization raised by a growing number of scholars against the organic sector (for an overview of the conventionalization debate see Best 2008). Fewer studies look at ethical aspects of consumption such as fair trade (Adams and Raisborough 2010; McCluskey et al. 2009) or animal welfare (Honkanen and Olsen 2009; Lagerkvist and Hess 2011). In this context, the analyses of Sautron et al. (2015) and de Cavalho et al. (2015) are among the few studies that include a concern for sustainability as a stand-alone concept. For instance, whilst Sautron et al. (2015) include sustainability concerns among several food choice motives, de Cavalho et al. (2015) focus their work on sustainability consciousness in food consumption and propose to treat sustainability as a five-dimension construct. All in all, most of the revised studies are conducted only in single countries or on single continents with a strong emphasis on industrialized countries (Grunert et al. 2014). This leads to problems in the comparability of studies and their generalizability

Against this background, the major contribution of this study is to provide a scientific basis for advancing agri-food business managers' knowledge concerning consumers' expectations regarding sustainable food as such not only for a specific product in both industrialized and emerging economies. To this end, the study design consists of three industrialized (the United States, Germany, and Switzerland) and three emerging countries (China, India, and Brazil).

The decision to also include emerging economies is due to the fact that although scarce, the literature on sustainable food consumption in emerging countries gives insights into a steady increase in production and consumption of sustainable food products there. It seems that this trend is particularly strong in the urban centers of Latin American (Brazil) and Asian (China or

India) countries (Eguillor Recabarren 2009; Flores 2013; Garibay and Ugas 2009; Kung Wai 2013; FLO Fairtrade International 2013; von Meyer-Höfer and Spiller 2013).

However, it seems that consumers' associations with sustainability and their expectations towards sustainable food differ between emerging economies and industrialized countries due to the different cultures and stages of economic development.

This requires an improved understanding of the differences in consumers' expectations. To our best knowledge, no study has so far analyzed consumer expectations towards sustainable food as such simultaneously in several emerging and industrialized countries.

Sustainability Attributes and Tested Items

For the communication of sustainable food, it is important to get to know consumers' expectations regarding sustainable food on a broad and global scale. Which attributes have to be communicated when offering sustainable food products? Do consumers from developed and emerging countries have the same expectations regarding sustainable food? These are the overarching research questions to be addressed in the present study. This is why this study does not focus on a specific product or single country but on food products in general and in several countries with different cultures as well as economic, social and environmental situations.

Table 1 shows the items that have been chosen to be tested in this study after an extensive literature review during the year 2012. At that time there was no commonly agreed definition of sustainable food available, but many different approaches (e.g., Sustainable Development Commission 2005; Reisch 2011; Reisch et al. 2013). Additionally, there were international certification schemes and labels for food marketed as more sustainable like eco, organic, fair trade or animal welfare labels. Putting the different available sustainability attributes and standards together sustainable food should at least comply with the following criteria: respect for biophysical and environmental limits in both production and processing, observable high standards of animal health and welfare, affordability of food for all, support for rural economies and the diversity of rural culture, viable livelihood for farmers, a safe and hygienic work environment for farmers and employees whether nationally or abroad. Moreover, as sustainable food is marketed mostly in premium niche markets, it is clear that it complies with the usual quality criteria for food such as safety, health, taste, freshness, etc. Keeping in mind that the different aspects of sustainable food were tested in a consumer study the list includes the most comprehensive items which were pre-tested in each country.

To provide a comprehensive presentation of the tested items, they are divided into sub-groups including environmental and ethical sustainability attributes, health aspects, traditional food attributes and terroir. The division of the twenty-four tested variables shown in Table 1 is by no means exclusive, but an attempt to make the huge variety of attributes more comprehensible. "no genetically modified organisms (GMO)", for example, is certainly an attribute used to differentiate sustainable food from conventional food, whether it is motivated from an environmental perspective or from a health perspective.

Table 1. Sustainability items grouped according to differentiating aspects

Sub-groups	Tested Items
Environmental attributes	Environmentally friendly production Environmentally friendly packaging Reducing greenhouse gas (GHG) emissions Free from synthetic fertilizer Free from chemical pesticides
Ethical attributes	Ensuring high animal welfare Ensuring fair prices for producers Ensuring good working and living conditions for food producers Produced without child labor
Health aspects	Health benefits Free from genetically modified organisms (GMO) Natural Safe No artificial additives
Traditional food quality attributes	Good taste Fresh High nutritional value Following current trends Innovative Convenient
Terroir	Seasonal production Local production Traditional

Source. Author's own compilation 2015

The sub-group of environmentally friendly attributes includes most of the basic criteria required for organic products. They represent the worldwide best known alternative food products which aim at sustaining the environment and natural resources. Among the organic production criteria, as for example defined in EU regulation 834/2007 for organic regulation, are no use of chemical pesticides, no use of synthetic fertilizers, no use of GMO and high animal welfare. Moreover, more general aspects of environmentally friendly food production are also included in this list like, e.g., environmentally friendly packaging, which is required by a number of eco-labels (e.g., EU-Eco-Label) and climate saving aspects such as reducing greenhouse gas emissions.

The group of ethical attributes summarizes fairness aspects such as those required for fair trade certification programs like good working and living conditions, fair prices for producers, and no child labor, but it also contains ethical aspects such as animal welfare.

The group of health aspects summarizes the items healthy, no use of GMO, naturalness, no artificial additives as well as safety, which play an important role in the sustainability of food consumption (Reisch et al. 2013; Sautron et al. 2015).

The category of traditional quality criteria comprises the most common food differentiation aspects, such as taste, freshness, nutritional value (high), the level of innovation and convenience (Sautron et al. 2015). These attributes traditionally influence the strategic positioning of food and can be easily identified by the consumer (Antle 2001; Darby and Karni 1973; Nelson 1970). Price is, in general, one of the most important food choice motives (Blaylock et al. 1999; Eertmans et al. 2005; Lindeman and Vaananen 2000; Steptoe et al. 1995). It has thus also an important (most often negative) impact on sustainable food consumption, because of the higher prices of sustainable food compared to conventional alternatives (Grunert et al. 2014).

Terroir is a category that emerges in several studies concerning sustainable food and relates to the cultural and geographical factors that characterize foods and agricultural products. The linkage between terroir and sustainability seems to be a prerequisite for the successful formation of territorialized food clusters (Sidali and Hemmerling 2014; Lee and Wall 2012). It contains the items "seasonal production", "local production" and "tradition".

Six countries, three industrialized and three emerging, were selected for data collection. Among the industrialized countries of the world, the United States of America, Germany and Switzerland were chosen. They represent leading markets for sustainable food products, in terms of production and consumption of for instance organic food (Sahota 2013) or fair trade products (Fair Trade 2013). They also belong to the two continents that are among the economically most developed in the world. The chosen emerging countries belong to the so-called BRIC-nations (Brazil, Russia, India, China), which represent the location of the majority of the global population, land area and economic growth (O'Neill 2001). By the selection of the countries, a variation of different cultural, economic, social and environmental situations is represented in the sample.

Data Collection

Data for this exploratory study were collected by an online consumer survey conducted during July and August 2013 in three industrialized (Germany, the United States of America, Switzerland) and three emerging countries (Brazil, China, India). The total number of respondents is 1,719 (N: GE= 288 CH=282; USA=290; BR=285; CN=295; IN=279). A private marketing research panel provider recruited the participants. Only consumers who stated to be responsible for the majority of food shopping in their household took part in the survey.

The question asked to the respondent was: Which characteristics should a sustainable food product have? The 24 items displayed in Table 1 were then shown to the respondents in randomized order. The answer options ranged on a seven-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = somewhat disagree; 4 = neither agree nor disagree; 5 = somewhat agree 6 = agree; 7 = strongly agree).

The questionnaire was originally designed in English. To ensure the quality of the translation, native speakers performed a back-translation, before the questionnaires were pre-tested in each country. In the USA and India, the survey was done in English. In Germany and Switzerland a

German version was used; additionally, French-speaking Swiss could choose a French version. In Brazil, the questionnaire was Portuguese and in China Mandarin.

Regarding the panel survey, the panel providers sent the survey link to the panel participants, allowing them to respond to the questionnaire at any time with Internet access. The statements of the respondents were saved online and converted into SPSS files for the analysis. The average time spent answering the questionnaire was between fourteen minutes in the USA and twenty in India.

The main reason for conducting an online survey was that this method means that data collection is not regionally restricted based on the mobility of the interviewer. Further advantages are lower costs and quicker response times compared to other survey methods (Weber and Bradley 2006). In industrialized countries, online consumer surveys have become quite common in marketing research, but also in emerging and developing countries more and more online surveys are conducted with the help of private marketing research panel providers.

Table 2 gives an overview of the gender distribution and education level of the samples from analyzed countries. Surprisingly, the samples found a majority of responders to be men in some countries, which might be due to the fact that single men are more often registered in private marketing panels than women in these countries.

Table 2. Sample characteristics

	CH-F	CH-GER	GER	USA	BR	CN	IN
N	130	152	288	290	285	295	279
Female (%)	48.5	47.4	56.6	68.3	44.9	41.4	29.0
Male (%)	51.5	52.6	43.4	31.7	55.1	58.6	71.0
University degree completed (%)	25.4	16.4	22.2	43.8	47.7	88.8	90.0

CH-F= French-speaking Switzerland, CH-G= German-speaking Switzerland, GER= Germany, USA= United States of America; BR= Brazil; CN= China; IN= India
Source. Own data 2013

The total sample of 1,179 respondents (around 300 per country) is not representative enough to make general conclusions because the sample is biased towards higher educated participants with higher incomes from urban centers compared to the averages of the analyzed countries. However, it is known that, socio-demographic characteristics often have only mixed effects on the consumption of sustainable food in industrialized countries (Dagevos 2005; Diamantopoulos et al. 2003; Dickson 2001; Doran 2009; Gil et al. 2000; Jain and Kaur 2006; Loureiro and Lotade 2005; Verain et al. 2012). In the context of emerging and developing countries, studies show that richer and better-educated consumers often have a significantly higher willingness to pay for food safety and quality which is often associated with sustainability aspects (Gonzalez et al. 2009; Krishna and Qaim 2008; Liu et al. 2009; Mergenthaler et al. 2009; Padilla-Bravo et al. 2007; von Meyer-Höfer et al. 2015). Hence, it is likely that the biased samples may still represent the potential target groups for sustainable food quite well. Following this line of argumentation and as displayed by the invariance analyses in the remainder of this article, the six

samples are comparable among each other. However, the implications and conclusions of this explorative should be interpreted in the light of the biases.

Data Analysis

As mentioned before, the aim of this study is to analyze whether consumers' expectations regarding sustainable food differ among industrialized and emerging economies . This raises the necessity to assess the cross-cultural comparability of the tested items (Brunsø et al. 1996) in order to establish to what extent the tested sustainability attributes are equally understood across the six different countries. These differ in their levels of economic development, environmental and social situation, culture and language. Thus, as stated by Davidov et al. (2008), if groups are not equivalent, like in the absence of invariance, interpretations of between-group comparisons are problematic because it could lead to erroneous conclusions (Davidov and De Beuckelaer 2010).

In their seminal article, Steenkamp and Baumgartner (1998) address the importance of establishing a method to compare groups by identifying three levels of equivalence, e.g., configural, metric and scalar invariance.

Configural equivalence is the weakest form of comparability and it means that "the matrix of loadings in two samples has the same pattern, e.g., the same non-zero elements" (Brunsø et al. 1996, 25). Furthermore, Davidov et al. (2008) point out that configural invariance is supported if a multiple-group model fits the data well, all item loadings are significant, and the correlations between the factors are less than one in all groups. The assessment of configural equivalence is a pre-requisite for the further analysis of metric invariance.

The latter is established whenever individual surveys have identical factor loadings across groups (Davidov and De Beuckelaer 2010). Since cross-cultural research is based on different sets of cognitive categories, which are translated from one culture to another (Brunsø et al. 1996), survey instruments should display metric equivalence across groups (Davidov and De Beuckelaer 2010). The assessment of metric equivalence reveals that individuals who belong to different cultural and/or linguistic groups perceive survey items in the same way. As stated by Davidov and De Beuckelaer (2010) metric equivalence is supported "if the model fits the data well and does not result in a significant reduction of fit when compared with a model that does not set any measurement parameters to be equivalent across groups" (Davidov and De Beuckelaer 2010, 5).

Whenever intercepts of like items regressions on the latent variables are equal across groups, scalar invariance can be established (Davidov et al. 2008). Scalar invariance is also referred to as "strong cultural identity because the only way in which the samples can differ is in the level of endorsement of the various items, while everything else – their complete meaning structure, including item reliability – is the same" (Brunsø et al. 1996, 26). After having compared the findings of different scholars, Davidov and De Beuckelaer (2010) found out that full scalar invariance is almost never supported. Hence, they suggest testing for partial equivalence across those groups that are culturally or linguistically similar. Since multiple group confirmatory factor analysis (MGCFA) is a well-established technique to measure invariance (Jöreskog 1971), in the

following, we present the results of several confirmatory factor analyses (CFAs) that have been conducted both for single countries as well as at aggregate levels.

Results

Before testing for different levels of invariance, several exploratory factor analyses (EFA) were calculated (data are anytime available upon request to the authors). Based upon these, the confirmatory factor analysis (CFA) model for each of the six countries was estimated as suggested by different authors (e.g., Byrne 2013; Davidov and De Beuckelaer 2010). This model contains five latent variables: Ethical attributes (F1); Naturalness (F2); Health-related attributes (F3); Terroir (F4) and Innovation (F5). In total, six variance-covariance matrices were used as inputs for the models. All models were estimated using AMOS 21.0 software program and the maximum likelihood (ML).

Results of the CFAs in each country employing second-generation tests (Homburg and Giering 1996) showed that it was not possible to identify all of the items tested in the previous exploratory factor analyses. Five items were problematic in almost all countries thus displaying item reliability value less than 0.4. This led to the deletion of three items: no child labor; traditional; natural; cheap and convenient. After this step, the model was run again at single country level. All models displayed satisfactory RMSEA but CFI-values below 0.90. Since model fit criteria do not provide an adequate indication of the size of the misspecification in the model the modification indices as suggested by Saris, Satorra and van der Veld (1987) were applied. The observation of these values in combination with the expected parameter change pointed to a substantial model misspecification, namely a large error covariance between the item fair payment for producers and the item fair working and living conditions for producers. Clearly, these two statements are related to fair treatment of producers both from a financial and from an ethical point of view. Given this overlapping, an error covariance between the two items was added. Next, the model was run again reaching satisfactory model fit values (see also Appendix).

Then the configural, metric and scalar equivalence were calculated. Table 3 presents the fit indices of the different equivalence models. Model 1 is the basic configural invariant model with six countries. The indices reveal a good fit to the data (CFI = .929, RMSEA = .029, P close = 1.000; AIC = 2804.810; BCC = 2877.761, Chi-square = 2038.810, degrees of freedom = 871), which means that configural invariance is supported in this model, and that the model pattern can be considered equivalent across the six countries.

Next, metric invariance was checked. As mentioned above, this test answers the question to what extent the tested items are related to the items across countries. As stated by Davidov (2008), this is a necessary condition to guarantee that people understand the questions equally across the six groups of countries. To test for metric invariance the same configural invariance model was used as a departing point, and a fully invariant model where all loadings were fixed equal across the groups of countries was built (Model 2) (Davidov et al. 2008). The indices reveal a good fit to the data (CFI = .918, RMSEA = .031, P close = 1.000; AIC = 2927.100; BCC = 2986.718, Chi-square = 2301.100, degrees of freedom = 941), which means that metric invariance is supported as well.

Finally, scalar invariance was tested. This allows for the comparison of factor means in addition to the factor loadings between the items and the factors. To test scalar invariance, the intercepts of the items should be a constraint to be equal across the six countries. The fit indices are presented in Model 3 in Table 3 and suggest that this model does not hold a good fit. In fact, only P close (= 1.000) and RMSEA (= .039) are indicative of a good fit.

As already shown, whilst factor items are comparable across all six countries, factor means are only comparable between the USA, Germany, and Switzerland. In the next and final step measurement error variances were calculated. Normally these parameters are rarely constrained equally across groups as this "is considered to be an excessively stringent test of multigroup invariance" (Byrne 2013, p. 220). However, this parameterization is considered important to test for the equality of reliability related to the assessment of scales (Byrne 2013). The last row of Table 3 shows that when constrained to be equals, measurement error variances display satisfactory fit indices (CFI = .926, RMSEA = .042, P-CLOSE = 1.000, AIC = 1368.173, BCC = 1397.165, Chi Square = 1116.173, DF = 501), which can lead to the validation of the tested sustainability scale across the USA, Germany and Switzerland.

Table 3. Fit measures of a multi-group confirmatory factor analysis

	CFI	RMSEA	PCLOSE	AIC	BCC	Chi-Square	df
Models							
1 Configural invariance	.929	.029	1.000	2804.810	2877.761	2038.810	871
2 Metric invariance	.918	.031	1.000	2927.100	2986.718	2301.100	941
3 Scalar invariance	.852	.039	1.000	3925.982	3967.506	3489.982	1036
4.1 Partial scalar invariance (Germany, Switzerland, USA)	.916	.045	.996	1446.558	1476.011	1190.558	499
4.2 Partial scalar invariance (Brazil, China, India)	.893	.047	.954	1526.377	1543.938	1280.377	444
Item Reliability							
5. Equivalence of measurement residuals (Germany, Switzerland, USA)	.926	.042	1.000	1368.173	1397.165	1116.173	501

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; PCLOSE = probability of close fit; AIC = Akaike information criterion; BCC = the Browne Cudeck criterion; df = degrees of freedom.
Source. Own data 2015

As a consequence, one can conclude that the tested items do not meet the scalar invariance test across the six countries as a whole. Hence, factor means are not comparable across the set of six countries. However, it may still be possible to compare the sustainability-related means across a smaller set of (more homogeneous) countries. Table 3 shows that when tested for scalar invariance among countries with a same economic development level as well as more equal culture fit indices satisfy cut off criteria for Germany, Switzerland and the USA (CFI = .916, RMSEA = .045, P-CLOSE = .996, AIC = 1446.558, BCC = 1476.011, Chi Square = 1190.558, DF = 499). This does

not apply to the set of tested emerging countries: Brazil, China and India (CFI = .893, RMSEA = .047, P-CLOSE = .954, AIC = 1526.377, BCC = 1543.938, Chi Square = 1280.377, DF = 444).

There are important similarities as well as differences among the six countries. To address them the unstandardized estimates are considered as suggested by Davidov and Schmid (2010). Table 4 compares them among countries (Also see the Appendix).

Table 4. Cross-country comparison of unstandardized estimates

Sustainability Factor	Item	Item code	CH	GER	USA	BR	CN	IN
F 1 **Ethical Attributes**	Ensuring animal welfare	V_166	.70	.49	.91	.57	.66	.66
	Ensuring fair payment of producers	V_208	.92	.88	.97	1.07	.60	.91
	Ensuring good working and living conditions for producers	V_209	.82	.95	1.07	1.01	.71	.75
	Environmentally friendly production	V_210	1.00	1.07	1.10	1.06	.67	.84
	Environmentally friendly packaging	V_211	1.02	1.11	1.11	1.14	.75	.95
	Reducing greenhouse gas emissions	V_212	1.15	1.09	1.15	1.09	.79	.86
F 2 **Naturalness**	Free from GMO	V_261	1.10	.69	1.50	.51	.40	.54
	Free from chemical pesticides	V_268	.93	.92	.90	1.20	.98	.97
	Free from synthetic fertilizers	V_269	1.02	1.21	1.05	1.37	1.06	.85
	Free from artificial additives	V_270	.95	1.05	.72	1.18	1.25	1.06
F 3 **Health-related attributes**	Good taste	V_266	.33	.34	.64	.71	.21	.28
	Safe	V_267	1.29	1.06	.87	.98	1.01	1.38
	Fresh	V_271	.95	1.06	.96	.82	1.15	1.15
	Health benefits	V_162	1.47	1.55	.97	.80	1.15	1.49
	High nutritional value	V_163	1.46	1.44	.98	.88	1.10	1.41
F4 Terroir	Seasonal production	V_164	.83	.86	.71	.83	.66	.66
	Local production	V_165	.97	.94	1.09	1.19	1.18	1.18
F 5 Innovation	Following current trends	V_213	.75	.51	.90	1.42	1.04	.92
	Innovative	V_263	1.75	2.06	1.19	.87	.82	.88

The observation of the factor loadings of the items related to the first factor: ethical attributes, gives evidence that with the exception of China the items related to environmentally friendly production (v_210) and environmentally friendly packaging (v_211) constantly score higher than the item related to fair working and living conditions of producers (v_209). Apparently, consumers are more likely to expect environment-related aspects rather than human

empowerment with regard to sustainable food. As already mentioned, China is an exception, which contrasts the findings of Gommersall and Wang (2012).

Another important similarity among all countries is the high loading values of items related to freshness (v_271) and healthy (v_162) or nutritive impacts of food (v_163) with the highest scores among Germany and Switzerland and India, followed by China, the United States, and Brazil. Thus, likewise it happens in Western countries, freshness seems to be a good proxy for sustainable food due to its close linkages to healthiness and safety. Also, the item related to innovative food (v_263) performs quite well among the countries: Germany is placed first, with a loading score of 2.06, followed by Switzerland, the United States, India, Brazil, and China.

Discussion of Results

In the proposed analysis consumer expectations towards sustainable food are examined across three industrialized (Germany, the United States, Switzerland) and three emerging countries (Brazil, China, India).

The five dimensions (ethic attributes; naturalness; health-related aspects; terroir; innovation) identified by the exploratory factor analysis show that consumer expectations regarding sustainable food are more diverse than the common interpretation of sustainability as related only to economic, ecologic and social aspects (FAO 2010; United Nations Environment Program 2010). Many of the underlying issues of the five dimensions have also been described by other studies (e.g., de Cavalho et al. 2015; Lee and Wall 2012; Sautron et al. 2015; Sidali and Hemmerling 2014), although with different contents and for different countries and analytical backgrounds.

The ethical dimension hints at the fact that consumers have higher expectations concerning environmental friendliness attributes (e.g., reduction of greenhouse gas emission, environmentally friendly packaging) compared to social attributes (e.g., fair trade) on an international scale. Hence, it seems that consumers' environmental consciousness is existent both in industrialized and emerging economies, but closer related to sustainability than social considerations. Actually, one should not be surprised by the fact that environmental awareness is also spread among emerging countries as they are often heavily affected by environmental degradation and climate change.

Naturalness is a dimension consisting of several promises that the respective product is free of artificial, chemical or genetically modified inputs. These are integral parts of the organic production standards and often highly discussed issues among consumers that are afraid of negative consequences for the environment. Apart from this more altruistic motivation consumers also relate sustainable food attributes to personal (health) benefits like good taste, freshness, and safety (von Meyer-Höfer et al. 2015). From an empirical point of view evidence of this work confirms Sautron et al. (2015) methodological approach according to which naturalness is distinguished from health. Thus, both are sub-dimensions of sustainability, and, although they can correlate very highly, they should be treated as two standalone dimensions. Especially food safety has become more and more important in times of severe food scandals affecting consumers in both industrialized and emerging countries like the BSE crisis in Europe

or the melamine scandal in China. From this point of view, marketers should always be sensitive to the relation between safety and trust.

Local production in correspondence to seasonal food production is one of the typically western consumer expectations regarding sustainable food (Sidali and Hemmerling, 2014), but also for consumers in other parts of the world at least the aspect of national / regional production under familiar circumstances and avoiding long transportation distances gain in importance (e.g., Sirieix et al. 2011).

An interesting expectation revealed in this study is described by the factor innovation. Consumers expect sustainable food today to follow current trends. Thus other than the pioneers of organic consumption in Europe who favored more traditional values and were extremely skeptic against modern trends, today alternative food products such as sustainable food seem to match with trendy lifestyles like the Lifestyles of Health and Sustainability.

Limitations

This study suffers from several limitations. The tested scale lacks important sustainability-related items, such as the absence of child labor or recycling, as these were deleted from the factor analyses due to poor item reliability. In a follow-up study that tries to replicate the current sustainability scale, these items should be reintroduced with better wording. Another limitation concerns the number of countries selected for this study, which was reduced to six due to financial constraints.

Future research should include a wider number of countries, including African countries, which in the present study were not included. Thus, to ensure a better understanding of sustainability on the global food market, more work has to be done.

Before starting with the implications chapter, it is important to be reminded of the fact, that the samples of this study are not representative and the results thus not generalizable. However, this exploratory study gives interesting first insights into consumer expectations regarding sustainable food in industrialized as well as emerging countries that should motivate further studies in this field.

Implications

The findings of our study are important from a managerial viewpoint. It offers agri-food market actors in emerging and industrialized countries five dimensions upon which successful sustainability-based differentiation and labeling strategies can be created: Ethical attributes; Naturalness; Health-related attributes; Terroir; Innovation. Food producers and retailers could find a niche in the highly competitive global food market by placing a distinctive mark on the sustainability dimensions revealed by this study. Moreover, it shades light into the specific expectations of consumers in some of the world's leading as well as promising future markets for sustainable food products.

Most of the here tested sustainability attributes are process characteristics or credence goods that cannot be judged by the consumer without the help of certification schemes or labels. Too high

or false consumer expectations are thus a severe risk. From the literature and practical evidence, it is known how disappointment or skepticism can become great barriers to sustainable food consumption. This is why marketers should try to be as clear and transparent about the process characteristics and credence goods of their products.

Marketers that want to address consumer expectations regarding sustainable food should try to use as many of the analyzed aspects as possible, also if this means to have a product labeled with several single sustainability claims or labels. Many of the expected sustainability attributes are already integral parts of the world's leading sustainability certification schemes for organic and fair trade. However, most organic labels focus primarily on the environmental dimension of sustainability, while fair trade schemes focus more on social aspects. A combination of both approaches exists but is still rather limited to special product groups like coffee, cocoa or bananas.

Special attention should be paid to a megatrend across countries: consumers expect that sustainable food should be innovative and trendy. A communication strategy which places emphasis on trends could attract sustainability-sensitive consumers worldwide.

The results of this study invite marketing actors to revise an old and widespread conventional wisdom that in emerging countries all consumers are purely seeking to satisfy their basic material needs without caring about the environmental or ethical aspects of their food consumption. For many years, it was asserted that consumers' environmental concern and the "postmaterialist" value of environmental protection was limited to affluent nations (Dunlap and York 2008, 529; Ingelhart 1977). However, this study rejects this view and supports, in this way, the findings of more recent reports of several international institutions (e.g., BBMG, GlobeScan and SustainAbility 2012, National Geographic and GlobeScan 2012); at least looking at well-educated urban middle classes. Nevertheless, the analysis shows that semi-globalized communication strategies should be considered instead of international strategies that build upon similar consumer expectations regarding sustainable food in every country (Douglas and Craig 2011).

Conclusion

The sustainability of food production and consumption has become a crucial global issue in the agri-food business. As more and more food is marketed using sustainability aspects as marketing cue, it gains market momentum, but most scientific studies only deal with single credence attributes for single products in individual countries or continents. A more comprehensive picture of what consumers expect from sustainable food on a global scale is still missing.

Thus the current exploratory study addresses the question what consumers expect from sustainable food products as such in several industrialized (Germany, the United States, Switzerland) and emerging (Brazil, China, India) countries. Twenty-four items representing sustainable food attributes are tested, and data is analyzed adopting the same methodological approach (multi-group comparison confirmatory factor analyses). This allows cross-country comparisons for the six analyzed countries and gives international agri-food market actors better insights into how to tailor adequate communication strategies.

The findings show that sustainability of food consists of five factors (ethic attributes, naturalness, health-related aspects, terroir, innovation) whose items are comparable across countries due to metric invariance. This confirms the presence of sustainability megatrends in the food market and, accordingly, permits agri-food market actors to tailor specific marketing strategies by adopting a semi-globalized marketing strategy as suggested by Douglas and Craig (2011). Furthermore, as the results of the invariance analysis display only partial scalar invariance, the interpretation of factors' comparison can only be applied to the country subset of the USA, Germany, and Switzerland. Moreover, the partial failure of the scalar invariance analysis for Brazil, China, and India, confirms the necessity for marketing scholars to deepen their analysis of sustainability dimensions in emerging countries. An important future stream of research in marketing science is henceforth the characterization of consumers with preferences for sustainable food on a global level.

Acknowledgement

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Appendix 1

Table A1. Overview about factors, items and item codes:

Sustainability Factor	Item	Item code
F 1 **Ethical Attributes**		
	Ensuring animal welfare	V_166
	Ensuring fair payment of producers	V_208
	Ensuring good working and living conditions for producers	V_209
	Environmentally friendly production	V_210
	Environmentally friendly packaging	V_211
	Reducing greenhouse gas emissions	V_212
F 2 **Naturalness**		
	Free from Genetically Modified Organisms	V_261
	Free from chemical pesticides	V_268
	Free from synthetic fertilizers	V_269
	Free from artificial additives	V_270
F 3 **Health-Related** **Attributes**		
	Good taste	V_266
	Safe	V_267
	Fresh	V_271
	Health benefits	V_162
	High nutritional value	V_163
F 4 **Terroir**		
	Seasonal production	V_164
	Local production	V_165
F 5 **Innovation**		
	Following current trends	V_213
	Innovative	V_263

Note. Three items had item reliability value less than 0.4 in almost all countries. This led to the deletion of: v_214 (no child labour); v_262 (traditional) and v_272 (convenient).

Appendix 2
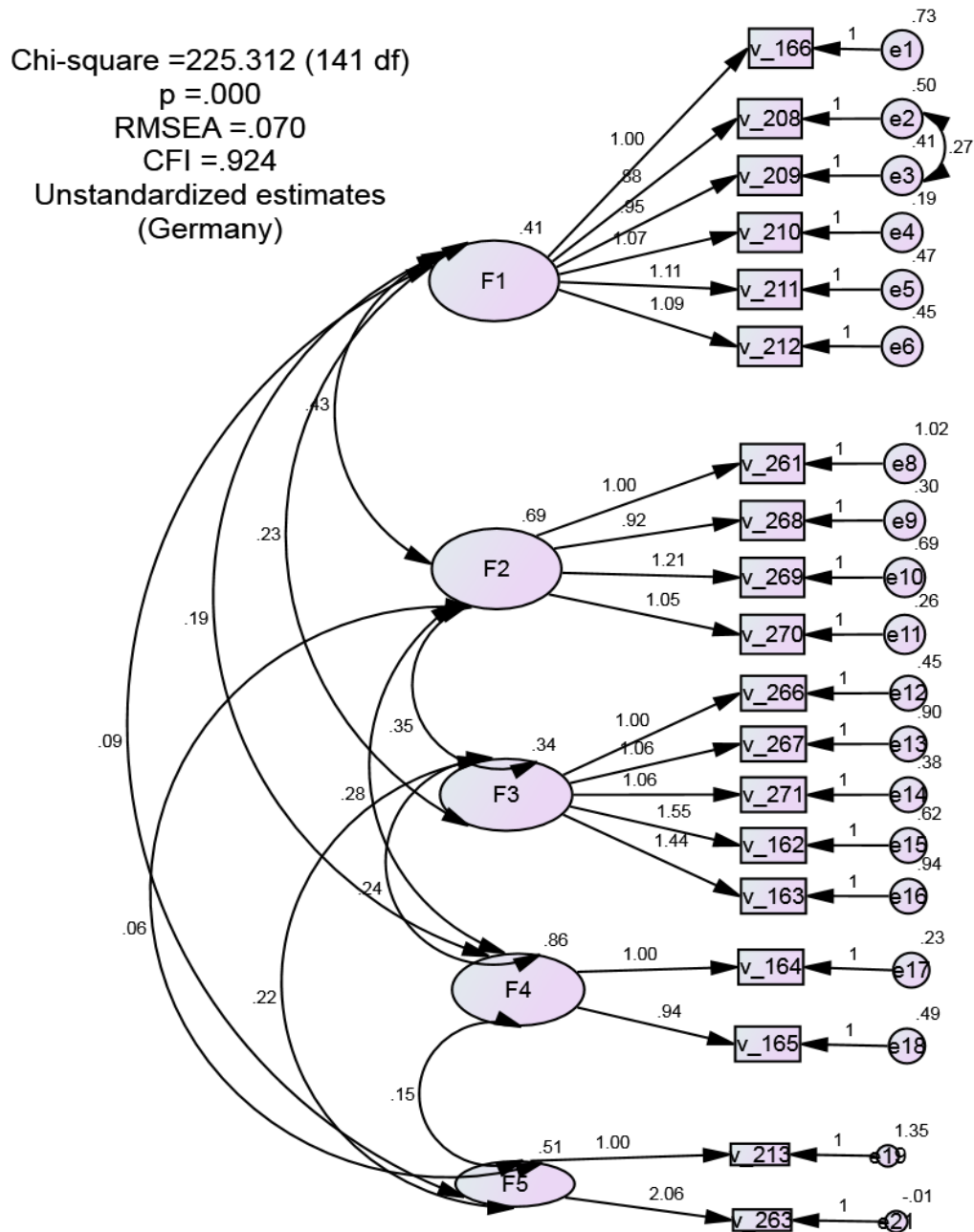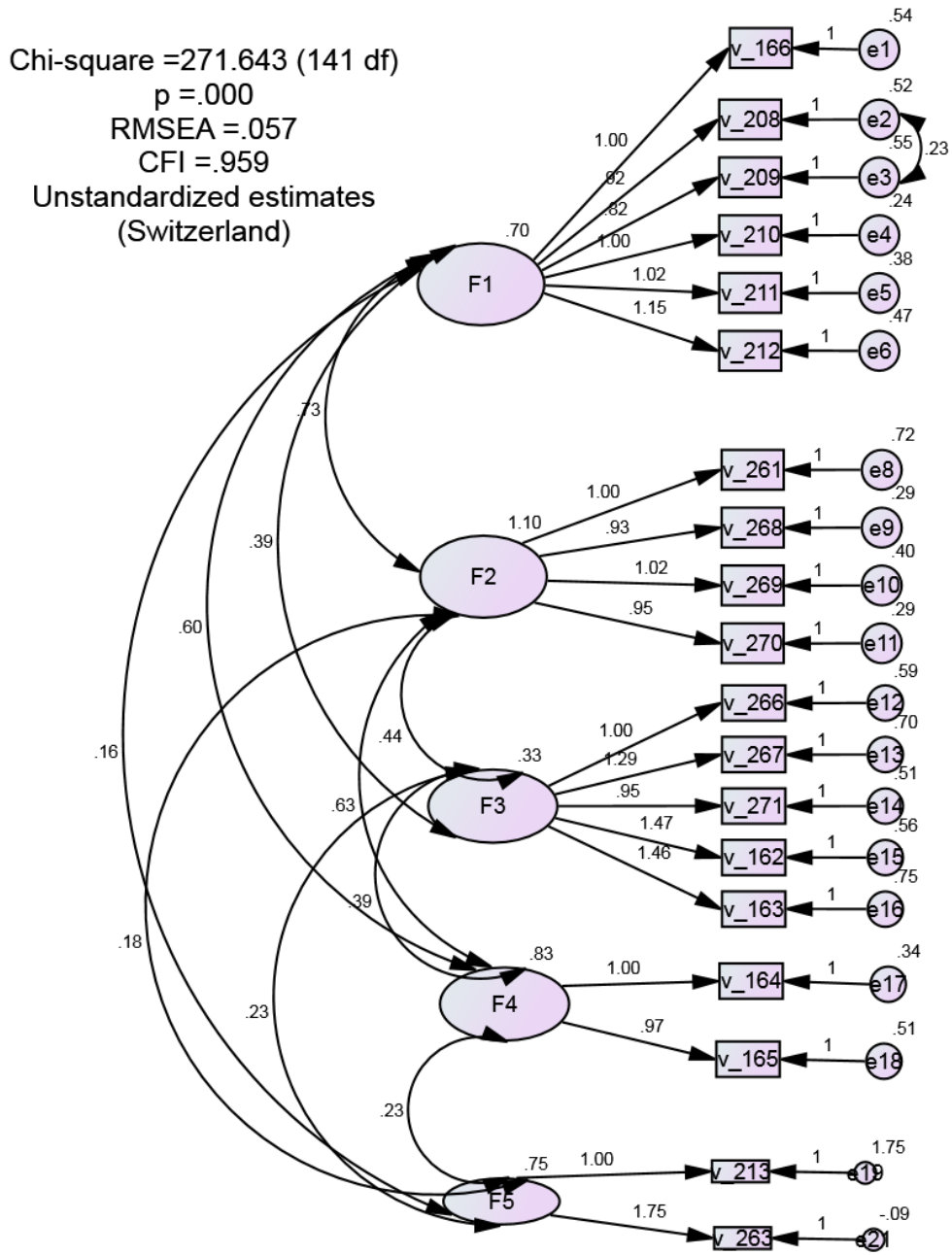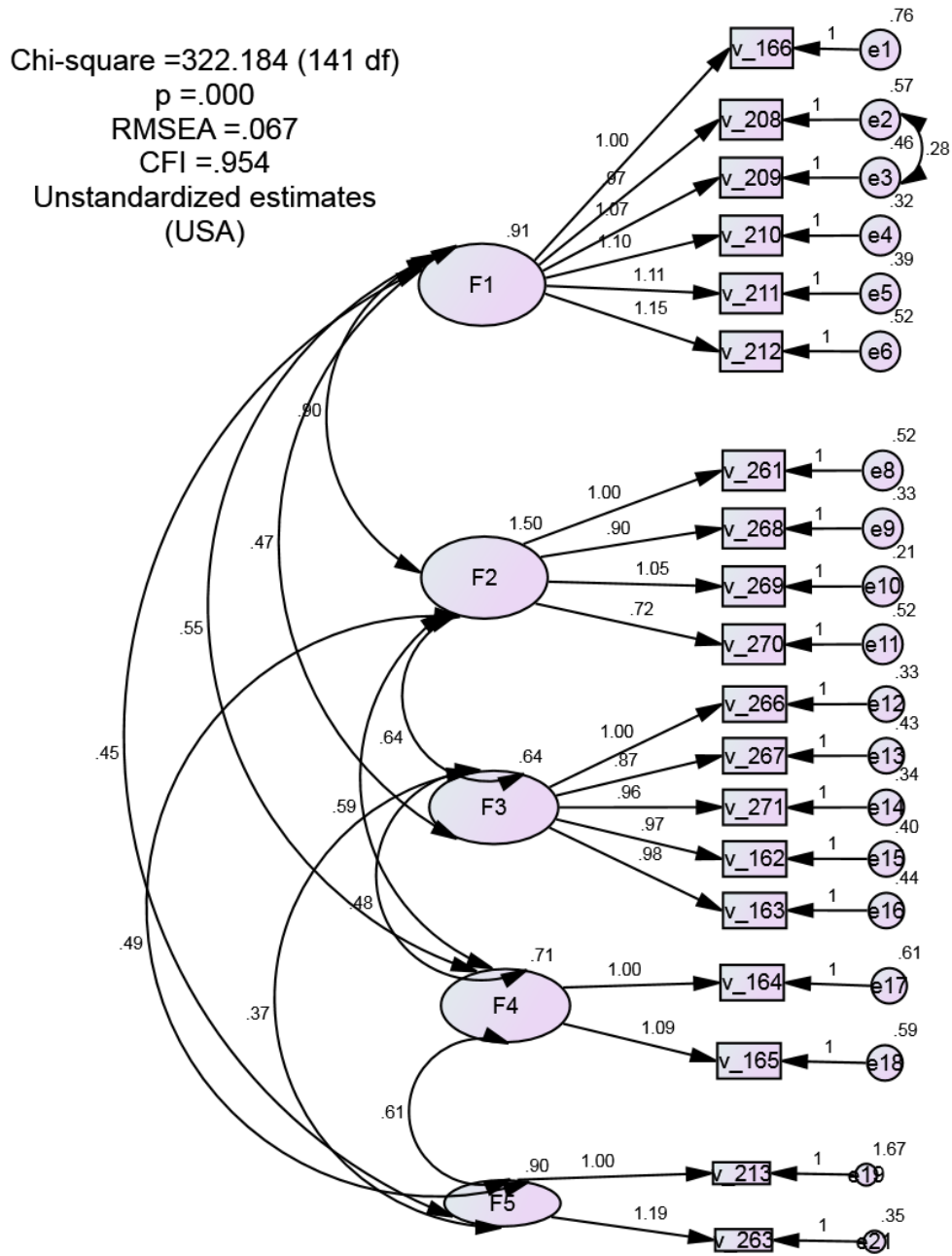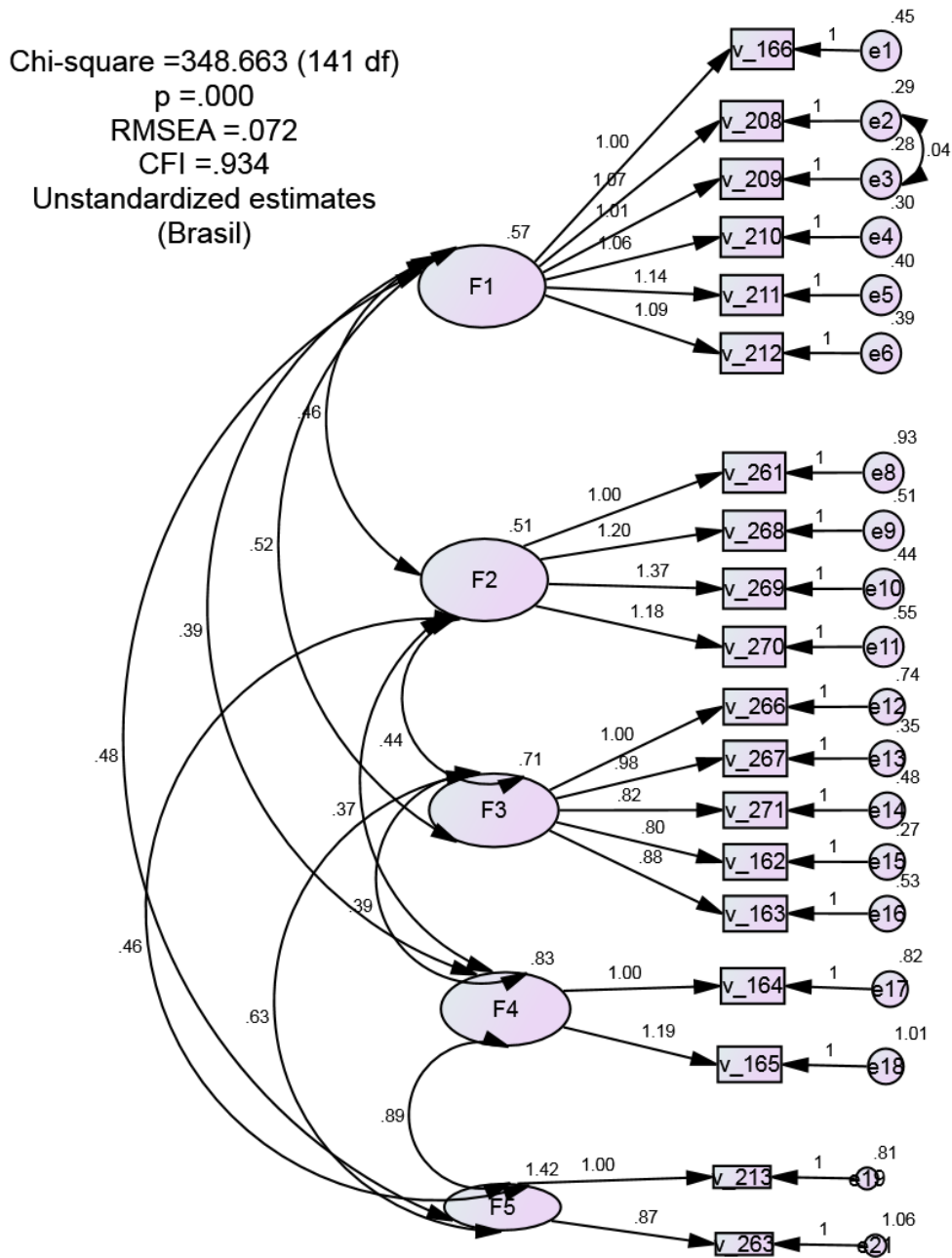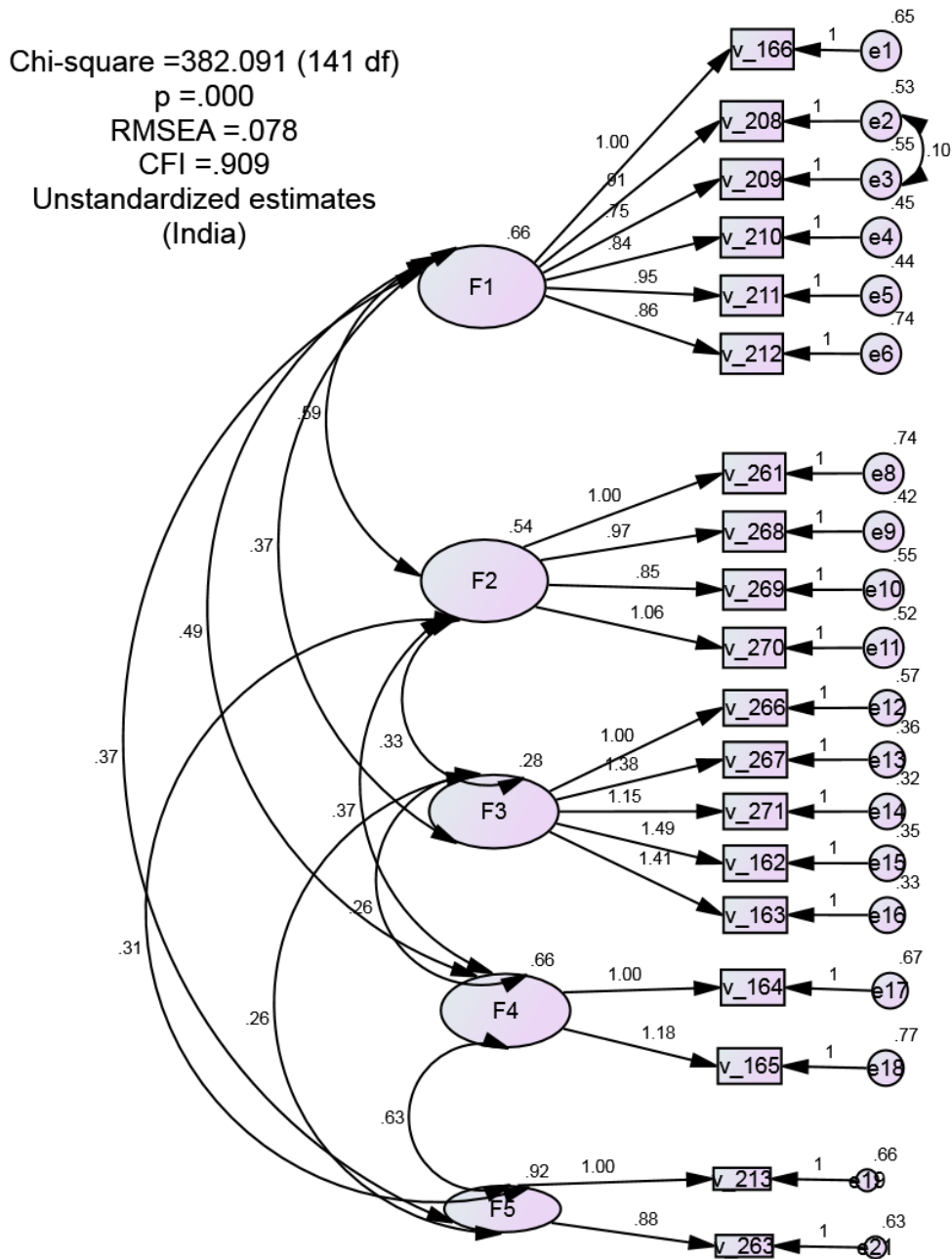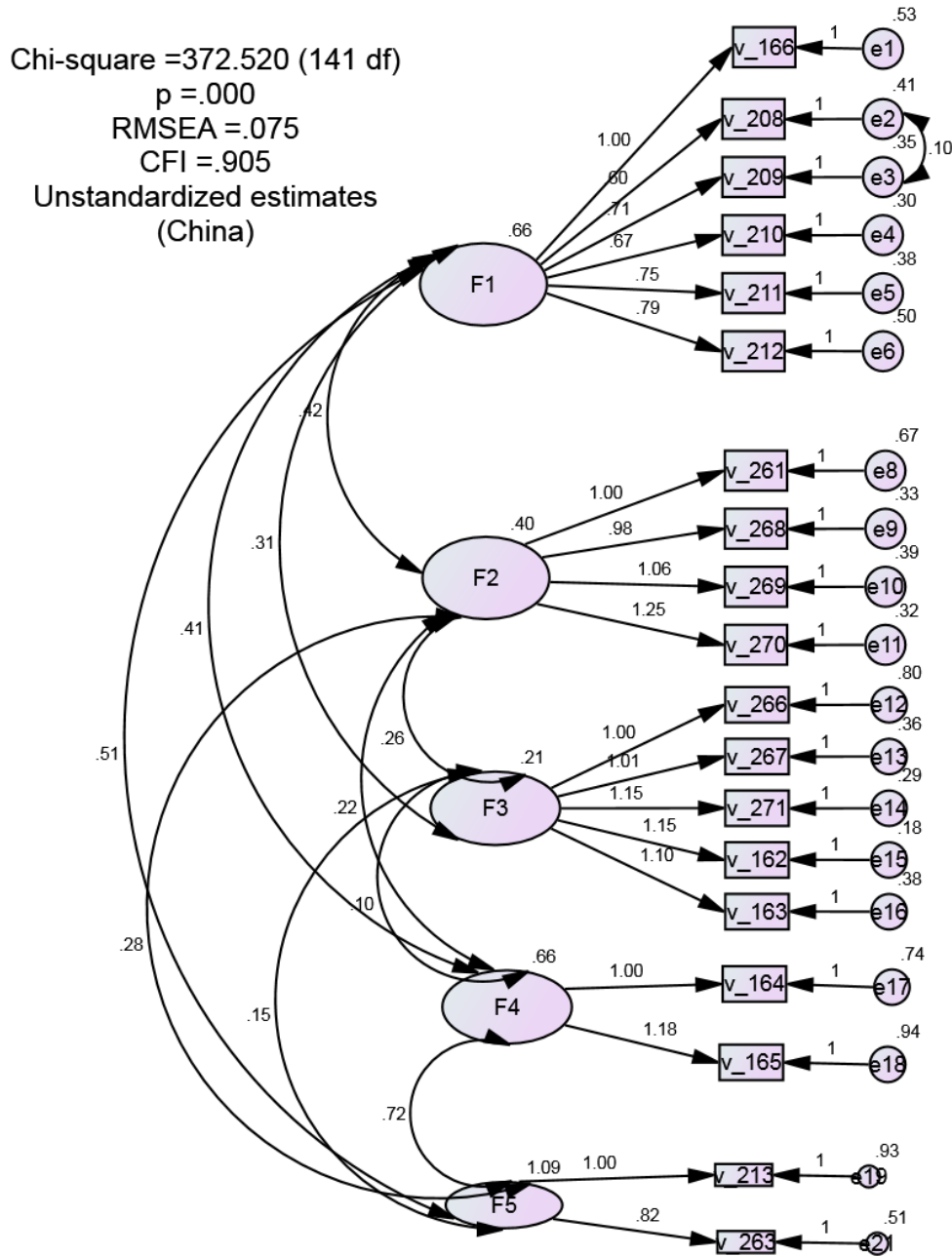
Chi-square =225.312 (141 df)
p =.000
RMSEA =.070
CFI =.924
Unstandardized estimates
(Germany)

Chi-square =271.643 (141 df)
p =.000
RMSEA =.057
CFI =.959
Unstandardized estimates
(Switzerland)

Chi-square =322.184 (141 df)
p =.000
RMSEA =.067
CFI =.954
Unstandardized estimates
(USA)

Chi-square =348.663 (141 df)
p =.000
RMSEA =.072
CFI =.934
Unstandardized estimates
(Brasil)

Chi-square =382.091 (141 df)
p =.000
RMSEA =.078
CFI =.909
Unstandardized estimates
(India)

Chi-square =372.520 (141 df)
p =.000
RMSEA =.075
CFI =.905
Unstandardized estimates
(China)

Journal Lists: A Theoretical and Empirical Analysis

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Abstract

This study examines the use of formal rankings of journals for personnel decision purposes by agricultural economics departments with agribusiness programs. It was hypothesized that the probability of using a list of formal rankings is related to a set of characteristics of the department. This suggests lists may reduce the level of uncertainty regarding the assessment of research quality by providing explicit targets in the department but may also induce faculty members to develop institution-specific human capital, thereby reducing faculty mobility and impeding career development. Whether lists are used, how they are compiled, and the extent to which they are relied upon when making personnel decisions should be viewed in the context of developments and trends in higher education; e.g., the presence of multi-disciplinary departments and the use of clinical and other non-tenure track faculty. Further, the difficulty of revising lists once they have been agreed upon should also be considered, especially when journal quality declines or where changes in personnel evaluations and in bylaws and similar documents are lengthy and arduous processes.

Keywords: journal list, personnel decision, ranking, bylaws, tenure track

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Introduction

Lists of journals have become more common in recent years as academic departments strive to increase their perceived prestige. Developing such a list may be an arduous and potentially contentious task, particularly if the list is formulated solely by internal, subjective processes. These difficulties are particularly exacerbated in agribusiness, a subfield of agricultural economics, since a subfield relies on paradigms and knowledge from other disciplines. Agribusiness faculty sometimes have diverse backgrounds and eclectic research interests (Axarloglou and Theoharakis 2002). Although dominated by agricultural economists, agribusiness programs may have faculty from other agriculture areas, science, or business disciplines. This diversity complicates the identification and evaluation of journals in which faculty publish (Barrett, Olia, and Bailey 2000).

There are studies of the impact (Laband and Piette 1994) and published rankings of economics and agricultural economics journals and departments (Herrmann, Berg, Dabbert, Pöchtrager, and Salhofer 2011; Ritzberger 2008; Kalaitzidakis, Mamuneas, and Stengos 2003; Huettner and Clank 1997; Kinnucan and Traxlet 1994; Burton and Phimister 1996; Laband and Peitte 1994; Enomoto and Ghosh 1993); but rather than use them, some departments have developed their own journal lists. Lists seem to be relatively common in some fields, e.g. management (Mingeres and Harzing 2007), operations management (Saladin 1985), and marketing (Baumgartner and Pieters 2003). While lists also seem to be emerging in agricultural economics (Hilmer and Hilmer 2005; Beilock and Polopolus 1988; Beilock, Polopolus, and Correal 1986), a recent study suggests that few departments have such lists (Detre, Gunderson, Peake and Dooley 2011).

Lists such as these are designed to reduce difficulties in evaluating quality and to help faculty members identify target journals. However, they can lead to a moral hazard associated with the agency problem (Gomez-Mejia and Balkin 1992). Because of that agency problem, work in economics journals (Detre, Gunderson, Peake, and Dooley 2011; Ng, and Siebert 2009; Ritzberger 2008; Hilmer and Hilmer 2005; Axarloglou and Theoharakis 2003; Barrett, Olia, and Bailey 2000; Kalaitzidakis, Mamuneas, and Stengos 2003) was used as a starting point for this study which replicates one conducted in the field of management (Van Fleet, McWilliams, and Siegel 2000). That study provided the following cost/benefit analysis of such lists and was used to develop a set of hypotheses, which were then tested based on a survey of departments with agribusiness programs (see also Cahn and Glass 2016, Elbeck and Baruca 2015, Adler and Harzing 2009).

The Costs/Benefits of Lists

Table 1 is based solely on those authors' judgment and informal feedback provided by senior colleagues at institutions that actually generated lists. A list provides an explicit indicator of what research outlets a department values and establishes explicit target publications. A list provides useful information on journal quality to faculty members outside of their area(s) of interest. If the list contains several "levels," it could be especially useful for faculty members who are targeting journals that may not necessarily be considered "top-tier" by all their peers. A list could also provide guidance to those whose work has been rejected at a premier journal and who want to maximize the impact (at least internally) of his or her work.

Table 1. Costs/Benefits of List Formulation

Costs	Benefits
▪ Development can be arduous and time-consuming.	▪ Provides an explicit measure of the value of research output.
▪ May be damaging to interpersonal relations.	▪ Establishes explicit publication targets.
▪ Compromises may lead to rewards for mediocre work.	▪ Reduces uncertainty in planning and evaluation.
▪ May induce rigidity in research standards.	▪ Provides guidance in publication strategies.
▪ Could discourage faculty from reading colleagues' work.	▪ Provides useful information on journal quality.
▪ Focus on inputs (articles) rather than on outputs (impact of contribution to the field).	▪ Reduces time and effort in evaluations
▪ Subject to biases and political processes.	▪ Provides defensible information in grievance situations.
▪ May hinder career development if standards are too institutionally specific.	▪ Useful in benchmarking/baselining.
▪ Could overestimate actual productivity.	
▪ Could disadvantage those who do specialized work, especially if they publish in newer journals.	
▪ Could add to power of editors and review boards.	

Source. Van Fleet, McWilliams, and Siegel. 2000.

A ranked list could also reduce the time and effort required to evaluate research quality by both the faculty member and the promotion and tenure committee. It could provide a defense in grievance situations when an individual is denied tenure or promotion. An agreed upon measure of research productivity clearly would be beneficial even if the objectivity of the ranking could be questioned.

But there are clearly costs incurred in formulating a ranking. Unfortunately, some faculty members, wishing to minimize time spent in evaluations, will rely solely on the ranking and thus will not actually read their colleagues' work to assess its quality independent of the outlet. Other costs are associated with the fact that such lists are generally subjective rather than objective in nature. As different parties seek to put forth their own particular interests, the effort to reach a consensus (which must occur for a subjective ranking to be adopted) may prove overly time consuming and damaging to interpersonal relations. Formulating a list may also involve agency costs (problems) so that potential rigidity in research standards may result. This induced rigidity may hurt, especially if the ranking is not updated regularly to reflect changes in the performance of various outlets. And as noted above, a ranking could discourage faculty from actually reading the manuscripts of their colleagues. They would all be familiar with the work of their colleagues, its true quality, and/or its potential impact. The use of the journal, rather than the article, as the unit of performance measurement, is problematic despite any savings in time.

Because lists are subjective and subject to the biases and political processes of those who develop them, journals rated highly at one institution may be rated lower at another. This could lead to institution-specific human capital, reducing mobility and impeding career development.

In addition, individuals who do highly specialized work could be disadvantaged by lists. In some instances, specialized work may be published only in a narrow set of specialized journals near the top in their field but not likely to be considered at the top of the broad field identified by such lists. This shortcoming exists precisely because the impact from limited audiences is likely to be small. If the number of top tier journals on a list is relatively small, a highly diverse department would have difficulty recognizing the best journals in multiple sub-fields. The existence of lists based on perceptual judgments restricts emerging journals from rapid recognition as top quality outlets. While procedurally levels of rigor can be accomplished quickly, assessing impact takes time, perhaps considerable time.

Hypotheses

As noted by Van Fleet, McWilliams, and Siegel (2000), there is no specific theory underlying the development of journal lists. However, social science and business concepts can help to understand the use of journal rankings. Institutional pressures [to improve quality, to guide career development] and expected efficiency gains [less time spent in evaluation, less contentious evaluation processes] are likely underlying reasons why departments develop lists (Barringer and Milkovich 1998). The performance appraisal literature recommends objective techniques that involve those being evaluated (Campbell, Campbell, and Chia 1998). Departmental agreement on a list represents both a form of involvement and some objectivity. Having a formal list would also inform individuals prior to the appraisal period about the criteria, which is also important for effective evaluations (Latham and Wexley 1981).

These concepts, however, do not distinguish between departments that develop formal lists from one that would not. The above discussion of costs and benefits along with the work of Garfield (1972) suggests several hypotheses concerning formal rankings of journals for personnel purposes. The arguments of Van Fleet, McWilliams, and Siegel (2000) and their hypotheses are summarized to supply an additional hypothesis.

There is evidence that smaller organizations find structured, formal performance appraisal systems impractical (London and Smither 1999), relying instead on informal methods (Jackson, Schuler, and Rivero 1989). Although reaching a consensus may be difficult, the time needed to actually read colleagues' work might (to some) warrant the use of proxies (journal rankings) to assess the quality of an individual's work. Hence, economies of scale might increase the likelihood of developing a list. Thus, the first hypothesis is:

H$_1$: A positive correlation exists between the department size and the probability of adopting a list.

Anticipating that many departments outside of the United States are relatively small leads to another hypothesis:

H$_2$: A positive correlation exists between a department's global location (in the United States or not) and the probability of adopting a list.

In departments with faculty using non-tenure track faculty a list might prove useful to guide their work. However, reaching a consensus in such departments may be more difficult and may also be related to size (Jackson, Schuler, and Rivero 1989). The third hypothesis is, then:

H3: A positive correlation exists between the use of non-tenure track faculty (clinical, instructors, post-docs, etc.) within a department and the probability of adopting a list.

As noted earlier, developing and using a list is a form of peer evaluation. However, because individual faculty members may be reluctant to evaluate one another, peer evaluations may not be used. Low performers also are likely to reject the use of peer appraisals (Long, Long, and Dobbins 1998). On the other hand, experience can substitute for peer information, rendering a list unnecessary (Maurer and Tarulli 1996). Therefore, experience is an important variable to consider (Ferris, Judge, Rowland, and Fitzgibbons 1994, 105). Experience and the quality of a department may pull in different directions regarding the use of a list. Higher quality departments (Zapata 2009; Palacios-Huerta and Volii 2004) have less of a need for a list because faculty are already socialized, mentored, and rewarded to publish in only those journals that are regarded as top-tier. Furthermore, those departments will strive to hire graduates of top rated institutions (Hilmer and Hilmer 2007; Hilmer and Hilmer 2005; Miranowski 2002; Connor, 1996), where graduate students are counseled to target top tier journals. Two hypotheses emerge from quality and experience considerations.

H4: An inverse relation exists between the quality of a department and the probability of adopting a list.
H5: Departments with faculty who have low levels of experience will be more likely to adopt a ranking.

Jackson, Schuler, and Rivero (1989) noted that industries differ in their human resource practices. Longenecker and Nykodym (1996) noted differences in public versus private sector organizations. Departments in public colleges or universities may have more bureaucratic environments and be subject to more grievance cases than private institutions. If so, the benefits of developing a list would outweigh the costs, leading to our next hypothesis.

H6: The probability of adopting a list will be greater in public institutions than in private institutions.

Similarly, if the college or university has an overall research focus, a list may be seen as unnecessary, leading to this hypothesis.

H7: The probability of adopting a list will be lower in research focused institutions than in those without such a focus.

Method

In an effort to identify formal lists of agribusiness journals, a survey was conducted of departments identified on the Internet as offering agribusiness programs (see Table 2). There were sixty-four US and thirty-six Non-US institutions identified and contacted. While such departments vary in the breadth of subjects covered, this procedure provides a replicable

convenience sample for exploratory purposes. An email was sent to the department chair and one other randomly chosen member of each department, asking if the department had a "formal ranking" of journals used for personnel purposes – faculty development, performance appraisal, and/or tenure and promotion recommendations. If the department chair failed to respond another random selection was made to assure two responses for each department. Copies of any formal list and informal lists that might be available were requested. An important point to note is that the survey was not about perceptions of journals or journal quality. It was simply an effort to collect formal lists used by departments for personnel purposes. In an effort to obtain as large a sample as possible, follow-up letters were sent to those individuals and finally a third set of emails was sent to other members of the faculties involved when there had been no response from the earlier emails.

Table 2. List of Respondents

US Respondents

Alabama A&M University	Oklahoma State University	University of Florida
Arizona State University	Olds College	University of Hawaii at Hilo
Auburn University	Oregon State University	University of Idaho
Cal. Poly- San Luis Obispo	Penn State University	University of Illinois
California State University-Fresno	Purdue University	University of Kentucky
Clemson University	Sam Houston State University	University of Maine
Colorado State University	Santa Clara University	University of Massachusetts
Cornell University	SUNY Cobleskill	University of Missouri
Iowa State University	Texas A&M University	University of Tennessee
Louisiana State University	Texas Tech University	University of Wyoming
Montana State University	University of California-Berkeley	Utah State University
North Carolina State University	University of California- Davis	Virginia Tech
North Dakota State University	University of Arizona	Washington State University
Ohio State University	University of Arkansas	

Non-US Respondents

Botswana College of Agriculture (BW)	Sokoine Univ. of Agriculture(TZ)	University of Guelph (CA)
Dalhousie University (CA)	Stellenbosch University (SA)	University of Kent (UK)
Egerton University (KE)	Technical Univ. of Munich (DE)	Univ. of Manitoba (CA)
ESSEC Business School (FR)	University of La Salle (CO)	University of Pretoria (SA)
Humboldt University Berlin (DE)	Univ. of British Columbia (CA)	Univ. of Queensland (AU)
Indian Institute of Management (IN)	Univ. of Nat. Res. and Life Sc. (AT)	University of Rwanda (RW)
Martin Luther Univ. Halle-Wittenberg (DE)	University of Adelaide (AU)	Univ. of Saskatchewan (CA)
Moi Universty-Kenya (KE)	University of Alberta (CA)	University of Rostock (DE)
Newcastle University (UK)	University of Bonn (DE)	
Royal Agricultural University (UK)	University of Goettingen (DE)	

Regardless of the categories used by a list, ("A, B, C" system, a numerical system "4, 3, 2, 1,", "tiers," or just labels such as "target journals and additional outlets" or "premier" or "highest quality"), for comparability the highest ranking reported for each institution was assigned a value of "4," the next a "3," and so on. Similarly, if ratings were used, in order to arrive at categories that could be combined with others, the ratings were standardized and first differences among the standardized values were visually examined by what is essentially a series of scree tests (Zoski and Jurs 1996; Zoski and Jurs 1990; Race and Planek 1992; Cattell 1966).

From the survey variables are Research Focus (1=yes or 2=no from the survey), Size is the number of tenured/tenure-track faculty, Other is the number of "other faculty" (non-tenured or tenure-track) faculty (clinical, instructors, post-docs, etc.), Experience is "years on average" of tenured/tenure-track faculty, AGBUS was either 1 (yes) or 2 (no); Quality-1 is RePEc Scores (low best[1]), and Quality-2 is Best Global Scores (high best;[2]). The study was IRB approved. The survey was provided online using Qualtrics. The full survey instrument is available from the authors upon request.

Results

This project dealt with formal lists of journals used for personnel purposes although informal uses and perceptions of journal quality were reported by some respondents. Despite how commonly faculty categorize journals, surprisingly few institutions reported using formal lists. Similar to the results of Detrea, Gunderson, Peak and Dooley (2011), only five US departments (12.2% of those responding) indicated that they used formal lists although several indicated that they used lists in an informal way of guiding research (Table 3). Interestingly, more Non-US departments used formal lists (15 or 53.57%).

Table 3. Use of Formal Lists by Respondents (Percent)

	Total	**US**	**Non-US**
Total	69	41	28
Use Formal List	20 (28.99%)	5 (12.20%)	15 (53.57%)
Do Not Use	49 (71.01%)	36 (87.80%)	13 (46.43%)

As shown in Appendix Table A1, among the variables for US departments, size is significantly correlated with Research Focus (yes or no from the survey) and Quality-1 (RePEc Scores; see Appendix Table A1 note), and Quality-1 is correlated with Others [Quality-2 is Best Global Scores' see Appendix Table A1) note). For the Non-US departments, size is significantly correlated with Others T-tests for US vs Non-US variables show all but Quality-1 and Control as significant. These results, then, suggest clear differences between US and Non-US respondents so they are next examined separately.

Appendix Table A2 reports the results for US respondents. The number of US responses with lists is too small for meaningful analysis. For those with lists, Size is clearly important, negatively related to Research Focus and positively related to Others (the use of non-tenure track faculty). Results from a t-test indicate that Size and Others differentiate whether or not US respondents

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[1] https://ideas.repec.org/top/top.agecon.html
[2] http://www.usnews.com/education/best-global-universities/agricultural-sciences

indicated the presence or absence of a list. H1 is confirmed but H3 is not, and there is no clear pattern in regards to H2.

Appendix Table A3 reports the results for Non-US respondents. These results indicate that for departments with lists there is a significant correlation between Size and Others but for those without lists, Size is significantly negatively correlated with Quality-1.The t-tests found no significant relationships.

While there appears to be some support for H4, there are no data supporting either H5 or H6. Because small sample sizes for some of these groupings led to mixed statistical significance to investigate further and to specifically address H7, a probit analysis was conducted.

Two probit analyses were conducted to investigate factors that influence the decision to adopt lists. The first focuses on the whole sample and the second focuses solely on those that actually have a journal list implemented. The following model specification was used (i denotes the ith department):

Prob(Li)=f(USAi, PUBLICi, RESEARCHi, SIZEi, OTHERSi, EXPERIENCEi, AGBUSi)
Where L is a dummy variable denoting whether the department has a list;

    USA is a dummy variable denoting whether the department was in the US;
    PUBLIC is a dummy variable denoting whether the institution is public;
    RESEARCH is a dummy variable denoting whether the institution has a research focus;
    SIZE is the number of tenured/tenure-track faculty;
    OTHERS is the number of non-tenured/tenure-track faculty;
    EXPERIENCE is the average number of years since receipt of degree of the faculty; and
    AGBUS is a dummy variable denoting whether the institution has a separate agribusiness program.

Results are displayed in Table 4. The Adopts column shows the results for the total sample while the Uses column shows the results only for departments that actually already use a journal list. The results support H2 and suggest that Non-US institutions are more likely to have lists than are US institutions.

Table 4. Determinants of the probability that a department adopts or uses a list (probit estimates)

	Dependent Variable			
Variable	**Adopts**		**Uses**	
Intercept	1.528	(1.156)	1.000	(1.581)
USA	-1.297***	(0.494)	-1.203	(0.841)
PUBLIC	-0.420	(0.556)	-0.948	(0.799)
RESEARCH	-0.424	(0.808)	-1.449	(0.946)
SIZE	-0.089	(0.133)	0.073	(0.203)
OTHERS	0.022	(0.102)	-0.059	(0.140)
EXPERIENCE	-0.024	(0.139)	0.140	(0.165)
AGBUS	-0.237	(0.370)	-0.313	(0.347)
LOG LIKELIHOOD	-32.0985***		-16.829*	

Note. Standard errors in parenthesis
* $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$

Discussion

Only one formal list was provided and it consisted of only ten journals. However, that respondent noted that "other high quality journals important to the discipline and/or an individual faculty member's specific research program will also be considered and are encouraged."

Among those who did not use lists, different views were expressed. One respondent noted, "We know the recognized journals in our field and in general. A promotion candidate would be evaluated on the overall quality and quantity of publications, teaching achievement, and extramural funding." Another indicated that they had "no formal or informal list. However, we look at publication numbers in 'tier 1' journals, each person defining 'tier 1' in their own way. We are all economists/ag economists from 4 Ph.D. institutions, and a consensus is not difficult to reach." A third simply said "We have used lists only informally." Another referring to a list used informally said "The list is not used in any formal way, but is used informally to make judgments about journal quality in promotion and tenure cases. The list was first assembled more than 10 years ago – and there is considerable dissatisfaction with it. There is a widespread view that it is in serious need of updating – but no one really relishes the prospect of that kind of undertaking, fearing that it would be plagued by individuals' strategizing to make their own portfolios look as strong as possible."

More meaningfully to our study, one respondent noted that existing lists are either economics lists with few or no agricultural economics journals or, even more to the point, agricultural economics lists with no agribusiness journals in them. With that in mind, then, the lists, articles with lists, and websites with lists that were provided by eight respondents whose departments used them only informally were examined. Those lists identified 335 journals, many of which had broad, inter-or multidisciplinary scopes or specifically mention and emphasize marketing, business, entrepreneurship, consumers, organizational structure or management or strategy, labor, or other business-related terms with no specific reference to agribusiness or agricultural economics. That set was reduced by selecting only those journals appearing on two or more lists and that were relevant to agribusiness or agricultural economics in terms of their aims, scope, purpose, and other information. This then resulted in the set of thirty-four journals in Table 5 along with their Impact Factors.

Table 5. Agribusiness Journals

Journal	5-Year Impact Factor[a]	Impact Factor[b]
Food Policy	2.949	3.092
Agriculture and Human Values	2.534	0.579
J Agricultural Economics	2.037	6.685
European Review of Agricultural Economics	1.828	4.229
American J Agricultural Economics	1.828	4.628
Renewable Agriculture and Food Systems	1.734	NA
British Food Journal	1.208	NA
Canadian J Agricultural Economics	1.113	1.532
Agricultural Economics	1.701	6.781
Review Agricultural Economics	NA	NA
J of Agricultural and Resource Economics	0.868	5.285
Agribusiness: An International Journal	0.949	2.288
Outlook On Agriculture	0.581	NA
International Food and Agribusiness Management Review	0.647	1.094
Agrekon: Quarterly J on Agricultural Economics	0.311	0.872
Australian J Agricultural and Resource Economics	1.516	4.676
J of Agricultural and Food Industrial Organization	NA	3.109
African J of Agricultural and Resource Economics	NA	2.165
Agricultural Economics Review	NA	1.162
J of Agribusiness	NA	1.003
International J of Agricultural Res., Governance and Ecology	NA	0.693
J of International Agricultural Trade and Development	NA	0.541
Indian J of Agricultural Economics	NA	0.249
Quarterly J of International Agriculture	NA	NA
International Journal of Food and Agricultural Economics	NA	NA
Agricultural and Resource Economics Review	NA	2.820
Food Economics (formerly Acta Agri Scandinavica – Sec C)	NA	NA
International Agricultural Economics and Management	NA	NA
J Agrarian Change	NA	NA
J Agricultural and Food Economics	NA	NA
J Agricultural Economics and Rural Sociology	NA	NA
J of Agricultural Education and Extension	NA	NA
J of Agricultural History and Rural Sociology	NA	NA
Yearbook of the Austrian Society for Agricultural Economics	NA	NA

Note. na = not available
a = 5-year Impact Factor from Journal Citation Reports. (accessed 8/22/2016).
b = Impact Factors from IDEAS/RePEc Simple Impact Factors for Journals.
ideas.repec.org/top/top.journals.simple.html#top. Accessed 8/22/2016.

It should be noted that the journal quality measures merely enable one to assess the perceived quality of the average article that appears in a given journal. For example, the average article that appears in the *American Journal of Agricultural Economics* (AJAE) is perceived as higher in quality than the average article that appears in, say, the *International Food and Agribusiness Review* (IFAMR). However, that does not mean that any particular article in the AJAE is "better" than any particular article in IFAMR, and it certainly does not mean that every article in AJAE is better than every article in IFAMR. The salient point is that this approach does not in any way preclude a more micro analysis of the quality or impact of an individual article. Further, as Johnson and Podsakoff (1995) demonstrate and a perusal of relevant articles in the *American Journal of Agricultural Economics* suggests, journal reputations change over time. Hence, any such "rankings" need to be periodically updated. Rankings also need to be kept current to reflect the current state of higher education as mission statements change and new initiatives, such as multi-disciplinary research, are pursued. The presence of multi-disciplinary departments, for example, might provide an agribusiness faculty member with opportunities to collaborate on research projects. The dilemma? The resulting publication may appear in a "quality" journal that has yet to be added to the agribusiness list. As a result of another trend, the increased use of non-tenure track faculty, research-active faculty members may find themselves short of colleague-collaborators. When faculty members with similar research interests or with similar motivations to conduct research are not in close proximity, the notion of serendipity in developing research and publication ideas can be reduced considerably.

Faculty salaries depend perhaps to a great extent on publication records and how those records are evaluated (Detre, Gunderson, Peake, & Dooley 2011; Hilmer & Hilmer 2005). Involving those being evaluated in the development of standards for evaluation is advocated by scholars in the field of performance appraisal (Campbell, Campbell, and Chia 1998; Daley 1993). But as noted earlier involvement may lead to agency problems (Gomez-Mejia and Balkin 1992). The solution, of course, would be to agree upon an objective metric, but attaining such an agreement might also involve agency problems. Nevertheless, continually examining individual contributions and the outlets in which those appear is necessary to assure fairness and equity in evaluations. That process will help establish a metric that can be agreed upon and more clearly define the field of agribusiness (Ng & Siebert 2009; Harling 1995).

Summary

Few departments have formal rankings of journals. Only 12% of responding institutions in the US had formal lists but 54% of Non-US did. This suggests that the formal use of journal lists is not as common as might be thought based on the number of published journal rankings. Apparently the costs generally outweigh the benefits of having a formal list. Based on our results, a tremendous amount of variation exists among such lists.

What seems to be needed is an objective measure of journal quality and/or influence independent of any particular faculty. One such measure, citation analysis, is frequently used (Blackburn and Mitchell 1981; Garfield 1972). Most of the strengths and weaknesses (Todorov and Glanzel 1988) of citation analysis are from its use in macro-analytic frameworks rather than more micro uses. Despite criticisms (MacRoberts and MacRoberts 1996), efforts to improve it have been made (Trenchard 1992; Garfield and Welljams-Dorof 1992; Liu 1993). Thus citation analysis

seems to be the basis for a measure that would be easy to keep up-to-date and acceptable to scholars in the field (Garfield 1996 and 1972; Tahai and Meyer 1999).

Measuring the quality and influence of journals in general and of an individual article in particular are essential to academic careers. Journal rankings could be useful tools if derived without political influence. Such rankings can reduce uncertainty regarding research quality and provide explicit targets to researchers. However, rankings also have problems. Rankings developed at any one institution could reduce career mobility and impede career development since journals rated high at one institution may not be similarly rated at another. The results presented here indicate considerable variability. Rather than inferring micro quality from macro quality, faculties should be willing to evaluate the quality and influence of individual articles rather than relying solely on its outlet. This suggests the need for a more objective ranking of journals, depending less upon local opinions and more on the impact or contribution to the field.

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Appendix

Table A1. Descriptive statistics, correlations, and t-tests: US and Non-US (number of cases in correlation matrix)

US

	Variable	Mean	SD	n	1	2	3	4	5	6	7
1	Size	18.0122	6.1393	41	1.0000	0.1769 (41)	0.2413 (41)	-0.3620* (24)	-0.1790 (14)	-0.0694 (41)	-0.5006*** (41)
2	Others	7.4756	2.6825	41		1.0000	0.0569 (41)	-0.2574* (24)	0.1449 (14)	0.4640 (41)	-0.1022 (41)
3	Experience	14.3048	3.1193	41			1.0000	-0.2360 (24)	0.4445 (14)	0.1028 (41)	-0.1227 (41)
4	Quality-1	28.2100	16.7505	24				1.0000	-0.2589 (14)	-0.2937 (24)	nm
5	Quality-2	75.4428	10.2901	14					1.0000	-0.0470 (14)	0.1054 (14)
6	Control 87.8% public (1) 12.2% private (2)	1.0487	0.2154	41						1.0000	-0.0745 (41)
7	Research Focus 90.24% yes (1) 9.75% no (2)	1.0975	0.2967	41							1.0000

Non-US

	Variable	Mean	SD	n	1	2	3	4	5	6	7
1	Size	12.3571	7.2960	28	1.0000	0.4122** (28)	0.0599 (28)	-0.7141 (4)	-0.1031 (9)	-0.2990 (28)	nm
2	Others	12.5535	6.9715	28		1.0000	0.1993 (28)	0.5408 (4)	-0.1845 (9)	-0.2221 (28)	nm
3	Experience	8.6964	8.8788	28			1.0000	0.1251 (4)	0.1814 (9)	-0.2494 (28)	nm
4	Quality-1	32.1875	7.5822	4				1.0000	1.0000 (9)	nm	nm
5	Quality-2	68.2556	6.1077	9					1.0000	nm	nm
6	Control 92.85% public (1) 7.14% private (2)	1.0714	0.2575	28						1.0000	nm
7	Research Focus 100% yes (1) 0% no (2)	1.0000	0.0000	28							1.0000

nm = not meaningful;　　　　　* $p \le .10$; $p \le .05$; $p \le .01$

t-tests	Variable	t	Variable	t	Variable	t
	1 Size	3.4793***	2 Others	4.2384***	3 Experience	3.7318***
	4 Quality-1	0.4614	5 Quality-2	1.8836*		
	6 Control	0.3969	7 Research Focus	1.7348*		

Note.
Size = Number of tenured/tenure-track faculty
Experience = Average years since degree
Others = Number of other (non-tenure track) faculty
Quality-1 = RePEc Scores (low best); https://ideas.repec.org/top/top.agecon.html
Quality-2 = Best Global Scores (high best)[3]

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[3] http://www.usnews.com/education/best-global-universities/agricultural-sciences

Table A2. Descriptive statistics, correlations, and t-tests: US departments with and without lists (number of cases in correlation matrix)

With

	Variable	Mean	SD	n	1	2	3	4	5	6	7
1	Size	13.4166	2.5601	5	1.0000	0.0000 (5)	-0.2308 (5)	-1.0000*** (2)	nm	nm	-0.1961 (5)
2	Others	5.4166	1.2113	5		1.0000	0.2193 (5)	1.0000*** (2)	nm	nm	-0.5590 (5)
3	Experience	14.0933	3.8852	5			1.0000	1.0000*** (2)	nm	nm	0.6864* (5)
4	Quality-1	25.8900	23.7400	2				1.0000	nm	nm	nm
5	Quality-2	na	na	0					1.0000	nm	nm
6	Control 100% public (1) 0% private (2)	1.0000	0.0000	5						1.0000	nm
7	Research Focus 80% yes (1) 20% no (2)	1.2000	0.40000	5							1.0000

Without

	Variable	Mean	SD	n	1	2	3	4	5	6	7
1	Size	18.2777	5.7049	36	1.0000	0.1820 (36)	0.3278* (36)	-0.2391 (22)	-0.1791 (14)	-0.0865 (36)	-0.5512*** (36)
2	Others	7.6111	2.8010	36		1.0000	0.0609 (36)	-0.3213 (22)	0.1449(14)	0.4704*** (36)	-0.0504 (36)
3	Experience	13.9444	3.0963	36			1.0000	-0.3150 (22)	0.4446* (14)	0.1286 (36)	-0.2988 (36)
4	Quality-1	28.4209	15.9473	22				1.0000	-0.2589 (14)	-0.0357 (22)	nm
5	Quality-2	75.4428	10.2901	14					1.0000	-0.0470 (14)	0.1054 (14)
6	Control 94.44% public (1) 5.56% private (2)	1.0555	0.2290	36						1.0000	-0.0731 (36)
7	Research Focus 91.67% yes (1) 8.33% no (2)	1.0833	0.2763	36							1.0000

na = not applicable;   nm = not meaningful;   * $p \leq .10$; $p \leq .05$; $p \leq .01$

t-tests	Variable	t	Variable	t	Variable	t
	1 Size	1.8633*	2 Others	1.7146*	3 Experience	0.0979
	4 Quality-1	0.2092	5 Quality-2	nm		
	6 Control	0.5360	7 Research Focus	0.8391		

Note.
- Size = Number of tenured/tenure-track faculty
- Experience = Average years since degree
- Others = Number of other (non-tenure track) faculty
- Quality-1 = RePEc Scores (low best); https://ideas.repec.org/top/top.agecon.html
- Quality-2 = Best Global Scores (high best)[4]

[4] http://www.usnews.com/education/best-global-universities/agricultural-sciences

Table A3. Descriptive statistics, correlations, and t-tests: Non-US departments with and without lists (number of cases in correlation matrix)

With

	Variable	Mean	SD	n	1	2	3	4	5	6	7
1	Size	12.1000	6.2209	15	1.0000	0.6039*** (15)	0.3674 (15)	nm	0.1141 (4)	-0.3564 (15)	nm
2	Others	9.9666	5.9403	15		1.0000	0.1791 (15)	nm	0.4271 (4)	-0.3669 (15)	nm
3	Experience	11.1333	5.4665	15			1.0000	nm	-0.6525 (4)	-0.2843 (15)	nm
4	Quality-1	30.6600	0.0000	1				1.0000	nm	nm	nm
5	Quality-2	67.6000	3.5601	4					1.0000	nm	nm
6	Control 100% public (1) 0% private (2)	1.1333	0.3399	15						1.0000	nm
7	Research Focus 80% yes (1) 20% no (2)	1.0000	0.0000	15							1.0000

Without

	Variable	Mean	SD	n	1	2	3	4	5	6	7
1	Size	12.6538	3.9001	13	1.0000	0.1485 (13)	-0.4392 (13)	-0.9991*** (3)	-0.2739 (5)	nm	nm
2	Others	7.2307	6.5703	13		1.0000	0.2722 (13)	0.5361 (3)	nm	nm	nm
3	Experience	14.1923	4.5541	13			1.0000	0.4630 (3)	0.3065 (5)	nm	nm
4	Quality-1	32.6966	8.6957	3				1.0000	1.0000 (3)	nm	nm
5	Quality-2	68.7800	7.5093	5					1.0000	nm	nm
6	Control 94.44% public (1) 5.56% private (2)	1.0000	0.0000	13						1.0000	nm
7	Research Focus 91.67% yes (1) 8.33% no (2)	1.0000	0.0000	13							1.0000

na = not applicable; nm = not meaningful; * p ≤ .10; p ≤ .05; p ≤ .01

t-tests Variable	t	Variable	t	Variable	t
1 Size	0.2769	2 Others	1.1572	3 Experience	1.5935
4 Quality-1	nm	5 Quality-2	0.2867		
6 Control	1.4104	7 Research Focus	nm		

Note.

Size	=	Number of tenured/tenure-track faculty
Experience	=	Average years since degree
Others	=	Number of other (non-tenure track) faculty
Quality-1	=	RePEc Scores (low best); https://ideas.repec.org/top/top.agecon.html
Quality-2	=	Best Global Scores (high best)[5]

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[5] http://www.usnews.com/education/best-global-universities/agricultural-sciences

Private vs. Collective Wine Reputation

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Abstract

Using a hedonic pricing model, this paper investigates the pricing implications of two broadly defined wine reputation strategies: private and collective. While the former consists of an individual quality differentiation strategy relying on an individual wine producer's own reputation, the latter mainly relies on the reputation of a group of wineries belonging to a particular geographic denomination. To this aim, wine purchases made by a nationally representative panel of Italian households were analyzed. Estimates based on quantile regression reveal that the effects of the two reputation strategies (private and collective) have a different weight according to the price segment of the wines in question. While private reputation plays a major role in both low and high priced wines, collective reputation in terms of geographical designations seems especially important for high priced wines.

Keywords: hedonic price function, Italian wine sector, quantile regression, geographical indication.

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Introduction

Reputation plays a crucial role in markets where product quality is uncertain until after consumption (Rogerson 1983; Rindova et al. 2005). Products showing such features are defined as credence goods (Nelson 1970; Roe and Sheldon 2007). Company names, individual brands or collective certification contribute to defining signals that affect consumers' expected quality of credence goods (Costanigro et al. 2012). The effects of reputation on food, whether private or collective, have been widely investigated in the literature (Di Vita et al. 2013; Brentari et al. 2011; Costanigro et al. 2010; Benfratello et al. 2009; Landon and Smith 1997; Shapiro 1983). Within the food industry, wine represents a clear example of a credence good[1]. It constitutes a rather complex and sophisticated case where a reputation system is of paramount importance for marketing outcomes. Most wineries have their own brand and at the same time can potentially benefit from a regional, and collective reputation such as that endorsed by a geographical indication (GI) label. Several marketing strategies have been designed worldwide to increase reputation for wines (Louriero 2003). This is due to a particular aspect of wine: drinking a glass or buying a bottle of wine embodies a bundle of choices that depend on attributes that different consumers identify, deem or perceive, in a different way (Ritchie 2007; Caracciolo et al. 2015; Dal Bianco et al. 2016).

Perceived quality and reputation attributes have been widely recognized in the wine industry, leading most scholars to argue that producer/private and regional/collective reputation plays a prominent role in determining wine price (Costanigro et al. 2010; Schamel 2006; Schamel and Anderson 2003). Despite the large number of contributions in the economics literature, the role of a wine's reputation in price formation is still widely debated (Panzone 2011; Costanigro et al. 2010; Goldstein et al. 2008; Tirole 1996; Shapiro 1983) and the effect that private and collective reputation have on price formation is still unclear. To illustrate this point, it has been observed that price allows better evaluation of wine quality than sensory attributes (Almenberg and Dreber 2011; Rao 2005; Rao and Monroe 1989; Monroe 1973), positively influencing the perception of expected quality and possibly contributing to the formation of the product's reputation (Veale and Quester 2008). For this reason, valuing the effect of private and collective reputation on price is far from straightforward.

Initiatives to enhance private reputation (based on producer brand) and collective reputation (such as the Geographical Indication label) may be viewed as two extreme quality differentiation strategies. While the former consists of an individual quality differentiation strategy relying on an individual wine producer's own reputation (Landon and Smith 1997; Shapiro 1983), the latter can be considered the sum of individual reputations, despite that it may be also affected by specific features of the group, such as size of the coalition[2]. Hence consumers might make their choice on the reputation of the region that endorses the particular denomination (Winfree and McCluskey 2005; Chambolle and Giraud-Héraud 2005; Loureiro 2003; Tirole 1996).

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[1] According to Schmit et al (2012) and Castriota and Delmastro (2014), wine can also be considered as an experience good when the consumer has the capability to measure its utility gain or loss after consumption. Thus, if for an expert consumer may prevail the experience side, for the average consumer the credence side is certainly more important. Considering we analyze the average Italian household, we referred to wine as a credence good.

[2] For instance, the size of a coalition could affect group reputation since it may influence its visibility (Castriota and Delmastro 2014).

Both strategies require long-term choices for wineries: adopting a *private brand* reputation strategy entails long-term investments in production/processing/bottling and marketing/promotion, as well as additional costs related to procurement strategies; *Geographical Indication,* or collective reputation, requires compliance with stringent quality schemes that are likely to pre-commit production level (delimited production area, maximum yields per hectare, maximum yield of wine from grapes, minimum density of rootstocks per hectare, etc.) with a loss of production flexibility for the wineries (Malorgio et al. 2013).

Whether either of the two strategies is beneficial for wineries depends on a number of factors. One could be strictly related to the specific segment of wine under investigation, and it cannot be excluded that the two strategies may be complementary and mutually reinforcing or even conflicting.

Indeed, according to Menapace and Moschini (2011), an interaction exists between collective and private reputation, with the former improving the ability of the latter to operate as a mechanism for signaling quality to consumers in a credible way. However, the perception of quality signals, including those related to private and collective reputation may largely vary across consumers, making their effect on the market complex to analyze. For instance, preferences for wine attributes, including the region of production and brand name also depend on consumers' expertise, (or subjective knowledge) differing among experts and novices (Viot 2012). Therefore, the resulting impact of both private and collective reputation strategies may vary according to consumers' characteristics, including wine involvement, geographical distance to the production area, age, etc. (Hristov and Kuhar 2015; Atkin and Thach 2012).

Since this point remains largely unaddressed by the literature, our study aims to partially fill this significant gap by valuing the contribution of both private and collective wine reputation to price. To do so, purchases of wines in 2011 by nearly 8,000 households, statistically representative of the Italian population, were analyzed in an attempt to disarticulate the relationship between price and wine reputation by estimating the hedonic function using quantile regression.

Quantile regression has been widely used in economic research related to consumer studies (Davino et al. 2015) and alcohol consumption (Kerr et al. 2006; Manning et al. 1995). In addition, a recent contribution using quantile regression showed that the importance of reputation varies as product prices change (Costanigro et al. 2010). Nevertheless, to the best of our knowledge, no estimates of hedonic function have been performed which compare private vs. collective reputation in the wine industry.

The paper is organized as follows. In Section 2 the theoretical framework and empirical approach adopted are described. Section 3 presents the sample data while Section 4 presents the estimates of the hedonic function via quantile regression. Some discussions are drawn in Section 5, while Section 6 concludes the paper.

Theoretical and Empirical Framework

Since the seminal study on hedonic modeling carried out by Rosen (1974), several studies have analyzed the quality attributes and characteristics of wine, estimating their implicit prices (Combris et al. 1997; Landon and Smith, 1997; Nerlove 1995; Oczkowski 1994; Golan and Shalit 1993). Hedonic price estimation has continued to be applied worldwide to the wine industry in the 21st century (Kwong et al. 2011; Schamel and Anderson 2003; Ling and Lockshin 2003; Oczkowski 2001; Combris et al. 2000), and some authors have specifically analysed Italian wine (Di Vita et al. 2015; Caracciolo et al. 2013; Brentari et al. 2011; Boatto et al. 2011; Benfratello et al. 2009).

The hedonic pricing method assumes that goods consist of a bundle of characteristics valued by their utility-generating properties. Market price reflects the composition of the attributes that, on the contrary, have no explicit price. To this extent, it is possible to value the attributes that compose the final good by analyzing the systematic variation in the price (Rosen 1974).

One of the crucial choices to make when using a hedonic function concerns the functional form of the hedonic price function (Combris et al. 2000). In the literature, there are many functional forms implemented (Fogarty 2006). Testing non-linearity parameters via Box-Cox transformation mainly drives the choice. That said, the stochastic version of the hedonic equation is generally estimated through ordinary least squares. However, this approach proves to be insufficient when the sample of wines is heterogeneous, and there is a broad distribution of prices (Costanigro and McCluskey 2011). Furthermore, hedonic price estimation with OLS can be cumbersome when quality information (or signaling attributes) change at different price ranges (Oczkowski 2001).

To overcome this limitation, in this work we implemented quantile regression (QR), which produces the estimate conditional upon different price percentiles, allowing analysis of the effect of key variables on different price levels/quantiles (Davino et al. 2015).

Stochastic formulation of the hedonic equation for the *w-th* wine estimated with quantile regression is as follows:

$$(1) \quad Qp_w(\tau \mid \mathbf{x}_w) = \alpha(\tau) + \mathbf{x}_w'\boldsymbol{\beta}(\tau) + \varepsilon(\tau)_w$$

Equation 1 expresses the quantiles of the conditional distribution of wine price as linear functions of $\mathbf{x_w}$, a R-vector of wine attributes $\mathbf{x_w} = \{x_w^1, ...x_w^R\}$, where $0 < \tau < 1$.

The *τ-th* QR estimator of $\boldsymbol{\beta}(\tau)$ minimizes the following objective function through the linear programming algorithm initially proposed by Armstrong et al. (1979) and generalized by Hunter and Lange (2000):

$$(2) \quad \sum_w \left| p_w - \alpha(\tau) + \mathbf{x}_w'\boldsymbol{\beta}(\tau) \right| h_w$$

where h$_w$ is the multiplier defined as:

$$(3) \quad h_w = \begin{cases} 2\tau & \text{if} \quad \left(p_w - \alpha(\tau) + \mathbf{x}_w'\boldsymbol{\beta}(\tau)\right) > 0 \\ 2(1-\tau) & \text{otherwise} \end{cases}$$

obtaining different values of $\boldsymbol{\beta}(\tau)$ for different values of τ indicated in the estimation.[3] Regarding the choice of the functional form which best fits the data, we conditioned the choice by the OLS estimates of restricted likelihood ratio tests on the Box-Cox transformation parameters θ (Cropper et al. 1988):

$$(4) \quad Qp_w^\theta(\tau \mid \mathbf{x}_w) = \alpha(\tau) + \mathbf{x}_w^{\boldsymbol{\theta}}{}'\boldsymbol{\beta}(\tau) + \varepsilon(\tau)_w$$

As for the selection of the appropriate set of attributes, $\mathbf{x}_w$, the literature on hedonic pricing provides important clues that guided our choice. Besides variables representing intrinsic attributes such as alcoholic content, grape variety and color (Oczkowski 1994; Landon and Smith 1997; Angulo et al. 2000; Steiner 2004), and extrinsic attributes such as age, brand, taste, bottle size, packaging, eco-friendly viticulture practices and size of producers (D'Amico et al. 2014; Kwong et al. 2011; Carew et al. 2012; Benfratello et al. 2009; Combris et al. 2000), also reputation has been tested, since pricing behaviour of wineries could depend on their reputation (Ali and Nauges 2007). To this extent, almost all studies were based on expert grading, showing a prominent role in price formation (Caracciolo et al. 2013; Schamel 2006; Jones and Storchmann 2001; Landon and Smith 1997). The drawback is, however, that expert opinions and wine ratings do not cover the whole range of wines on the market, especially non-premium wines and, in several cases, expert opinions differ from the preferences of average consumer since the latter "*…simply does not like the same types of wines as experts*" (Goldstein et al. 2008, 12). Nevertheless, the long-term reputation of wines and producers is more valuable than taste attributes in market price formation (Benfratello et al. 2009), and GI has to be taken into account with regard to the effect on reputation (Teuber and Hermann 2012). In this study, we particularly focus on the contribution of both private and collective wine reputation on price. While the latter can be straightforward—included in a hedonic function, the former presents methodological challenges that need to be properly addressed.

In particular, private reputation can be approximated by means of the share of category requirements (SCR). SCR is one of the most "*…common loyalty measures used by most major market researchers*" (Bhattacharya et al. 1996, 6). For the *b*-th brand, it is defined as each brand's market share among the group of households that bought the brand at least once during the time period under consideration:

$$(5) \quad SCR_b(T) = \frac{\sum_h \sum_{t \in T}(p_{hb} \cdot q_{hb})}{\sum_h \sum_j \sum_{t \in T}(p_{hj} \cdot q_{hj})} \cdot 100 \, .$$

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[3] The absence of assumptions on the distribution of errors is significantly more robust to anomalous values (or outliers) and is substantially unaffected by heteroskedasticity problems.

where $p_{hb} \cdot q_{hb}$ represents the expenditure for brand b by household h during time period T (one year in our case), while j refers to all the brands purchased by household h during the same time period. SCR reflects the intangible benefits linked to the b-th brand measuring the customer loyalty. Even though customer loyalty is strongly interconnected to private reputation, it might also be affected by other variables, like market price (Selnes 1983). For instance, consumers can be loyal to brands also for their lower prices. Thus the inclusion of SCR_b in a hedonic function may induce ambiguity in the causal direction and introduce endogeneity. Usually, instrumental variable approach (IV) can be evoked to address this source of endogeneity. The use of IV's in quantile regression (IVQ) was recently proposed by Chernozhukov and Hansen (2005; 2006) however, is not exempt from limitations, and it is still rarely used in empirical works. Moreover, we have no access to external exogenous data for obtaining a reliable set of instruments.

Our strategy to avoid endogeneity is as follows, being aware that the adopted approach represents an ad-hoc solution rather than a generalizable solution: firstly, in order to calculate SCR_b we used a separate sample from the one used in the hedonic equation, including data on prices and expenditures referring to the year preceding the one for which hedonic model is estimated[4]. Moreover, we acknowledge the customer loyalty as calculated in time t -1, $SCR_{b,t-1}$, can be decomposed into two parts: the first, $SCR(corr)_{b,t-1}$, potentially depending to the average $p_{b,t-1}$ market price for the b-brand, and the remaining part that captures the variation of $SCR_{b,t-1}$ that results uncorrelated to $p_{b,t-1}$, $SCR(unc)_{b,t-1}$. $SCR(unc)_{b,t-1}$ can be proxied by using the estimated residuals, $\hat{SCR}(unc)_{b,t-1}$ as provided by the OLS estimate of γ_0 and γ_1:

$$(6) \ \hat{SCR}(unc)_{b,t-1} = SCR_{b,t-1} - \hat{SCR}(corr)_{b,t-1} = SCR_{b,t-1} - \hat{\gamma}_0 - \hat{\gamma}_1 \ln(p_{b,t-1})$$

This strategy allows inclusion of exogenous information about private reputation of each b-brand into the hedonic equation, and their role in influencing the price for the single w-th wine in time t.

Data

Our empirical specification is built on the full set of wines marketed for domestic consumption in the year 2010 and 2011 in Italy. The empirical analysis embodies the underlying data generation process straightforwardly. More than 150,000 purchases of wine made by around 8,000 households, statistically representative of the Italian population, were recorded (HomeScan) by A.C Nielsen (a leading market research organization operating worldwide). The database reports around 2,100 brands of wines from about 1,000 wineries which market close to 6,000 different types and formats of wine. For each purchase the following data are recorded: price (€), the volume purchased (liters), product type (white, red or rosé), geographical origin, sales channels, packaging (glass, carton, PET, bag in box and the volume format) and lastly, the presence of geographical indication. As for the latter, it is worth noting that the EU legislation uses the terms PDO and PGI (respectively Protected Designation of Origin and Protected Geographical Indication[5]) to specify geographical indications. In Italy, and only for wine, the designations DOC and DOCG constitute PDOs. [6] Jointly the three certifications of geographical indication can be seen as a quality hierarchy, in which PGI wines have to be considered higher

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[4] Previous year data were used for breaking the temporal "simultaneity" of prices and brand loyalties.
[5] EC Reg. 607/2009
[6] ITA DL 61/2010

quality than simple table wines, although they do not conform to the strict wine laws for their region (DOC).[7] The main difference between a DOC and a DOCG is that the latter must pass a blind taste test for quality in addition to conforming to the strict legal requirements to be designated as a wine from the area in question (Corsi et al. 2004; Cembalo et al. 2014). The Nielsen database does not include consumption which goes through HORECA channels (HOtels, REstaurants and CAfés). However, from a Mediobanca study (2013) it emerges that wine purchased for domestic consumption accounts for about 70% of total consumption in volume.

Purchases made during 2010 were used to obtain exogenous information about the private reputation of each *b*-brand, while those made during 2011 were explicitly included in the hedonic model[8]. Secondary data sources, such as scanner panel data, are particularly appropriate for depicting the structure of the wine market: there is a large variability in wine prices, with a highly asymmetric distribution. The distribution of prices is furthermore extremely skewed to the right (Figure 1). The mean value is 3.3€per liter while the median is 2.44€per liter, interquartile range 1.33€per liter - 4.2€per liter).
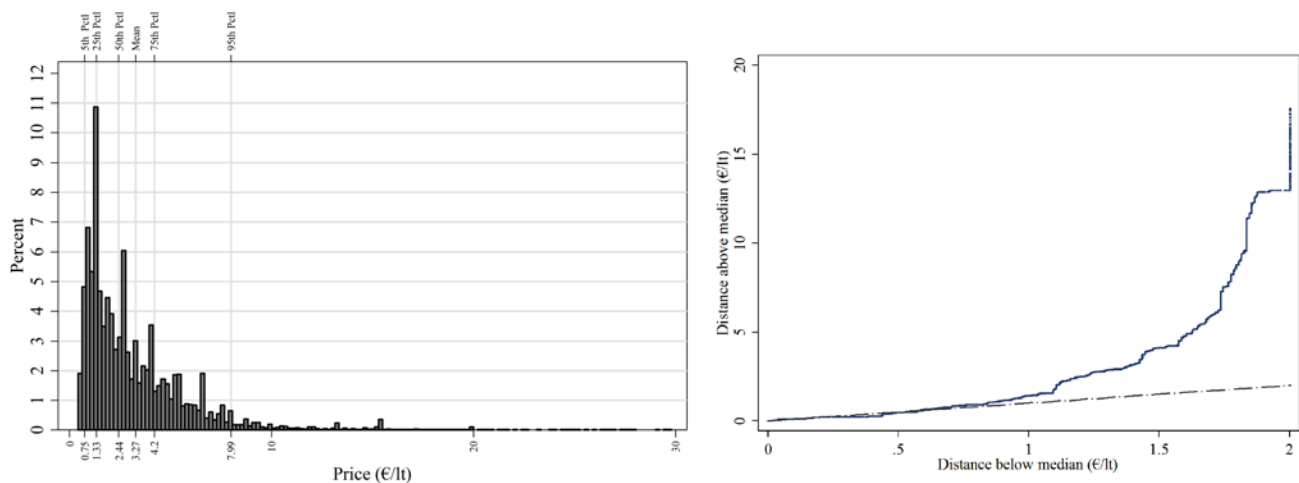
Figure 1. Wine price distribution (histogram and symmetry plot)
Source. AC Nielsen Homescan data 2011

Regarding the adopting of collective or private reputation systems by wine producers, Table 1 reports the position of the top fifteen private Italian wine brands, showing the measures of private and collective reputation as well as a measure of producer market share. Collective reputation, associated with specific production locations, was expressed as the incidence of three GI Italian labeling certifications per brand.

From a preliminary inspection of Table 1, it seems that strong private reputation initiatives (in terms of SCR) are rarely associated with collective initiatives such as adoption of PGI, DOC, and DOCG certifications (Pearson correlations between SCR(*unc*) and GIs are, respectively, -0.49 for PGI, -0.40 for DOC and -0.42 for DOCG).

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[7] Italian wineries on their own initiative may also use EU PGI and PDO indications and the corresponding European logos in place of the traditional domestic acronyms (Corsi et al. 2014). PDO labeled wine was observed in few cases only and handled as DOC in the model.

[8] In 2011, nearly 80,000 purchases of wine were recorded by A.C Nielsen.

As regards market price, thirteen out of fifteen brand leaders have an average market price lower than the sample mean. It is worth noting that private label wines from Coop and Conad benefit high value of SCR(*unc*), being behind only the market leader Tavernello which, since 2002, has been the most popular brand of table wine (Torrisi et al. 2006). Finally, among the top fifteen brands in terms of market penetration, only three premium wines[9] ranked 11[th,] 13[th,] and 15[th,] mainly characterized by the adoption of both PGI and DOC labeling.

Table 1. Top fifteen private Italian wine brands ordered by brand market penetration

Brand	Private Reputation		Collective Reputation				
	Brand market penetration[a] (BMP)	Brand share category of requirements (in bracket SCR *unc*)	PGI (%)	DOC (%)	DOCG (%)	Producer market share[b]	Average price (€per liter)
Tavernello	18.5	20.7 (18.6)	2.1	0.0	0.0	5.28[c]	1.43
San Crispino	11.3	12.0 (10.5)	0.0	0.0	0.0	2.06	1.30
Conad	8.2	18.8 (13.0)	7.3	0.2	0.1	1.05	1.03
Quargentan	6.4	14.0 (12.0)	43.1	1.3	0.0	0.53	1.03
La Cacciatora	6.4	7.5 (6.1)	46.7	34.2	6.2	2.60	2.16
Freschello	5.1	10.8 (9.6)	0.0	0.0	0.0	1.06	1.72
Castellino	4.9	10.8 (9.0)	0.0	0.0	0.0	5.28[c]	1.39
Coop	4.9	17.3 (15.3)	0.0	0.0	0.0	0.57	0.98
Carrefour	4.0	12.7 (8.7)	14.9	13.5	1.7	0.56	1.59
Botte Buona	3.8	8.3 (6.6)	100.0	0.0	0.0	5.28[c]	1.91
C.S.Soave	3.6	6.3 (5.6)	25.9	23.2	2.6	1.54	3.28
Caldirola	3.5	6.0 (4.9)	45.3	43.2	0.0	2.60	2.22
Zonin	3.4	6.6 (5.0)	39.9	24.2	1.9	1.54	4.16
Gotto D'oro	3.3	12.6 (10.7)	20.4	76.0	0	0.94	2.07
Cavit	3.3	7.5 (6.9)	0.0	89.2	0	1.57	5.84

[a] Number of purchasers of the specific brand over total purchasers (%)
[b] Total consumer expenditure on wines produced by the specific producer over total expenditure (%)
[c] Tavernello, Castellino and Botte Buona are brands owned by the same company (Caviro).
Source. AC Nielsen Homescan data 2011

Results

In estimating a quantile hedonic function we assume that implicit prices, focusing on those of private (SCR(*unc*)) and collective (GI: PGI, DOC and DOCG) reputation, significantly vary through different percentiles of the marketed price. The dependent variable consists of the logarithm [10] of the wine price. As regards the observable attributes $\mathbf{x}_w$, other than those concerning reputation, we include distribution channels such as discount stores or specialized

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[9] According to a well-established classification (Heijbroeck 2003), premium (popular) wine are those wines sold at least at 3€L.

[10] According the restricted likelihood estimates, the functional form which best fits the data is the double log.

shops, the presence of promotion (in terms of discount sale price), packaging, and wine color[11]. Table 2 shows the full descriptive statistics of the whole set of regressors, while estimation results are reported in Table 3. Figures 2 and 3 show a graphical display of coefficients and confidence intervals for, respectively, private and collective reputation variables as τ varies from 0 to 1. This graphical representation of the estimates allows us to verify the implicit prices of attributes with respect to different price segments of wines. Furthermore, the confidence intervals indicate the robustness of the results.

Table 2. Descriptive statistics of variables in the model

Variable	Mean	Std. Dev.	Min	Max
*ln*Price	1.027	0.691	-0.861	2.919
ln SCR(*unc*)	3.524	0.513	-2.303	4.656
PGI (1 if wine with PGI certification; 0 otherwise)	0.246		0	1
DOC (1 if wine with DOC certification; 0 otherwise)	0.331		0	1
DOCG (1 if wine with DOCG certification; 0 otherwise)	0.045		0	1
Discount (1 if purchased in a grocery outlet; 0 otherwise)	0.104		0	1
Specialized shop (1 if purchased in a specialized shop; 0 otherwise)	0.398		0	1
Promotion (1 if purchased with a promotion; 0 otherwise)	0.366		0	1
Packaging (1 if sold in a glass bottle; 0 otherwise)	0.693		0	1
ln Format (volume L.)	-0.134	0.451	-1.386	1.609
Wine color (1 if red wine; 0 otherwise)	0.525		0	1

Table 3. Hedonic function estimates via quantile regression and OLS

Variable	25		50		75		OLS	
ln SCR(*unc*)	0.017	***	0.001		0.055	***	0.011	***
PGI	0.224	***	0.209	***	0.254	***	0.222	***
DOC	0.500	***	0.499	***	0.497	***	0.489	***
DOCG	0.668	***	0.685	***	0.730	***	0.725	***
Discount	-0.355	***	-0.456	***	-0.624	***	-0.496	***
Specialized shop	0.040	***	0.001		0.012	**	0.025	***
Promotion	-0.109	***	-0.120	***	-0.136	***	-0.138	***
Packaging	0.540	***	0.633	***	0.817	***	0.675	***
Wine color	0.029	***	0.001		-0.004		-0.006	*
ln Format	-0.372	***	-0.367		-0.336	***	-0.382	***
Constant	-0.225	***	0.085	***	0.066		0.035	**
P(τ)	1.33		2.44		4.2		3.27	

	Restricted log likelihood
θ = −1	-97,477
θ = 0	-85,251
θ = 1	-123,293

[11] Variables included in the model simply reflect the data collected and made available by AC Nielsen.
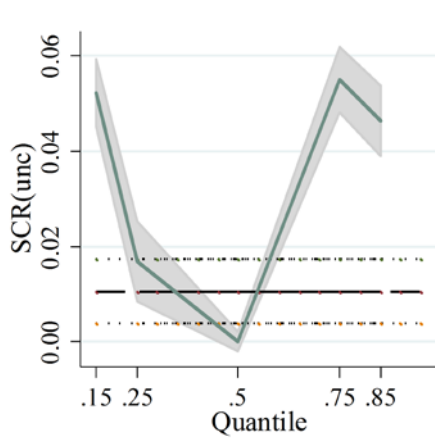
Figure 2. Coefficients and confidence intervals of OLS and as τ varies from .15 to .85 for private reputation wine attribute - SCR(unc)
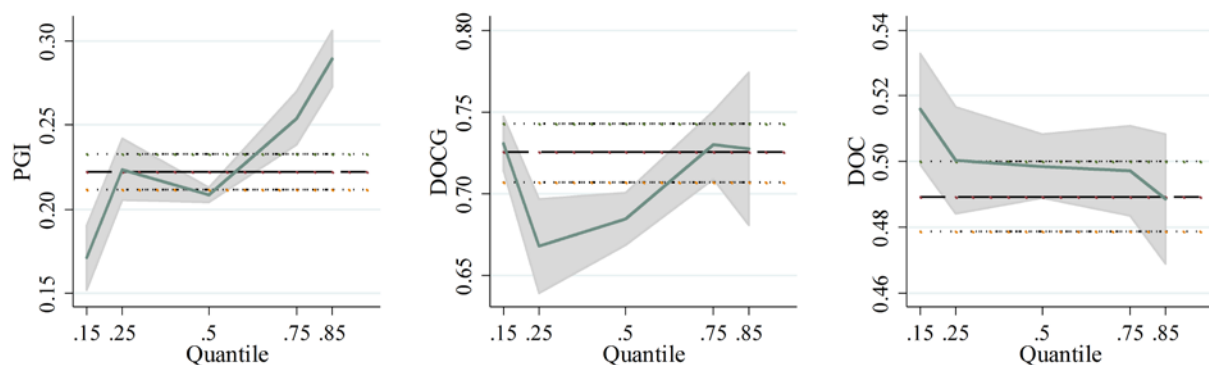
Figure 3. Coefficients and confidence intervals of OLS and as τ varies from .15 to .85 for collective reputation wine attributes (PGI, DOC and DOCG certifications)

SCR(*unc*) was included in the hedonic function as a logarithm, so the estimated coefficients may be directly interpreted as elasticities. More precisely, they represent the effect, in percentage terms, on the price of the *w*-th wine due to a unit percent change in private reputation of the *b*-th brand. Estimated coefficients are positive, thus, the higher the private reputation of the *b*-brand, the higher the price premium received by the *w-th* wine. Coefficient estimated show a u-shaped pattern across quantiles. To illustrate, price premium declines up to the 50th quantile (nadir) and rises afterward with a peak at the 75th quantile. Put differently, the price effect of private reputation seems more relevant for both low-priced and high-priced wines (Table 3 and Figure 2).

As for certifications of origin, the pyramid of quality seems to be confirmed: consumer appreciation of wines increases as the level of origin designation increases from lower (PGI) to higher quality (DOCG) in all quantiles. PGI, DOC and DOCG positively contribute to a price premium in all wine segments, though they show different patterns. While the implicit price of DOC certification, in percentage terms of sold product, may be considered constant among centiles, the implicit price of PGI attribute shows an increasing trend: PGI rewards more, in percentage terms of sold product, those wines that fall in the higher centiles. As for DOCG certification, it seems less rewarding for medium-priced wines. Put in terms of private (SCR(*unc*)) and collective reputation strategies; it seems that non-premium wines that compete

in a crowded market segment, are forced to implement differentiation strategies to compete among suppliers, aiming to convey positive quality attributes.

In evaluating sales channels (discount stores and wine shops) it is advisable to interpret the relative parameters jointly. Wine shops and discount stores represent diametrically opposite sales methods: As a result, the two trends are opposite. This outcome confirms that the price formation mechanism at large-scale retailers is quite different from that of wine shops (Brentari et al. 2011; Levaggi and Brentari 2014 [12]). Greater emphasis is laid on discount stores through which discounts may be obtained for the whole range of wine. Furthermore, discount stores play a negative role on price. For wine shops, the result is diametrically the opposite: all wines sold within this sales channel receive a price premium.

As expected, promotion adversely affects price formation, showing a higher impact on higher priced wines. As regards the other attributes included in the model, our findings suggest that packaging (glass bottle) affects price positively for all types of wines. By contrast, larger bottle size has a negative impact on price determination for all price classes; lastly, red wine has a negative impact on price determination only for lower priced wines.

We finally tested for the interquartile difference of estimated parameters. This is necessary to see whether estimated coefficients vary significantly through different percentiles. Table 4 reports the above estimates and the significance level for the hypothesis of sample homogeneity conditional on selected covariates. Major differences occur across different points in the distribution, showing that implicit prices of selected wine attributes statistically vary among quantiles. In particular, the greatest differences in estimates occur for the differences [50th – 25th quantile] and [75th – 50th quantile] wherein almost all coefficients of differences are significant. This result provides further empirical evidence of hedonic price estimation based upon price classes: since different coefficients refer to a statistically significant difference in the valuation of wine attributes by consumers, it is reasonable to conclude that these wine classes might be considered by consumers as strongly non-homogeneous.

Table 4. Interquartile estimates

Variables	50/25		75/50	
ln SCR(*unc*)	-0.017	***	0.055	***
PGI	-0.015	***	0.046	***
DOC	-0.002		-0.001	
DOCG	0.017		0.045	***
Discount	-0.101	***	-0.168	***
Specialized shop	-0.039	***	-0.013	***
Promotion	-0.011	***	-0.016	***
Packaging	0.093	***	0.184	***
Wine color	-0.028	***	-0.005	
ln Format	0.005		0.031	***
Constant	0.269	***	-0.019	***

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[12] However, while Levaggi and Brentari (2014) demonstrated, using separate hedonic functions, that the main determinants of price formation are quite different into the two distribution channels, we included the role of distribution channels as a fixed effect. In other terms we do not analyze explicitly the interaction of the distribution channels with the other price determinants.

Discussion

From the trend of the coefficients relative to private reputation (SCR(*unc*)) it may be inferred that the impact on price of the latter is lower for the medium price range, thereby enhancing the value of wines in the low and high price ranges. By contrast, when it comes to the trend of the coefficients for collective reputation (PGI, DOC and DOCG), it can be seen that, while DOC certification contributes similarly to price premiums in all wine segments, PGI and DOCG certifications most enhance the value of wines falling in the higher centiles. The latter result confirms the conclusion of Di Vita et al. (2015) and Menival and Charters (2013), showing a highly heterogeneous impact of the collective reputation. While Di Vita et al. (2015) showed that wines certified as PGI achieve prices that are progressively higher as the price level of the wine increases, Menival and Charters (2013) demonstrated the variability of geographical reputation that can be either positive or negative for wineries. Discussing the results by price classes, designation of origin, especially DOC and DOCG certifications, and private reputation play a major role for lower priced wines compared to medium-priced wine segments. The importance of private reputation for lower priced wines seems supporting the results of Carpenter et al. (1994). Brands may successfully differentiate products on the basis of attributes that on closer examination seem irrelevant to experts (*meaningless differentiation*). Similarly, collective reputation for lower priced wines seems to have the same effect. DOCG (and also DOC) certifications would recall to consumers wines of higher prestige (and price), (probably) without having the same intrinsic characteristics. This phenomenon is likely to happen with less involved consumers.

Equally, private reputation is relevant in high priced wines too. This result is not surprising since the importance of brand in non-essential goods have been widely highlighted in literature, especially for consumers with high income (Han et al. 2010). Collective reputation in terms of geographical designation, especially PGI and DOCG, confirms their positive effect also for high priced wines, supporting what has been suggested elsewhere (Schamel 2006; Steiner 2004). Finally, private reputation and DOCG certification result less effective when considering medium-priced wine segments.

The empirical results appear to suggest the possible key to success on the Italian market, for which there has been a historic lack of specific studies. High-quality wineries seem to be stimulated to set their marketing strategies at low volumes and high prices, and in some cases, to follow niche strategies, while industrial wineries could be encouraged to develop private brands, sourcing from multiple production areas, tending towards high volumes with low or medium price tags. These findings are consistent with the results of Malorgio et al. (2013) and depict quite well the structure of the Italian wine market, characterized by the widespread presence of industrial lower priced wine trademarks (such as San Crispino, Freschello, Castellino and Coop) that aim to strengthen the degree of consumer loyalty to their own brand.

From an empirical point of view, we found that a model allowing for the existence of price classes is better at explaining the variability in the data and produces more accurate and interpretable results regarding the implicit prices of the attributes. Moreover, our findings suggest that the wine market in Italy could be considered as segmented into several product classes or market segments, confirming, in this regard, previous findings revealed by Costanigro

et al. (2007), Kwong et al. (2011) and Di Vita et al. (2015). Costanigro et al. (2007) distinguished different price categories, revealing the presence of several market segments (commercial, semi-premium, premium, and ultra-premium) although they took into account wine categories whose prices were, on average, considerably higher than those included in our study. Similarly, Kwong et al. (2011) estimated two separate hedonic models for high and low price wines and demonstrated the presence of price segmentation between two classes of wines. The same authors also showed that the hedonic price function for lower priced wines is strongly influenced by search attributes related to the label. Finally, Di Vita et al. (2015) identifies the wide heterogeneity existing in the Sicilian wines market using quantile regression technique as well.

The present study provided empirical evidence mainly for non-premium (or basic) wine marketing, highlighting important implications for wineries in this segment. The marketing activities of such wineries should be based on enhancing private reputation. This strategy could be achieved by developing promotional strategies, such as participating in wine fairs (Benfratello et al. 2009; Oczowski 1994;), or emphasizing (if appropriate) the expert judgments of wine guides on the label (Caracciolo et al. 2013). In conclusion, initiatives to enhance both private and collective reputations, though valued differently by consumers depending on specific wine classes under examination, have to be considered complementary and mutually reinforcing.

Limitations

Starting with the concept introduced in this study concerning private and collective reputation strategies on price formation, future research could develop a strategy to identify cut-off market prices. Indeed, as results have shown, there are several wine classes. However, the model implemented did not endogenously set specific cut-off prices. Moreover, in order to fully disentangle the contribution of private and collective reputation on price, more dedicated, valid indexes should be computed. SCR is only rough proxies of private reputation, and we believe this index is still at an early stage. At the same time, as regards collective reputation variables, if data were available, proxies of investments in advertising could provide a better understanding of this kind of reputation strategy. Eventually, we did not assess the possible interaction between the two types of reputation, and in particular the effect of collective reputation on the producers' capability of assuring quality through private reputation. The analysis of the effect of distribution channel on price mechanism is here also undeveloped and deserve further investigation. Moreover, the potential presence of omitted variables could result in overestimating the effect of private and collective reputation. Finally, this study did not consider denomination of origin-specific reputation effects so that a further and deeper investigation in this field is also needed.

Conclusions

This study valued the impact of private and collective reputation on Italian wine market prices through a hedonic pricing model, using a dataset including more than 150,000 purchases collected by AC Nielsen. A quantile regression - that produces the estimate conditional upon different percentile—was implemented, to allow analysis of the effect of key variables on different price levels/quantiles. Our results show that implicit price estimates of private, as well as collective reputation vary largely through different percentiles of sale price. Our findings have

implications for the literature on food reputation, providing additional but consistent results with those of earlier studies that observed the presence of a price premium for collective reputation (Menival and Charters, 2013; Oczkowski 2001; Landon and Smith, 1997). Indeed, this study provides empirical evidence that both reputation systems significantly contribute to wine price formation at different price segments.

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Food Value Chains: Social Networks and Knowledge Transfer in a Brazilian Halal Poultry Network

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Abstract

This paper describes a food value chain driven by Muslim precepts, exploring the influence of religion on social networks aspects and on knowledge transfer. Religions have a growing importance for international business, shaping the value chain. Assimilating religious precepts can contribute to better business network management for actual and intended food producers. A qualitative case study based on interviews, non-participant observation, and document analysis was conducted. The main results are that trust and commitment give a competitive edge to the Brazilian Halal poultry network when serving Muslim markets worldwide. Knowledge transfer is influenced by the religious context, with a small group of companies (Islamic Centers) governing interpretations of the Muslim precepts.

Keywords: International business networks, religious knowledge transfer, Halal food markets, Brazilian poultry exports.

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Introduction

Food and agribusiness firms face a number of complex challenges to remain competitive, including globalization (Hopewell 2013), IT implementation (Verdouw, Robbemond and Wolfert 2015), environmental changes (Ioris, Irigaray, and Girard 2014), and genetic modification (Inghelbrecht, Dessein, and van Huylenbroeck 2014). Religion has long played its part, as a number of faiths have rules concerning food consumption. As followers grow in numbers and in economic power, so does the influence of their religious customs. Understanding the interconnectivity that religion has in food value chains is critical to delivering products to these specialized and growing market segments. Which procedures must be established and how they are followed depend on the interchange among people, knowledge, and fait—forming a complex network. This research focuses on the following question: what are the characteristics of a religious-based food network? The study addresses Halal food, a growing market due to the rapid increase of Muslim consumers. It depicts roles assigned to Muslim and non-Muslim actors as they play different parts in the value chain. Social network aspects, such as trust and commitment, are assessed with regard to how one builds trust to be accepted into the network and how this type of knowledge, which is highly based on religious precepts, is transferred. The main objective of this research is to describe a Brazilian Halal poultry business network in terms of how religion influences the value chain, especially knowledge transfer and assimilation into processes.

Social Networks

Social networks are abstract, invisible sets of interwoven wires (interactions) and nodes (actors) that form social ties (Fombrun 1982). From a sociological perspective, social networks can be a tool to understand inter-organizational and social relations (Powell and Smith-Doerr 1994) and an alternative concept to the economically defined vision of firms and their constituents (Granovetter 1985). We live in a network society where people are connected, and firms are connected through people. The business environment is formed by a network of organizations to which the specific firm is open to and associated with (Nohria 1992). Inter-organizational networks involve firms linked by sets of people who transfer resources and information among each other, adding value to a product to fulfill a specific consumer need (Gulati and Gargiulo, 1999). These actors (people) relate to each other (purposefully or not), with decisions, behaviors, and deliveries shaped by the rules of the network in which they are inserted (Nohria 1992).

Social networks involve trust; that is, "*an individual's belief about the integrity and dependability of another*" (De Jong, Van der Vegt and Molleman 2007, 871). When relations between actors are based on trust, there is a higher chance of positive results to the network and its participants (Gulati 1995). Trust improves business performance in several ways: continuous learning through increased information exchange; higher motivation for problem solving; greater achievement through joint investments in specific assets that enhance customer relationships; reduction of transaction costs due to fewer control mechanisms; and incentives (Sako 1998). Trust is often acquired through cooperation, i.e., coordinated actions oriented toward common goals, resulting in more efficient collective mechanisms with an outcome of mutual benefits (Combs and Ketchen 1999; Gulati 1995; Verschoore and Balestrin 2008). Religion is also a source of trust (Traunmüller 2010) and encourages benevolence (the intention of one party to do

good to another) and integrity (adherence to a set of commonly acceptable principles) (Mayer, Davis and Schoorman 1995).

Social networks involve commitment and "*a feeling of sharing beliefs and values with one's entire organization*" (Harrison, Newman and Roth 2006, 306). It involves the confidence from one actor that the other will behave according to rules (explicit or tacit) that regulate (formally or not) the network (Verschoore and Balestrin 2008). It is the belief that the existing relationship is important to the point of being worth keeping which ensures maximum effort to sustain it (Morgan and Hunt 1994). Commitment encourages network participants to preserve their relationships and resist opportunistic behavior toward short-term results in favor of long-term benefits. Ruyter and Semeijn (2002) classify commitment in six categories: emotional, calculative, instrumental, resistance, behavioral, and moral. Although all six may occur in a social network, moral commitment, which is based on social obligations, may be more relevant in a religious context.

Knowledge Transfer

A systematic understanding of how knowledge obtained by individuals diffuses into networks and firms that thus become repositories of such knowledge is a contemporary discussion. Polanyi (1966) conceptualizes knowledge as being both explicit (objective and concrete) and tacit (subjective and implicit). They are intertwined in a dynamic movement. Explicit knowledge is easier to access, formalize, communicate, and share. Tacit knowledge is personal, contextual, and difficult to disclose; it is deeply rooted in an individual's actions and experience as well as in their ideals, values, and emotions (Takeuchi 2001). Tacit knowledge transfer requires an understanding of if, how, and how frequently individuals gather in groups to discuss, converge, and share what they know. These networks may autonomously emerge from individuals, as in communities of practice (Wenger 1998), or they may be promoted by firms (Grant 1996).

Firms are typical repositories for explicit knowledge and enablers of tacit knowledge. They use their structure and schemes to enhance the transference and communication of skills and capabilities, promote the exchange of ideas, and provide internal mechanisms that coordinate and integrate individuals' specialized knowledge (Grant 1996). Knowing how to select, interpret, and integrate knowledge is a valuable asset for firms, and the special skills for creating and transferring it have been identified as central to firm advantage (Modi and Mabert 2007; Nahapiet and Ghoshal 1998). This knowledge management involves the ability to process information, usually through social interactions, changing the firm's range of potential behaviors to a wider set of actionable options. In a value chain, the way knowledge is transferred and internalized through procedures and practices is important for performance by ensuring successful client-oriented experiences (Modi and Mabert 2007). In a network of individuals from different firms, inter-organizational knowledge transfer results from acquiring a partner's existing knowledge or by creating new knowledge collaboratively.

Islamic Faith and Halal

Muslims are a fast growing religious group in the world today with potential to reach more than 2 billion people by 2030 (van Waardenand and van Dalen 2013). Demand from Muslim

consumers is expected to grow rapidly, especially in non-Middle Eastern regions such as Western Europe and Asia (Ayyub, Rana, Bagi, and Al-Thomaly 2013; Lever and Miele 2012). Many followers include Halal certification as a buying criterion. Halal refers to that which is permissible according to the Islamic law (Zainalabidin, Golnaz, and Mad 2011). A Halal certification guarantees that a number of "must do" activities were observed to declare the meat is Halal, involving production, manufacture, transportation, and commercialization processes. A network of religious leaders, auditors, plant supervisors, laboratory analysts, and chemical technicians work in consonance with a common religious drive (Xu, Cai, Chui, Ye, and Yu 2012). After a careful examination of what is done, how it is done, and by whom, a product may be labeled as permissible to Islam customs. Agribusiness firms interested in expanding to Muslim markets may find it difficult to obtain a Halal certification as it demands specific religious processes and knowledge management. Costs can be higher due to more strict rules and procedures. However, these markets are often willing to pay more for Halal products (Verbeke, Rutsaert, Bonne, and Vermeir 2013).

Methodology

The main objective of this research is to describe a business network driven by Muslim precepts with the aim of understanding the characteristics of a religiously based food network. It involves questions related to social networks, knowledge transfer, and religiosity (represented by the Islamic faith), such as: (i) Do Muslim and non-Muslim actors play different roles in the value chain? (ii) How are trust and commitment built into this network? (iii) How is this religious knowledge transferred? Is faith a facilitator or a blocker? (iv) What are the challenges for Halal-based networks and how are these met?

A qualitative case study was conducted to suit the descriptive nature of the study and used open-ended questions to elicit an understanding of the decision-making process (Eisenhardt 1989; Halinen and Törnroos 2005). This technique provided opportunities to access this network and reveal its peculiarities by capturing the reality from "someone internal" to the phenomenon (Yin 2009). Qualitative research is also expected to better capture the meanings hidden in rules, routines, and practices, which is necessary in a phenomenon closely tied to religious precepts, where actions have an additional dimension to the usual business management interpretations. Activities were fulfilled from March 2013 to June 2014 with participants from the Brazilian Halal poultry network. The researcher individually interacted with the participants in a neutral, uncontrolled environment. These interactions involved: twenty-nine interviews with key actors (e.g., Islamic Centers); thirty-nine reports and institutional documents from associations (e.g. 2012 Brazilian Poultry Magazine); sixteen Halal documents (e.g., expedited certificate); two visits to slaughterhouses in the South and Southeast regions of the country. Pictures and other identification information were not disclosed; one non-participant observation on a mission to a Mexican firm (e.g., field journal page).

Events were observed through the conceptual lens of social networks, knowledge transfer, and religiosity, which oriented data selection and analysis based on the information that was freely disclosed by the Halal network actors during the trip. Questions were asked as the phenomenon unfolded and not as *a priori*. Data was interpreted through discourse analysis, building meaning through stories, narratives, and dialog (Bardin 1977; Denzin and Lincoln 2005). Critical events

related by the actors were recorded to convert this tacit information into more explicit knowledge. To construct meaning, the researchers observed how meaning was grounded in the actors' discourse (Ryan 1999; van der Spiegel, van der Fels-Klerx, Sterrenburg, van Ruth, and vanDijik 1997).

Results: The Brazilian Halal Business Network

Brazil has a prominent role as a food exporter, e.g., being the world's major broiler meat exporter (Figure 1). About 44% of this volume is Halal-labeled (MDIC 2014), a substantial mark achieved from a series of businesses in a well-organized network. This network emerged around the 1980's in response to demand on the Brazilian poultry exporters to slaughter chickens under Islamic religious precepts for the growing Middle East Halal market.
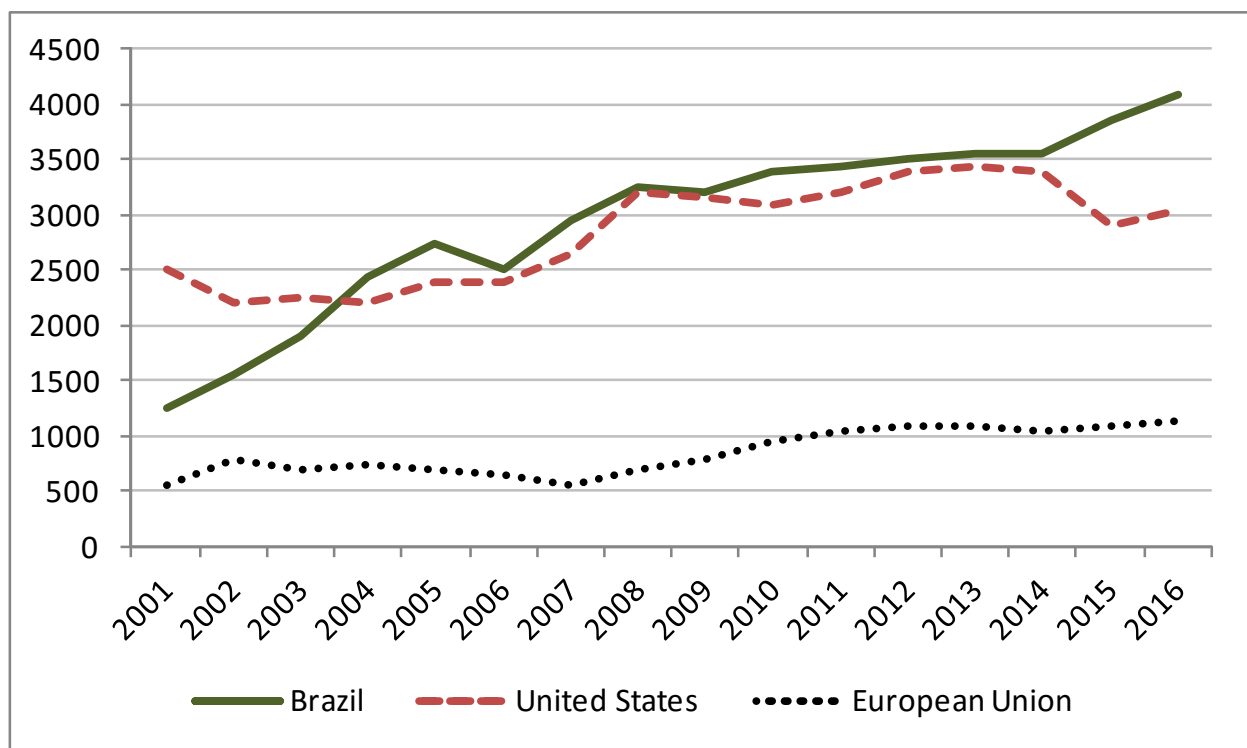
Figure 1. Major broiler meat exporters estimates 2001–2016 (USDA 2016).

This network became especially active in the last decade and involves chicken poultry producers (e.g., BRazilFoods), chambers of commerce (e.g., CCIBI - Brasil Iraq Chamber of Industry and Commerce), government representatives (e.g., APEX - National Agency for Promotion of Exports and Investments), national associations (e.g., ABPA - Brazilian Association of Poultry Producers), and Islamic Centers (e.g., CDIAL - Latin American Promotion Center of the Islam), with these last groups responsible for Halal certification for exported products. The network is mostly informal and horizontal, with no actor in full control of events. Although producers have economic influence (e.g., BRazilFoods had a total income of around US$10 billion in 2014), they do not stand alone. Chambers of commerce support negotiations with export markets, being able to direct actions:

We do studies, research, fairs, and invite the slaughterhouses. We accompany the buyer, introduce buyers to the exporters […] When delegations come from abroad […] the chamber accompanies them, offers support with translations. [...]We try to serve as a link with the embassy, so we can solve those problems. We have joint actions with the Ministry of Agriculture; what interests us is seeing reliable Brazilian Halal chicken in the Middle Eastern countries. (Chambers of Commerce)

The government may block participants that do not comply with regulations, e.g., enforcing sanitary normative and influencing commerce through its ambassadors:

All Embassies work closely with the producers, exporters and associations in Brazil for this end. We are […] official facilitators (Brazilian Embassy)

The Ministry of Agriculture also acts outside of the slaughterhouse [...] in the making of rations, in the aviaries, regulating the way they make the chicken's ration and the way the chicken is raised (Chamber of Commerce)

In the international Halal market, Brazilian companies and bureaus seems to have a competitive edge through these inter-organizational exchanges. Brazil openly abridged Arab immigrants in the twentieth century (e.g., Syrians and Turkish) and coexistence with diverse cultures and cults—from European Catholicism, African Umbanda, Japanese Shinto, and Middle East Judaism—is encouraged. Brazilians offer little resistance to foreign habits and procedures, accepting others' ways with a little constraint. The first Islamic-oriented bureaus were established there by immigrants around the 1970's, building a robust network to guarantee that religious requirements were fully respected and promoting the country to a first-mover position in food exports (especially poultry) to the Middle East. In a context governed by beliefs and dogma, the Brazilian Halal network assigned specific roles, built trust and commitment, and transferred knowledge through its actors, thus overcoming a series of challenges.

(i) Do Muslim and non-Muslim actors play different roles in the value chain?

Islamic Centers also block participants by denying certifications to those that do not follow strict Halal rules. These rules determine explicit roles in the value chain for Muslim and non-Muslim actors. As an example, the slaughter process is performed by a practicing Muslim, hired by the Islamic Center, working inside the producer facility. This is a *sine qua non* condition for certification. Non-Muslims may participate in other phases of the production process such as receiving livestock, preparing it for the slaughter, adjusting equipment, processing poultry, packing, and transporting it to export consolidation centers. However, the slaughter must be done by a Muslim and facilities must have the necessary infrastructure for them such as an appropriate area for daily prayers. Most Muslims employed by Islamic Centers are originally from Middle Eastern countries such as Iraq and Syria. This practice serves to guarantee that not only procedures, but above all, the will of God, will be respected during the critical phases of the process. As the responsibility relies on the Islamic Centers, they work diligently to maintain their reputation. Formed in their majority by Middle East immigrants who moved to Brazil in the twentieth century, Islamic Centers are central to the legitimization of the whole process. They act as local beacons to Islamic followers, with the Shah (religious authority), offering spiritual

guidance. As a by-product, they legislate on Halal issues and lend their reputations to the certification process. However, their professed duty is to contribute to a better understanding of the Islamic faith. Transferring knowledge—be it religious values or technical procedures—is considered a privilege, resulting in direct (employment) and indirect (investment in social events) benefits to the Islamic community.

(ii) How are trust and commitment built into this network?

Common religious backgrounds play an important part. Spreading Islam is a central activity to Muslims, one which must be above all others. Islamic Centers do not compete openly with each other. They collaborate, even helping competitors. Cooperation comes easily, especially internationally:

> *There is a professional ethics in the world of the Halal certifiers, what we call borderline ethics [...] We have a certain respect, to not cross borders and to not get in other people's way. [...] I've done some work in some countries, Uruguay; I've been helping out people in Argentina, Malaysia, etc. [...] (Islamic Center).*

The chambers of commerce, formed in their majority by immigrants from Middle Eastern Muslim countries, help connect producers, Islamic Centers, and government agencies with potential clients, usually from their motherland (e.g., Saudi Arabia). Islamic Centers do not see one another as "enemies" as they are created for the same purpose: to practice their religion, to provide teachings for children and adults, and to connect participants with their religion, consequently spreading the Islam. To foster distrust among each other would be harmful to the business network that they are all part of. There is respect for both the acting boundaries as well as a disposition to help:

> *He is my competition [another Islamic Center], and I'm helping out a competitor, I know this (Islamic Center).*

Cooperation is achieved as it benefits the network. A trusted *Halal* product favors a higher market share in Muslim countries, which results in more future invoices that will need a certificate, promoting a virtuous cycle. How does someone build the trust to be accepted into the network? Potentially any firm may participate as long as it follows Islamic precepts correctly. However, given the huge number of chicken slaughterhouses in Brazil (in the thousands), forming a reliable network is necessary to build trust. The presence of too many certification emitters could prove harmful, leading to a myriad of interpretations of the Quran, eventually influenced by a specific firm interest. Because there are few internationally recognized Islamic Centers in Brazil, there is enhanced trust that the food is produced in accordance with strict Halal procedures. It is clear who is in charge of religious guidance, increasing trust. In an informal conversation, the Director of an Islamic Center reported that once a relevant poultry producer attempted to bypass the center and planned their own structure for Halal slaughter and certification. The initiative was halted after the firm realized that it would not be able to legitimize its process. Also, the majority of producers are represented by a centralized nationwide association:

> *There are divided sectors, I don't want to name them, but there are many. [name excluded], for example, is one case. There are one hundred associations, so the government doesn't know who to speak to. But when the government talks to me, for example, about exports, he knows that I represent 97% to 98% of the Brazilian chicken exporters. When he comes to me and says there is a registration problem, I talk to 97% of the people that export, so this has a lot to do with the synergy between the private sector, through these strong associations, and the government perceiving this "associative" model (ABPA).*

(iii) How is this religious knowledge transferred? Is faith a facilitator or blocker?

Centralization fosters homogenous interpretation. With few certifiers Halal customers' needs can be quickly embedded, enhancing trust. Knowledge transfer is practically immediate. To assert that this is done is of utmost importance to establish a solid relationship with the Islamic Centers, i.e., with the local religious authority, thereby according to reputation and legitimize participation. Knowledge transfer is therefore mediated by the Islamic Centers, which have the legitimacy to interpret Muslim precepts. Explicit knowledge of the Halal process is widely documented and freely available on websites, but its enactment is tacit and involves a deep commitment to religion:

> *It's teaching. The people that don't profess the Islamic religion (…) don't know their details, so the Islamic Centers (…) also take care of the certification of Halal slaughter and have a fundamental part in it, in saying: look, this is licit, this is illicit; if you want to sell in my country, this is how it's produced and accepted by the Muslim community (Islamic Center).*

The transfer of this knowledge is not a purely rational, planned process. It comprises both tacit and explicit knowledge. Explicit knowledge comes from widely known Halal regulations, subject to certification upon inspection. However, interpretations may vary. To many Sunni religious leaders, it suffices that the prayer "Allah is great" is said, irrespective if by a human being or by a machine with a recorded voice. To Shi'a followers, the prayer must be offered by a Muslim, present at the time and repeated for each animal slaughtered. The Islamic Centers accumulate a number of experiences in shared narratives, transferred to both Muslim and non-Muslim workers - these stories help determine what to do. Also, stages critical to the religious precepts must work as a separate, independent part. The less the company disputes an issue with the Islamic Center technician, abiding promptly to his religious directives, the faster it will have the batch certified. What is paramount is that technicians share questions and interpretations with religious authorities, participate in training sessions and discussions, and pass on experiences and lessons learned. When an unexpected event occurs, it is not uncommon for production to stop while a call is placed immediately to the highest religious authority from the Islamic Center. Every new technology, process, and change must be approved by the religious authority to maintain the Halal certificate. The Quran does not have specific answers to all modern questions (e.g., if transgenic soy beans are Halal); therefore, interpretation is needed. The Islamic Centers provide answers based not only on their knowledge of the Quran, but also based on international communities of practice that are periodically consulted, as processes and initiatives are discussed with the highest religious authorities.

(iv) What are the challenges for of the Halal-based networks and how are these met?

Following Islamic precepts is not difficult; however, to be perceived as a follower of Islamic precepts is a great challenge. Social connections, active government participation, historical and immigration ties provide an important part of the answer. Recent events (e.g., 9/11) led to a mutual sentiment of distrust, explaining part of the declining exports of poultry from the U.S. to Muslim markets. Centralization and coordinated actions, such as those promoted by the ABPA, help harmonize network players:

> *[We] have this, a single position, teaching everyone how to produce [to the Muslim world]. If you go to the International Agriculture Fair, held last week, you'll see the network united, from the genetics to the salesman, passing through equipments [sic], laboratories, vaccines, through everything. That has helps [sic]a lot (ABPA).*

Brazilian Halal poultry producers must accept the external slaughter agent and his decisions. Success in certification depends mostly on the firm's propensity to create the proper conditions for the work of the Muslim technician responsible for slaughter:

> *The employees that usually do the bleeding, supervision, auditing, they are Muslims. They are already hired by the Islamic Center, they have no bond to the producer, to the slaughterhouse. They are not employees of the company they are working directly with [...]. [The firm] has to provide offices [...] and one praying room [to them] (Islamic Center).*

Discussion

The Brazilian poultry Halal network is formed by a complex social array (Fombrun 1982; Powell and Smith-Doerr 1994) that includes Muslims and non-Muslims alike. Although its economic drivers are strong, there is evidence of a concern for other social objectives (Granovetter 1985) such as the dissemination of the Islam and the strengthening of the Muslim community and customs. Producers adapt themselves to foreign social rules and beliefs, modifying installations and procedures if they are to participate in this market (Nohria 1992), driven to a great extent by religious precepts (Traunmüller 2010). Participants act according to rules that regulate the network (Verschoore & Balestrin 2008) as trust is strongly governed by the Islamic Centers. The network is committed to every value-adding activity since mishandling by any link of the chain may compromise the reputation of the system. This reputation is strongly based on social obligations (Ruyter & Semeijn 2002); incurring an error is interpreted as not acting according to Muslim rules and beliefs. The expressive growth of this social network, based on trust and commitment, is evidence that coordinated actions oriented toward common goals result in mutual benefits and improved performance (Sako 1998). The social component of the network is decisive since different interpretations occur as to what constitutes a Halal product (Lever & Miele 2012). Without a completely clear standard, there is a barrier to entrants due to interpretation. Knowledge is not totally explicit (Polanyi 1966); i.e., knowing the rules and procedures is not enough to build trust. The tacit component, with its ideals, values, and emotions (Takeuchi 2001) plays a significant part, with decisions being taken by the religious authority and then transferred as knowledge through the network. This knowledge transfer is subject to the specific governance of the Islamic Centers (Grant 1996). Their predominance in

knowledge selection, interpretation, and integration, given their identification and proximity to the Muslim customers, result in a central firm advantage (Modi & Mabert 2007; Nahapiet and Ghoshal 1998).

Conclusions

This research described a Brazilian poultry export social network driven by Halal precepts. The network involves Muslims and non-Muslims alike abiding to Islamic religious procedures and rules. Trust, commitment, and knowledge transfer in a religious centered network were observed, specially from the Islamic Centers, which offer spiritual and practical guidance. The implications of this research include the importance that religious precepts may have for international business networks (e.g., shaping operations) and confirmation that knowledge transfer theories explain situations where religious precepts play a central role. Assimilating these implications may contribute to better business network management for food producers. Recommendations for future research include describing networks for other products (e.g., meat), for other religious regulations (e.g., Kosher), and in other countries (e.g., Australia) to better comprehend how religious precepts influence food value chains.

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Evaluating Strategies for Honey Value Chains in Brazil using a Value Chain Structure-Conduct-Performance (SCP) Framework

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Abstract

Development organizations have used value chain analysis in defining interventions for the honey business in major exporting countries like Brazil. Yet, the impact of interventions has been unclear. This paper aims at evaluating strategies of three honey value chain streams in Brazil, selected for a multiple case study between the years 2007–2011.Using the value chain Structure-Conduct-Performance (SCP) framework, likely successful strategies are identified by comparing stream performances. Next, the outcomes of this comparison are validated through questionnaires with experts. Understanding current stream strategies and local structural conditions, and fostering well-aligned strategies are found to be key for successful donor interventions.

Keywords: economic development; supply chains; interventions; beekeeping.

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Introduction

Bees are important pollination agents for many commercial crops. In addition, economic sectors like processed food, food services, and pharmaceuticals use apiculture products as input. Recently, this intertwined relation became more explicit in Europe and the United States with the puzzle of disappearing bees (Tapparo et al. 2012; Henry et al. 2012). More fundamental problems in apiculture, however, are commonly found in countries that are major producers and exporters of honey: weak market linkages, low pricing transparency, inadequate labor skills, limited access to credit, and inability to perform quality requirement tests (Bradbear 2009).

In order to address these problems, several development agencies have employed the value chain perspective in defining their interventions (Anand and Sisay 2011; Reji 2013). However, often the outcomes of these interventions are not clear in terms of their contributions to competitiveness improvement and poverty reduction. This is because many interventions miss connections among their strategies and expected outcomes, fail to realize limitations in the environment in which they take place, or use evaluation periods shorter than the time required for the results to materialize (Brusky and Monteiro 2008; Horton et al. 2010; Demont and Rizzotto 2012; Fernandez-Stark and Bamber 2012). Additionally, intervention evaluations do not usually rely on causal relations, on a mix of qualitative and quantitative approaches, and on the inclusion of comparative case studies (Ton 2012), and are frequently not well documented (Kidoido and Child 2014). Impact evaluation is also compromised by the introduction of new policies and changes in the management of the government organizations that undertake the intervention, or by the absence of a sound monitoring system for the program (Cuny Garloch 2012).

The shortcomings of the evaluation of interventions also apply to the honey value chain interventions carried out in the northeast of Brazil. There, national, state governments and non-governmental organizations (NGOs) have been investing in the honey value chain, so far with unclear outcomes. Those interventions are usually made on a segment of the honey value chain located in specific territories. Herein, a segment of a value chain located in a territory is defined as a value chain stream. Against this background, the main objective of this paper is to identify likely successful strategies employed by three honey value chain streams in Brazil, including the ones supported by interventions. The three cases investigated – Limoeiro do Norte, Picos, and Santana do Cariri – all received support from government and NGOs. The methodology employed in this paper to identify successful stream strategies addresses the aforementioned shortcomings of the evaluation of value chain interventions.

The remainder of this paper is organized as follows. Section 2 describes the methodology: the choice of the strategy framework to identify and evaluate value chain strategies, the selection of the value chain stream cases, the selection of the framework indicators for inter-case comparison, and the evaluation process. The evaluation of the streams' strategies itself is conducted using the value chain Structure-Conduct-Performance (SCP) framework in Section 3, and the discussion of the results and policy conclusions follow in Section 4.

Methodology

Strategy Identification and Evaluation Framework

This paper used the value chain SCP framework (Figueiredo Junior et al. 2014) developed specifically to devise and evaluate strategies (conducts) for value chains through an integrated assessment of structure, conduct, and performance. This value chain SCP framework extends the dynamic SCP framework (Bain 1951; Bresnahan 1989; Scherer and Ross 1990; Lee 2007), used more recently by managers to conceive strategies for firms (Copeland et al. 2000; Stuckey 2008). This framework not only recognizes direct interactions but also feedbacks among structure, conduct and performance, and accounts for the occurrence of shocks, i.e. significant events that can alter the way those interactions take place. The value chain stream is the unit of analysis, and the categories of the framework are groups of related indicators describing a relevant dimension of structure, conduct and performance. For structure, there are categories related to market forces, and categories related to the enabling environment. For conduct, there are categories related to business process decisions, and categories related to organizational decisions. And for performance, there are categories related to the operations of a stream, and categories related to the contribution of that stream to local development. The performance categories related to the stream operations can be associated to the competitiveness of the stream, while the performance categories related to development can be associated to poverty alleviation (Figure 1).
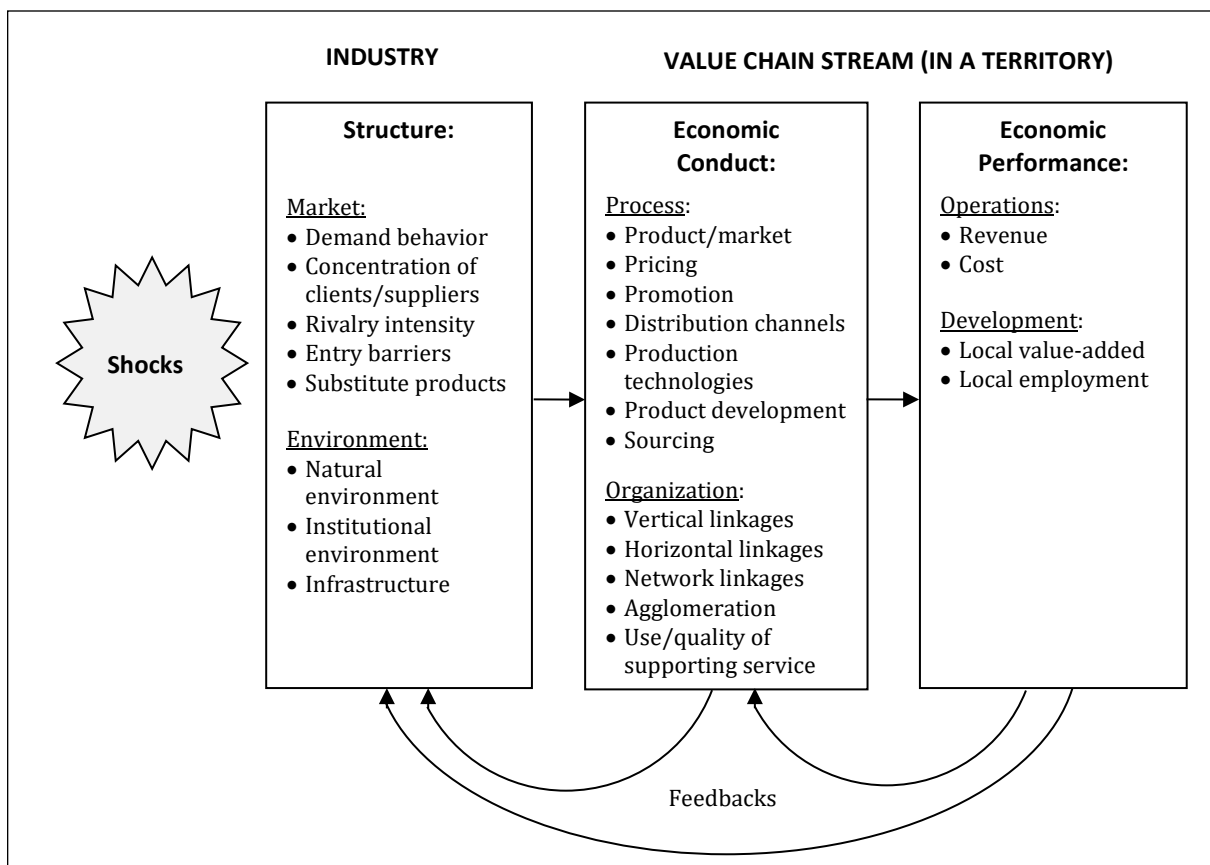
Figure 1. Value chain SCP framework and its categories
Source. Figueiredo Junior et al. (2014).

The value chain SCP nests the Five-forces framework (Porter 1980, 1990), and is compatible with the resource-based view of firms (Barney 2001). The value chain SCP framework also takes into account the concepts of governance and value distribution from global value chain (GVC) theory (Gereffi and Korzeniewicz 1994; Humphrey and Schmitz 2002) in its conduct categories. Moreover, the framework incorporates, from Global Production Network (GPN) theory (Coe et al. 2008; Coe and Hess 2011), the concept of territorial embeddedness in its unit of analysis and in its structural categories, and the notion of competing geographies in its unit of analysis. By doing so, the value chain SCP framework combines the strengths (Parrilli et al. 2013) of two leading approaches, GVC and GPN, towards local and regional development. With its economic development perspective, the framework departs from the Supply Chain Management (SCM) literature, concentrated on performance of a local firm's supply chain (Lambert and Cooper 2000; Drost et al. 2008), but maintains SCM's orientation to performance.

Case Selection

A multiple case study was conducted with competing streams of the honey value chain in Brazil with different business characteristics: two in Ceará State—one in and around the municipality of Limoeiro do Norte and the other in and around the municipality of Santana do Cariri – and one in Piauí State—in and around the municipality of Picos. Those three municipalities accounted for 3.3% of the Brazilian production and ranked in the top five among the more than 3,800 honey producing municipalities in the entire country in 2011 (IBGE 2012). The country itself was among the top ten world honey exporters in 2011 (FAO 2013). Each case is a value chain stream in a territory, consisting of a set of firms vertically and horizontally linked, with their own group of products, technology levels, supporting market services and other conduct characteristics, under a given business environment. The selected value chain streams also experienced distinct degrees of donor interventions. The reason to pick different streams of the same value chain is to allow for retrospective inter-case comparison (Yin 2009). Picking the streams in the same country reduces the complexity of the analysis as the number of relevant structural indicators goes down, and makes the data collection less costly.

Both primary and secondary sources were used according to the type of data required. Production by municipality was extracted from Brazilian official government registries. This information was used to support the identification and selection of the streams of the honey value chain. Information about the chains was also obtained through interviews with 45 stream stakeholders such as beekeepers, processors, traders and supporting services providers (Appendix, Table A1). The interviews took place between November 2012 and October 2013 in the locations of the streams and were undertaken using a semi-structured general interview schedule with mostly closed questions and some open questions. This schedule, by the stream, aimed at obtaining quantitative and qualitative information about the participants of each step of the value chain stream, about the interventions the stream went through, and about the value chain stream SCP categories and their indicators. Each interview focused on parts of the schedule which were more familiar to the interviewee and lasted between thirty minutes and two hours. Sometimes, the interviews were followed up by phone calls or e-mail exchanges, depending on the need for further clarification on the information initially provided by each interviewee. Data were gathered for the period from 2007 to 2011. Five years is considered to be a sufficiently long period to capture the effects of interactions within the value chain SCP framework.

In this research, the borders of the territory where the stream activities take place were defined by the administrative borders of the group of municipalities (Table 1) housing the participants of the stream. The selection of the municipalities to compose continuous stream territories (Figure 2) started from the main honey producing municipality. Next, its immediate neighbors in the same state were included. Furthermore, municipalities within the range covered by local service providers, as identified by the interviewees, were added to the territory. The final configuration of the stream territory was validated by stream representatives. The three resulting streams accounted for 11.2% of Brazilian honey production (IBGE 2012) and 10.2% of honey volume exports in 2011 (MDIC 2013).

Table 1. Geographical composition of value chain streams

Value Chain Stream	Geographical Composition
Limoeiro do Norte	- 7 municipalities, 8,214 km^2, 261,037 inhabitants (2010): Alto Santo, Limoeiro do Norte, Morada Nova, Quixeré, Russas, São João do Jaguaribe, Tabuleiro do Norte
Picos	- 34 municipalities, 15.784 km^2, 294.017 inhabitants (2010): Alagoinha do Piauí, Alegrete do Piauí, Aroeira do Itaim, Belém do Piauí, Bocaina, Caldeirão Grande, Campo Grande do Piauí, D. Expedito Lopes, Francisco Macedo, Francisco Santos, Fronteiras, Geminiano, Itainópolis, Jaicós, Marcolândia, Massapê, Monsenhor Hipólito, Padre Marcos, Paquetá, Patos, Picos, Pio IX, Santa Cruz do Piauí, Santana do Piauí, Santo Antônio de Lisboa, São João da Canabrava, São José do Piauí, São Julião, São Luís do Piauí, Simões, Sussuapara, Vera Mendes, Vila Nova do Piauí, Wall Ferraz
Santana do Cariri	- 14 municipalities, 9,352 km^2, 640,306 inhabitants (2010): Altaneira, Araripe, Assaré, Barbalha, Campos Sales, Crato, Farias Brito, Jardim, Juazeiro do Norte, Missão Velha, Nova Olinda, Potengi, Salitre, Santana do Cariri

Source. IBGE (2013), field interviews, analysis of the authors.
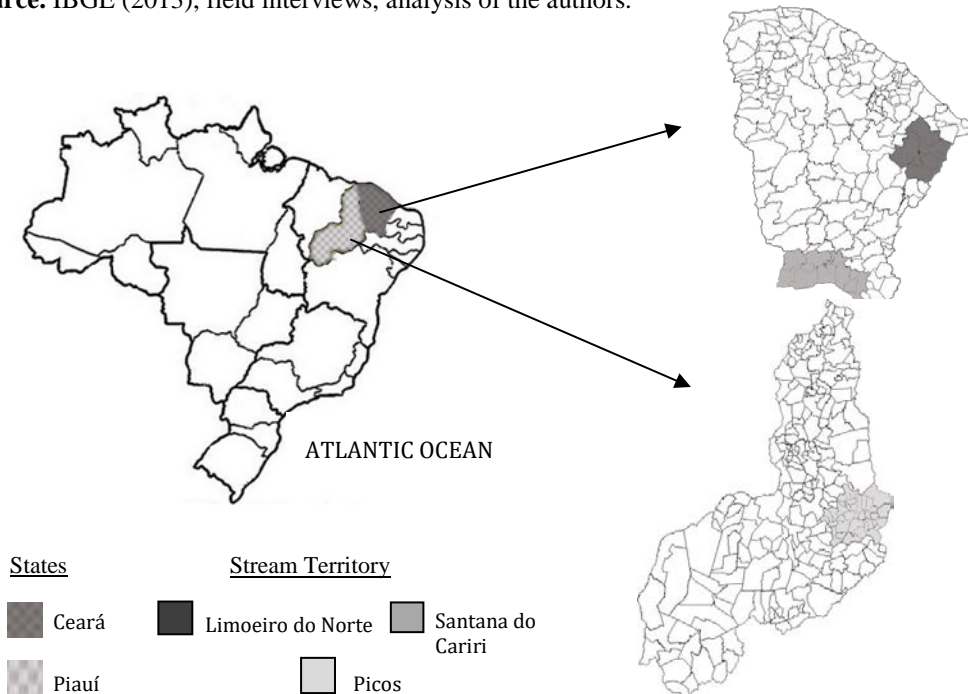
Figure 2. Location of the value chain streams in Brazil
Source. IBGE (2013), field interviews, analysis of the authors.

Several government and donor interventions took place during 2007 and 2011 in the selected streams and are described next, based on the information obtained during the interviews. Very often, those interventions did not rely on a comprehensive development plan for the chain in the region, but just addressed demands of producers. One of the few initiatives that addressed several aspects of the honey business and took a longer range view was the APIS Project carried out by the Brazilian Micro and Small Business Support Service (SEBRAE) between 2003 and 2008 in many regions of Brazil, included the regions around Limoeiro do Norte, Santana do Cariri and Picos. Its goal was to develop a sustainable apiculture in the Brazilian territory, through the diffusion of technical and managerial assistance to smallholders (Souza 2006).

In Limoeiro do Norte, with the end of the more widespread technical and managerial assistance by the regional development agents of the APIS Project in 2008, only a small group of producers in one village kept receiving some assistance by SEBRAE. From the state government, one intervention was reported between 2007 and 2011: training of groups of producers on beekeeping management, honey house operations and association of farmers, offered by the Secretariat of Agrarian Development of Ceará State (SDA).

In Santana do Cariri, the number of interventions is abundant from 2007 to 2011. The stream was also served by SEBRAE's APIS Project until 2007. In the beginning of that year, the stream was granted by the Ceará State Government and the Ministry of National Integration a new honey processing unit in the municipality of Barbalha, and five new honey houses in other municipalities of the region of the stream. The farmers were expected to extract honey in the houses and process it in the new unit, but that unit never worked. Out of the five honey houses, none has the Hazard Analysis and Critical Control Points (HACCP) certification, and one was not finished. From 2008 on, SDA, with resources from The Food and Agriculture Organization (FAO), Ministry of National Integration (MNI), Banco do Brasil (Bank of Brazil) Foundation (BBF) and its own, undertook scattered initiatives to small groups of farmers consisting of distribution of queens, and training on beekeeping, honey house operations, and association of farmers. SDA also funded the construction of another honey house with money from the World Bank whose construction has been paralyzed for three years. A very local initiative with a group of 75 small producers in five rural agrarian reform communities was under way by BBF from 2007 to 2011 as a sustainable development action (social program). BBF mobilized partners for technical (from the Rural Extension and Technical Assistance Ceará State Company – EMATERCE) and managerial (from SEBRAE) assistance, and provided financing through regular rural credit lines of the local bank branch.

In Picos, government and donor interventions were even stronger in terms of the total amount of subsidies provided. MNI, SEBRAE, BBF, Unisol (a workers' national cooperative), Unitrabalho (network of universities and unions), and ICCO (a Dutch NGO) contributed to the construction, in 2007, of Casa Apis, a processing and fractioning unit in the form of a central producers' cooperative (joint venture of 8 regional honey cooperatives in Piauí State). During this period and with money from those supporters, standard HACCP accredited honey houses were built in the region of the stream to supply Casa Apis. Starting in 2008 and still going on are donations of Casa Apis by SEBRAE and BBF to fund the full salary of regional sustainable development agents and extension officers (inspired in the previous APIS Project). Casa Apis is currently an important player in the Brazilian and in the export market. The national (through the

government-owned São Francisco Valley Development Company – CODEVASF) and the Piauí State government (through its Rural Development Secretariat) also implemented programs that involved the donation of hives and training of new producers. In addition, CODEVASF funded a brand new honey technology development center (CENTAPI) that was built in 2009, and not used so far.

Selection of Indicators for Stream Comparison

Starting from a suggestion of generic indicators by category (Figueiredo Junior et al. 2014) of the value chain SCP framework, specific indicators were chosen for each category according to: a) relevance; b) measurability; c) mutual exclusivity; and, d) data availability. Normalization of indicators in terms of growth, percentages of total or per unit values was sometimes required to allow for appropriate inter-stream comparison. Categories for which data on indicators were not available, like cost, were left out. The problems found by Bradbear (2009) in honey value chains were used to point out the relevance of indicators associated to the value chain SCP categories. For instance, in the case of structure categories, labor characteristics are considered in the institutional environment. In the case of conduct categories, commercial and physical market linkages are considered in distribution channels, quality certification is considered in production technologies, and access to credit is considered in use of supporting services. In general, the main strategic alternatives faced by the value chain streams during the period, per conduct category, were translated into conduct indicators. At least one indicator per conduct category was initially identified to ensure that all value chain SCP conduct categories were represented from the outset.

In total, eighteen indicators were initially selected for structure, twenty-six for conduct, and four for performance. A list of the selected SCP indicators is presented in Appendix, Table A2. For structure and conduct categories, both quantitative (for instance, coverage of technical assistance) and qualitative indicators (for instance, technical assistance type) were obtained from the interviews with the chain representatives and from secondary data. For performance, apart from possible conflicting goals, the interpretation of the results is straightforward for each of its quantitative indicators: that is, higher reflects a better performance. Conflicting goals in terms of increased competitiveness and poverty alleviation may be evidenced, for instance, when attempting to increase local value-added by processing commodity honey in the stream territory leads to lower export growth.

Evaluation of Strategies

After the quantitative and qualitative indicators were chosen and assessed, the value chain streams were ranked according to each performance indicator. A list of strategies that were most likely to have influenced the relative performance of each stream was initially prepared, based on literature and deductive reasoning in line with the SCP framework. Variations among stream strategies were exploited to explain performance. Strategies that were somewhat similar for each stream were not expected to contribute to performance differences, and thus, were discarded as important.

Next, the importance of each remaining strategy and the effects of those strategies on each stream were further evaluated through a structured questionnaire with two local experts per stream, six in total. The experts consisted of honey business consultants and large honey processor associates, who actually experienced the discussed facts. The experts were asked to rank the strategies, according to the impact of each strategy on the performance indicator(s) the stream excels. The questionnaires were applied between October and November, 2013. Finally, the top three strategies for each performance indicator were determined by averaging the ranks of the two experts in each stream. Thus, the robustness of the qualitative explanation of each stream performance by its strategies, using the SCP framework, is quantitatively assessed by the experts.

Results

Structure

The majority of the structure indicators was similar for the three value chain streams, either because they depict world market and environment conditions, or because they depict conditions of similar regions of Brazil where the streams are located. Out of the eighteen structure indicators initially selected, ten were assumed to influence the relative performance of the streams, either directly (as in the case of the favorable conditions shown by the natural environment indicators) or by strengthening the effects of stream strategies (as in the case of the demand behavior indicators that favor the streams that choose to export). A summary of the more influential honey business market and environmental structure indicators is presented in Table 2, and the figures for the remaining, less influential structure indicators are presented in Appendix, Table A3.

During the 2007-2011 period, some events (shocks) with the potential to significantly alter the structure of the honey industry, as defined by the value chain SCP framework, are identified. More generally, the financial crisis in the US and the EU that started in 2008 may have affected relationships among some exporting firms and traders but, overall, both international honey prices and consumed volumes kept going up. Other events in the supply side counterbalanced the economic slowdown, such as the CCD in Europe and US, and the gradual displacement of traditional bee forage cultures by cattle farms in Argentina (D. Chiachiarini, personal communication, November 14, 2012). More specific to Brazil, the embargo to Brazilian honey by the EU from 2006 to 2008 represented an opportunity for competitors in the EU at the time that it forced Brazil to redirect its exports to the US. The 2011 EU ban on honey ruling out genetically-modified organisms (Court of Justice of the European Union 2011) from general sale was another relevant event, but its effect may be mostly felt by producers from 2012 on. As a result of industry dynamics, worldwide average honey import prices rose by 8.7% per year between 2007 and 2011, which is mainly attributed to a poor harvest in the US, EU and Argentina (USAID 2012). Alongside, the average price of honey exported from Brazil went up 17.8% per year (MDIC 2013) in the period 2007–2011.

Table 2. Relevant structure indicator figures for the selected value chain streams

		Value Chain Stream		
Category	**Indicator**	**Limoeiro do Norte**	**Santana do Cariri**	**Picos**
Demand behavior	World honey consumption growth 2007-2011 (% year)[1]	2.7% (with growing organic and fair trade segments)		
	National honey apparent consumption growth 2007-2011 (% year)[1]	(3.2%)		
Concentration of clients	World market share of top 4 honey import countries (% of volume, 2007 and 2010)[1]	64%, 56%		
Entry barriers	Capital and knowledge intensity[2]	Relatively low in production		
Local natural environment	Average temperature (^{o}C)[1]	25-29		
	Normal rainfall (mm/year)[1]	721-973		
Institutional environment	Subsidies*,[2]	Limited	Limited	Very strong to small producers
	Business chamber/board/ federation[2]	Existence of honey chamber and beekeeping federation at state and national levels		
	Labor[2]	Increasing cost of labor at national level, limited highly skilled labor at local level		
	Quality requirements[2]	Stricter quality requirements at both national and international levels		

Source. (1) CBI (2011), FAO (2013), IBGE (2012, 2013), INMET (1992), IPECE (2012), MDIC (2013); (2) field interviews.
* Indicator taxes and subsidies divided to account for realized stream differences

Stream Conduct

Some of the strategies followed by the value chain streams can be read from the interventions undertaken by government and donors, and more rarely by explicit declarations of leading firms. However, most of the strategies are not known beforehand, they have to be deciphered through registering and comparing conduct indicators. In that sense, from the twenty-six conduct indicators initially selected, fourteen were selected for further analysis. These fourteen indicators presented in Table 3 were selected because they differed between chains and, thus, were assumed to be important for explaining performance differences between streams. The importance of these conduct indicators was confirmed by the outcomes of the questionnaires with experts. A description of these indicators enriched with qualitative information provided during the interviews with the value chain stream stakeholders is next. Less influential conduct indicators are reported in Appendix, Table A4.

Table 3. Relevant conduct indicator figures of the selected value chain streams

Category	Indicator	Value Chain Stream					
		Limoeiro do Norte		Santana do Cariri		Picos	
		2007	2011	2007	2011	2007	2011
Product/ market	Honey direct exports (% of production)[1]	8%	41%	150%	127%	11%	27%
	Honey certified organics (% of production)[2]	0%	22%	89%	75%	7%	14%
	Honey certified fair trade (% of production)[2]	0%	0%	0%	0%	0%	16%
	Monofloral honey (% of production)[2]	0%	0%	45%	37%	0%	0%
Production technologies	Number of honey house units/HACCP units and per 100 beekeepers[*,2]	13/0 (2.6/0)	43/2 (4.0/0.2)	14/0 (3.0/0)	29/3 (4.4/0.5)	20/17 *(2.6/2.2)*	22/19 *(1.2/1.0)*
Vertical linkages	Honey production by vertically or quasi-vertically integrated processors (% of production)[2,3]	5%	16%	Insignificant		7%	22%
	Honey production sold to local processors (% of production)[2,3]	10%	42%	95%	85%	19%	31%
Horizontal linkages	Resources sharing at production step[2]	Associations for sharing equipment, labor and facilities for honey extraction		Associations for sharing equipment, labor and facilities for honey extraction		Strong cooperatives for sharing equipment labor and facilities for honey extraction & sale	
Network linkages	Participation in Chamber/Board/Federation[2]	Almost no participation in apiculture State Federation or Chamber		Irregular participation in apiculture State Federation or Chamber		Active participation in apiculture State Federation or Chamber	
Quality of supporting services	Technical assistance type[2]	Specialized		Specialized	Not Specialized	Specialized	
	Technical assistance practice[2]	No free distribution of hives		No free distribution of hives		Free distribution of hives	
Use of supporting services	Technical assistance coverage (% beekeepers)[2]	63%	6%	NA	43%	59%	30%
	Managerial assistance coverage (% beekeepers)[2]	63%	22%	54%	12%	59%	30%
	Credit coverage (% beekeepers)[**,2]	9%	5%	10%	11%	21%	25%

Source. (1) FAO (2013), IBGE (2006, 2013), MDIC (2013); (2) field interviews; (3) estimated by authors.
* Standard capacity around 1,400 kg/day
** Two government-owned banks, Banco do Nordeste and Banco do Brasil, represented 100% of apiculture credit contracts
NA: Not available

In terms of product/market choices, the streams present many differences. In Limoeiro do Norte, despite the enormous growth, less than half of the production was directly exported. In Picos,

exports were less than 30% of production and in Santana do Cariri, the processing units exported more than the local production, by acquiring honey from other regions. The only region able to offer monofloral honey was Santana do Cariri, due to the high demand for its white *Serjania sp* honey, and to the separate site and season of this plant's blossoming. All but Santana do Cariri increased the participation of organically certified honey in the production, while only Picos had part of its production certified as fair trade. When comparing production practices, relevant is the total number of honey houses and the ones with the HACCP accreditation: Limoeiro do Norte had more houses than the other streams but Picos had more houses with HACCP (often built with support of donors).

A clear-cut distinction is observable in the vertical linkages among producers and processors within the stream. In Picos, propelled by cooperative arrangements and family relationships, there was a quasi-vertical integration organization that accounted for roughly 25% of the local production. In Limoeiro do Norte, the processors were vertically integrated towards production, and although their volume represented only around 15% of the stream volume, the processors were local entrepreneurs with a long-standing history of trust-based deals and technical assistance. In Santana do Cariri, the processors were entrepreneurs that moved from other producing areas in the south of Brazil, and managed to pioneer the activity in the region and grow the business through market-based exchanges. As to the flow of the locally produced honey through the streams to the end markets, in Santana do Cariri, the local units acquired almost all local production while in Limoeiro do Norte it was the opposite, with Picos somewhere in between, but growing towards local processing.

In all three streams, it was still common to find groups of producers organized in associations, very often as a result of a requirement of donors to qualify for grants. Nonetheless, horizontal co-operation was usual among producers in the form of labor and material sharing during honey harvest and extraction, especially among the ones located close together. Only in Picos, the associations were turned into active cooperatives, with sales capabilities. In both Ceará and Piauí states, there was one state honey chamber which served as a forum for problem solving and for channeling demands of the honey chain representatives to government, a form of network level co-ordination. Picos representatives were very participative on the state honey chamber, occupying management positions, while Santana do Cariri and Limoeiro do Norte representatives were not. Apart from participation in the honey chamber, co-operation among processors was not existent.

As to supporting services, technical and managerial assistance originally provided by SEBRAE development agents in 2007 through the APIS Project were mostly discontinued, except for Picos, where the local cooperative maintained its specialized assistance to its affiliates and recurred to donor funds to distribute hives for free to beekeepers. In Santana do Cariri, technical assistance was provided by the Ceará State extension services company but the technicians also provided extension to producers of other products such as fruits, sheep and goats. In Limoeiro do Norte, those services were provided only to a small group of beekeepers by SEBRAE. Financial services were provided by two national government-owned banks, Banco do Nordeste and Banco do Brasil, with the former being more active in apiculture than the latter, especially in Ceará state. Picos financial service providers were able to cover a larger percentage of producers than in the other two streams but, in all regions, close to 80% of the producers had no access to credit between 2007 and 2011.

Stream Performance

A description of the performance of each value chain stream is presented next, for both the operational and the developmental dimensions (Table 4). As for the operational dimension, a comparison between streams also requires understanding aspects of the performance of the honey chain as a whole in the country. In that regard, Brazil's honey production grew 4.6% per year, on average, between 2007 and 2011 (IBGE 2012), while the value of exports grew, in value, on average, 35.2% per year in the same period (MDIC 2013). Meanwhile, Limoeiro do Norte's production grew below the country's rate, but its exports grew far above the country's rate due to the start-up of the operations of the local processing and exporting unit during the period. Picos production grew even higher than Limoeiro do Norte's, followed by a rapid increase in its exports, while Santana do Cariri was not able to keep the pace with its exports despite its fast production growth. As for the development dimension, Santana do Cariri had the highest local value-added for all steps of the stream in 2011 normalized by kilogram of honey produced in the stream, with Picos and Limoeiro do Norte lagging further behind. In terms of employment generation, the growth in the number of beekeepers was also the highest for Picos.

The effects of the international trade shocks that occurred around 2008 (EU embargo and world financial crisis) apparently impacted more strongly the export pioneer Santana do Cariri stream, while Limoeiro do Norte and Picos were able to build up their businesses in the new environment. It is not possible to make educated inferences about the impact of the trade shocks on the local value-added behavior of the streams since the measurement was for only one year.

Table 4. Performance indicator figures of the selected value chain streams

		Value Chain Stream		
Category	**Indicators**	**Limoeiro do Norte**	**Santana do Cariri**	**Picos**
Revenue	Honey production growth 2007–2011(% per year)[1]	2.7%	4.9%	8.0%
	Honey exports value growth 2007–2011(% per year)[1]	85.4%	10.6%	52.7%
Local value-added*	Honey value-added in all stream steps 2011 per total production (US$/total kg produced)[1,2,3]	2.4	3.5	2.6
Local employment	Number of beekeepers growth 2007–2011 (% per year)[2]	21%	9%	23%

Source. (1) IBGE (2012, 2013), MDIC (2013); (2) field interviews; (3) estimated by authors.
* Proxy calculated by the difference from honey sales and acquisition costs at each step

Evaluation of Stream Strategies

For each performance indicator, the top performer among the three value chain streams was identified along with the strategies adopted by that stream that can be more closely or directly associated with that outcome (Table 5). Notice that some strategies can be more directly connected to the market and the environment structure while others require more investigation to make those connections. Following, the findings about the connections between the SCP indicators in the streams are explained.

Table 5. Top value chain stream performers by indicator, likely contributing strategies and supporting structure

Performance Indicator	Top Performer	Likely Contributing Strategies[*]	Likely Supporting Structure
Honey production growth (% per year)	Picos	*Increase in honey direct exports as % of production*[**]*;* *Offer of technical assistance with free hives;* *Offer of specialized technical assistance*; Cooperative-type of horizontal linkage among producers; Higher coverage of technical and managerial assistance; Higher coverage of credit.	High world honey consumption growth as opposite to decrease in local consumption; Favorable natural conditions; Low capital and knowledge intensity in production; Strong subsidies to small producers; Increasing labor costs; Stricter quality requirements.
Honey export value growth (% per year)	Limoeiro do Norte	Increase in honey direct exports as % of production; *Increase in honey certified as organic as % of production;* *Increase in % of honey production sold to local processors (the exporters);* *Increase in number of HACCP accredited honey houses.*	High world honey consumption growth as opposite to decrease in local consumption; Low concentration of foreign clients; Stricter quality requirements.
Honey value-added in all stream steps per total production (US$/ total kg produced)	Santana do Cariri	*High differentiation through organic certification;* *High differentiation through monofloral production;* Aggressive acquisition of honey outside territory; *High % of honey production sold to local processors.*	High world consumption growth of differentiated honeys.
Number of bee keepers growth (% per year)	Picos	*Offer of specialized technical assistance;* Higher coverage of technical and managerial assistance; Increase in coverage of credit; Active participation in honey chamber; *Offer of technical assistance with free hives;* *High % of honey production sold to local processors*[**]*.*	High world honey consumption growth; Low capital and knowledge intensity in production; Strong subsidies to small producers.

Source. Interviews with experts and analysis of the authors.
* Strategies *in italics* were the top three of fourteen conduct indicators selected by experts
** Included by the experts

Picos opted to offer higher coverage of credit, specialized technical and managerial assistance, along with free distribution of hives. Those strategies can be directly linked to performance not only in terms of growth in production but also in terms of growth in the number of beekeepers. Alignment with the cooperative-type of horizontal relation among producers facilitates the offer of specialized technical assistance, and alignment with an active participation of stream representatives in the state chamber facilitates fund raising with donors for distribution of hives. Free distribution of hives to overcome the limited investment capacity of the resource-poor entrepreneurs in the territory was only possible because of the low capital intensity of honey production. Other structural conditions such as honey world consumption growth and adequate local natural conditions potentiate the effects of the strategies adopted by Picos. Stricter quality requirements also favor Picos, which offered specialized technical assistance to a higher proportion of producers, just like increasing labor costs encourages co-operation of producers for costs savings. For exports, under a growing general demand for honey, a low client concentration and stricter quality requirements, it is expected that the streams that grow their exports faster are the ones like Limoeiro do Norte, which target the export market and increase the number of honey houses certified for exports. In addition, selling more of its honey production for local processing also contributes to the increase in exports, as the local processors are the only exporters. Although no hard figures are available for the organic honey segment growth, the increase in the production fraction certified as organics may explain part of the exports growth as well.

Processing more of the produced volume internally in the stream and selling part of this volume as differentiated, premium-priced products can lead towards a relatively high value-added in the stream. Complementarily, aggressive acquisition of honey outside the stream territory by local processors and packers (notice that the stream exported more than it produced) increases local value-added. This is a successful combination used in Santana do Cariri.

By and large, the experts interviewed confirmed those strategies as the most influential to the individual performance of the streams. Only the effects of horizontal and network linkages were not immediately recognized by the Picos experts, who preferred to associate the superior performance of the stream to market and vertical linkage choices. In all cases, the experts unanimously agreed that reducing the coverage of credit and technical/managerial assistance had a negative impact on the performance of the streams.

Whereas Picos managed to achieve the highest performance among the streams both in honey production and in the number of beekeepers growth, production grew less than the number of beekeepers, meaning that productivity went down, as new producers are likely to lag behind in the learning curve. In a period of growing demand and prices, like the one from 2007 until 2011, this combination of top operational and developmental performance is more likely to be found in practice. However, in the long run, the stream needs to increase its technical and managerial assistance coverage to recover its productivity.

Notice also that strategies that were identified as not important to some performance indicators under the structural conditions prevailing during the period of analysis (2007–2011) may become relevant when those conditions change. For instance, during a period of drought, the stream

whose beekeepers adopt migratory apiculture is likely to have its production less affected by the harshness of the climate.

It is also noteworthy that the conduct indicators measure the realized strategies, not the intended strategies. This is relevant when considering that some strategies attempted by the interventions did not even materialize (such as building and putting into work honey houses and a processing unit in Santana do Cariri, and an R&D centre in Picos). Other strategies that did materialize (such as offering of technical and managerial assistance in all three streams, technical assistance along with free distribution of hives in Picos, and construction and operation of a processing unit in Picos) can be evaluated by linking the conduct indicators they influence (such as technical and managerial assistance coverage, technical assistance practice, % of honey production sold to local processors) to the performance indicators.

Discussion and Conclusions

The value chain SCP framework allows development practitioners to make an integrated assessment of structure, conduct and performance from a value chain perspective. Thereby, it clearly identifies the value chain strategies and points out the main links between strategies and outcomes in a certain business environment. Data collection to proceed with making an integrated assessment is intense. Given the large number of conduct indicators, a qualitative analysis prevails; a quantitative, statistical analysis to identify key success factors is only feasible if data for more value chain streams are available.

The qualitative inference highlighting successful strategies in honey value chain streams, revealed through the multiple case studies presented in this paper, find ground in the value chain literature. Product and functional upgrades (Humphrey and Schmitz 2002) such as organic certification and additional local processing are regarded as the main sources for increasing honey value-added. HACCP accreditation of honey houses, a process upgrading strategy, is also seen as a source of export value growth—a sign of increased competitiveness (Trienekens 2011). In line with widespread knowledge that technical, managerial and financial assistance positively influence production and job creation, the higher the coverage of those supporting services, as observed in Picos, the higher the performance regarding production and beekeeper growth.

In all cases, a market-based type of vertical arrangement among the value chain streams and their outside clients is observed. This arrangement is in line with the following expectation from Gereffi et al. (2005) for products like honey that require little specification from buyers. As quality requirements increase further, movement towards a more modular kind of governance may take place, with local processors codifying the requirements of their foreign buyers. However, determining the effects of vertical, horizontal and network linkages within the stream on stream performance, is not straightforward, as shown by the interviews with experts.

Explicit feedbacks from conduct or performance to structure were not expected at the national or world level due to the small size of the selected streams. At the local level, feedbacks to structure were not identified. Feedbacks from performance to conduct may have taken place, reinforcing or not the behavior of the streams but they were also not observed because more frequent, intermediary periods of data collection would be required to investigate such events.

As to the interventions by donors observed in the three value chain streams, according to the typology by Humphrey and Navas-Alemán (2010), they were not based on existing lead firms but rather on strengthening chain linkages, especially among small producers. Besides, none of the interventions started off with the understanding of the current stream strategies and of the local structural conditions, or with development plans calling for integrated network strategies. The stream strategic decisions were made by leading processors and supporting service organizations in the streams, and the existing network arrangements did not follow up any stream strategy implementation.

In the studied streams, interventions that considered upgrading strategies without observing the alignment to other categories of strategy, like building processing units, or without observing local structural limitations, like building a technology development centre, were not successful. The bulk processing and packaging unit in the Santana do Cariri territory for a cooperative could not run in the absence of horizontal co-operation and in a situation where almost all local honey was already sold to local processors. An apiculture technology centre in Picos required the existence of local R&D personnel (a structural limitation) or the attraction of outside competence at a high cost. The opposite happened when interventions were aligned with the stream strategies and took advantage of structural conditions. Supporting the construction of a bulk processing and packaging facility in Picos succeeded as it was built on existing cooperative ties, and free distribution of hives (taking advantage of the availability of direct subsidies) worked better when specialized technical assistance was offered. The alignment of strategies recognized as a good management practice in the supply chain literature (Chopra and Meindl 2013) also seems to hold in general when the unit of analysis is a value chain stream instead of a focal firm.

In this study, only likely positive contributions were investigated, and 'offer of specialized technical assistance' was found to positively contribute to two performance goals: 'honey production growth' and 'beekeepers growth'. Along those lines, 'high % of honey production sold to local processors' was also found to positively contribute to 'honey value-added' and to 'beekeepers growth'. Value chain participants, however, should bear in mind that those situations where one strategy contributes positively to different performance goals at the same time does not always hold, and conflicting goals may arise for the same strategy.

Specific findings related to the most successful stream strategies in Brazil – for honey production and export value growth (associated to increased competitiveness), and for honey value-added and beekeepers growth (associated to poverty reduction) – can serve as good practices for the honey value chains streams only during the period of analysis in this study. In line with the value chain SCP framework, if structural indicators change in the future, those specific strategies need to be revaluated. Also, applying those successful strategies to streams in other countries depend on the similarity of their structural indicators to Brazil's. Contrary to Brazil, a country with a large and growing domestic market, for example, is likely to host high performance streams that sell their production locally.

For development agencies and donors, the upfront understanding of the current strategies deployed by the targeted streams and their competitors, along with local structural conditions, are paramount for a successful intervention. Strategies that do not reinforce others tend to fail and jeopardize the stream. Therefore, an intervention should identify the business and organizational strategies it

intends to act upon, and foster strategies that are aligned with each other and reinforced by the business environment. In addition, value chain participants should be aware that effective strategy choices vary according to the goal of the value chain stream in a given industry structure, be they in the context of development interventions or be they in response to structural shocks.

Acknowledgements

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Appendix

Table A1. Number of interviewees per value chain stream and type of stakeholder

Type of stakeholder	Value Chain Stream			
	Limoeiro do Norte	Santana do Cariri	Picos	Total
Beekeeper[*]	3	4	1	8
Intermediary	1	-	1	2
Processor	2	2	4	8
Service provider (technical/managerial assistance)	5	9	3	17
Service provider (financing)	2	2	2	6
Regulator (sanitary inspection)	1	-	1	2
Trader	-	1	1	2
Total	14	18	13	45

Source. Field Interviews.
* Selected beekeepers represented large groups of producers. Six out of the eight processors and the two intermediaries were also beekeepers

Table A2. Initial selection of structure, conduct and performance indicators

Component	Category	Indicator
Structure	Demand behavior	- World honey production growth
		- National honey apparent consumption growth
	Concentration of clients	- World market share of top 4 honey import countries
		- National market share of top 4 food retailers
	Concentration of suppliers	- Not applicable
	Rivalry intensity	- World market share of top 4 honey export countries
	Entry barriers (barriers created by competition)	- Capital and knowledge intensity
	Substitute products	- Existence of relevant substitute products
	Local natural environment	- Average temperature[1]
		- Normal rainfall[1]
		- Main bee forage sources
	Institutional environment	- Taxes and subsidies
		- Business chamber/board/federation
		- Labor
		- Import tariffs
		- Quality requirements
		- Exchange rates
	Local Infrastructure	- Access to utilities
		- Road distance to export harbor
Conduct	Product/market	- Honey direct exports as % of production
		- Direct exports to US as % of exports
		- Honey certified organics as % of production
		- Honey certified fair trade as % of production
		- Monofloral honey as % of production
	Pricing	- Honey bulk export price and % ratio to market price
	Promotion	- Message/media
	Distribution channels	- Honey exported directly to packers as % of exports
		- Transportation modes to main clients
	Production technologies	- Honey production and extraction
		- Number of honey house/HACCP[*] units, level and per 100 beekeepers
		- Honey bulk processing and packaging
	Product development	- Internal vs. outsourced
	Sourcing	- Floral sources distribution as % of production
	Vertical linkages	- Production by vertically integrated processors as % of total production[**]
		- Type of governance regarding clients outside stream
		- Honey production sold to local processors as % of total production[**]
	Horizontal linkages	- Resources sharing at production step
		- Resources sharing at other steps
	Network Linkages	- Participation in chamber/board/federation
	Agglomeration	- Concentration of stream beekeepers per km^2
	Quality of supporting services	- Technical assistance type
		- Technical assistance practices
	Use of supporting services	- Technical assistance coverage as % of beekeepers
		- Managerial assistance coverage as % of beekeepers
		- Credit coverage as % of beekeepers
Performance	Revenue	- Honey production growth[***,****]
		- Honey exports value growth[***]
	Local value-added	- Honey value-added in all stream steps per total production
	Local employment	- Number of beekeepers growth[****]

Source. (1) Adjare (1990); field interviews and authors' analysis.
* Hazard Analysis and Critical Control Points accreditation. ** Indicators not mutually exclusive but left in final selection to reveal perspectives of vertical integration. *** Indicators not mutually exclusive but left in final selection to reveal components of revenue. **** Indicators not mutually exclusive but left in final selection to represent operations and development categories.

Table A3. Additional structure indicator figures for the selected value chain streams

Category	Indicator	Value Chain Stream		
		Limoeiro do Norte	Santana do Cariri	Picos
Concentration of clients	National market share of top 4 food retailers (% of sales, 2011)[1]	50%		
Rivalry intensity	World market share of top 4 honey export countries (% of volume, 2007 and 2010)[1]	49%, 44%		
Substitute products[2]	Existence of relevant substitute products	Sugar, glucose syrup and other sweeteners		
Institutional environment	Taxes[*,2]	Tax incentives to attract processing units offered at state and national levels		
	Import tariffs[1]	Lower import tariffs to competitors from North America (by US) and Africa (by US and EU)		
	Exchange rates[1]	Appreciation of Brazilian Real while main competitors Argentina, Turkey, Mexico and Vietnam depreciated their currencies against US dollar		
Local natural environment	Main bee forage sources[2]	*Borreria verticillata, Merremia aegytia, Croton sonderianus Müll. Arg., Hyptis suaveolens*	*Serjania sp, Croton sonderianus Müll. Arg., Borreria verticillata, Hyptis suaveolens*	*Croton sonderianus Müll. Arg., Piptadenia moniliformis, Merremia aegytia, Hyptis suaveolens*
Local Infrastructure	Road distance to export harbor Pecém/CE (km)[1]	253	538	560
	Access to utilities[2]	Partial coverage of cell phone, electricity and water in some areas of the apiaries and honey houses		

Source. (1) ABRAS (2012), European Commission (2013), FAO (2013), FXTOP (2012), IPECE (2012), USITC (2010); (2) field interviews.
* Indicator 'taxes and subsidies' divided to account for realized stream differences

Table A4. Additional conduct indicator figures for the selected value chain streams

Category	Indicator	Value Chain Stream					
		Limoeiro do Norte		Santana do Cariri		Picos	
		2007	2011	2007	2011	2007	2011
Product/market	Direct exports to US (% of exports)[2]	100%	90%	100%	90%	100%	80%
Pricing	Honey bulk exports 2011 (US$/kg) and ratio to market price (%)[1]	1.49 (91%)	3.09 (98%)	2.04 (124%)	2.97 (94%)	1.92 (117%)	3.29 (104%)
Promotion	Message/media[2]	Natural, wild blossom honey through word of mouth					
Distribution channels	Honey exported directly to packers (% of exports)[1,2]	0%	0%	67%	100%	0 %	23%
	Transportation mode to direct export clients[2]	Trucks (inside Brazil) and ships from Pecém harbor in Ceará State					
Production technologies	Honey production and extraction[2]	Stationary apiculture		Some migratory apiculture (less than 5% of producers)		Some migratory apiculture (less than 5% of producers)	
	Honey bulk processing and packaging[2]	Standard					
Product development	Internal vs. outsourced[2]	Outsourced					
Sourcing	Floral sources distribution (% of production)[2]	*Borreria verticillata,* 50%; *Merremia aegytia,* 25%; *Croton sonderianus Müll. Arg.,* 15%; *Hyptis suaveolens* and other bushes, 10%		*Serjania sp,* 30%; *Croton sonderianus Müll. Arg.,* 30%; *Borreria verticillata,* 20%; *Hyptis suaveolens* and other bushes, 20%		*Croton sonderianus Müll. Arg.,* 50%; *Piptadenia moniliformis,* 30%; *Merremia aegytia, Hyptis suaveolens, Croton campestris* and other bushes, 20%	
Vertical linkages	Type of governance regarding clients outside stream[2]	Market-based until 2011					
Horizontal linkages	Resources sharing in other than production steps[2]	No sharing of resources					
Agglomeration	Concentration of stream beekeepers per 100 squared km[1,2]	6.2	13.1	4.1	6.0	3.5	9.5

Source. (1) FAO (2013), IBGE (2006, 2012, 2013), IPECE (2012), MDIC (2013); (2) field interviews.

Slaughterhouse in Southeastern Afghanistan:
A Public–Private Partnership

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Abstract

A contractor faces a decision whether to bid on becoming the private partner in a public–private partnership in the capital city of a southeastern province in Afghanistan. At stake is an investment in building an open-air slaughter facility and operating costs in return for 75% of generated revenues. The contractor works to develop a budget to estimate the economic viability of the operation. Factors encouraging risk analysis include estimates of daily animal slaughter numbers and the viability of and enforcement of a facility-use requirement to support use estimates. This teaching case is suitable for advanced undergraduate or graduate courses in business strategy examining the challenges faced by small-scale agribusinesses in an emerging economy. It is also appropriate for executive education considering foreign investment or management opportunities.

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IFAMA Agribusiness Case 19.3

Introduction

Mohammad Aziz had to make a decision. He knew this sort of opportunity might not happen again. He reflected on the growing pressure throughout the province to find additional means to generate income as contracts offered by various government and non-government organizations began to dry up in Afghanistan. His own situation is particularly tenuous because of his near-term objective to expand his fledgling construction firm, Global Rock Construction Company, in order to accommodate the addition of his oldest son, Popal.

Mohammad thought back to his younger days when he and his siblings would follow their father to the grange (livestock market) on the hill in Qalat on top which rested a castle said to be built and used by Alexander the Great. His father, then a local butcher, would visit the grange several times a week to purchase sheep and an occasional cow. Mohammed would help his father slaughter livestock on a flattened area of the hillside just adjacent to the grange. This traditional location for slaughter by Qalat's butchers remains today, although an increasing number have begun butchering their livestock closer to their homes or shops due to pressure from the Afghan National Army, which occupies the castle on top of the hill, and some more powerful local residents.

Mohammad had to admit that open-air slaughtering on the hillside has a number of undesirable health, sanitation, and aesthetic impacts. But, like most municipalities in Afghanistan, Qalat lacks an operating slaughter facility. Further, there are no restrictions on animal slaughter and few, if any, incentives for butchers to change standard slaughtering techniques and locations.

The Region

Qalat is located in the interior of Zabul Province and serves as the capital city[1]. Zabul is located in south-eastern Afghanistan, and because it shares a border with Pakistan, it serves as an Afghan entry-point for insurgents. There are three NATO-occupied, forward operating bases in Qalat, one of which hosted the Zabul Provincial Reconstruction Team comprised of US soldiers and airmen, and representatives of US government agencies including USDA, USAID, and the Department of State until the withdraw of NATO forces in 2014[2]. The Afghan National Army occupies Alexander's castle, and there is an Afghan National Police unit based in Qalat. Highway One, the paved Afghan ring road, runs through Qalat. There are generally passable but non-paved roads throughout most districts in the province.

Approximately two-fifths of the province is covered by mountains, or semi-mountainous terrain and just over one-fourth of the province is flatland. Most of the land is considered shrub-land although areas benefiting from spring runoff from the mountains and where irrigation is possible are farmed. Both the Arghandab and Tarnak rivers run through the province, and there exist

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[1] Information on Zabul Province and Qalat is sourced from the Naval Postgraduate School at https://my.nps.edu/web/ccs/zabul and from the knowledge of the author based on US military briefings and within province experience.
[2] At the time of the decision, the impending withdraw of NATO forces was a generally anticipated reality for Qalat.

many seasonal rivers and streams. Most of the populous, including that in Qalat, have ready access to potable water. The literacy rate is estimated at 1%.

The primary occupation of the province is agriculture. Predominant crops include wheat, corn, barley, almonds, grapes, apricots, potatoes, watermelon and poppy. Primary livestock consists of cattle, sheep, goats and chickens. Swine are not raised in the province as most occupants are Muslim. Many agricultural products are sold direct from the farm to traders. There are active markets in Qalat for commodities and food, and approximately three dozen butchers operate shops in town or out of their home compounds.

The Project

The leadership of RampUp South proposed the building and operation of a slaughter facility through a public-private partnership. This organization is an Afghan-run and Afghan-owned non-profit largely funded by USAID with the objectives of strengthening the resources and functioning of municipalities. In December, they held a pre-bid meeting for construction and operation of a slaughter facility.

In preparation for the pre-bid conference, representatives from USAID, Ramp-Up South, USDA and the Qalat mayor (hereafter called "the team") met to discuss building a slaughterhouse in Qalat. The consensus was that a slaughter-house should be built as a public–private partnership

and that it should be co-located with the existing livestock market. The team also agreed that additional stakeholders, to include local butchers, traders, and the Director of Agriculture, Irrigation and Livestock (DAIL), need to be involved throughout the planning process. Subsequently, representatives from the team assessed current livestock marketing, slaughtering practices, locations, quantity and type of livestock moving through the market so they would have this information available for facility design and to provide to the contractors who would bid on the project.

The team visited butchers both in the Qalat market and on-site during the slaughter process to solicit input and assess practices and impacts. On the day they visited the butchers, they found them among approximately fifteen animals that had been killed awaiting butchering (all sheep and goats). The animals were being butchered on their hides, so the process itself appeared relatively sanitary, although there was no water source present for cleaning tools or other items. The general area was littered with offal; there was moderate fly pressure, and it had a slightly offensive odor. It was also apparent that the butchers had been leaving animal byproducts (largely offal) over many weeks in depressions they had dug near the site used for slaughter. When the butchers were asked why they did not clean up the offal, they replied that this was the mayor's responsibility. When visiting the site again two weeks later, the slaughter site was occupied by only two butchers, each of whom had killed a cow and were processing it on its hide. There was no offensive odor, and the site was relatively clean. One of the butchers indicated they regularly clean up the blood and other non-meat products when they can sell them for use as fertilizer.

During a follow-on shura (meeting) with nineteen local butchers, the team learned they had never used the existing open-air slaughter facility that had been previously built in town (Exhibit 1). The butchers said it was not necessary as their current slaughter practices and locations were adequate and that the location of the slaughter facility was far from both the livestock market, where they purchased animals and their shops, where they sold the meat. They did not oppose the idea of a slaughter facility, however, if it were advantageous to them and did not pose substantial cost for use. From the discussion with the butchers, three criteria emerged and were determined essential for a facility: a) located close to town and their shops; b) the slaughter facility and market should be co-located or reasonably close; and, c) with traders in mind, the market plan should include overnight facilities for livestock. In general, by the end of the meeting, butchers were supportive, and thirty-six butchers signed an agreement to use such a facility if it met their criteria.

The team also visited livestock traders onsite at the market prior to the conference. Traders concurred that the market should be co-located with the slaughter facility and have overnight facilities. They added the market would need running water and walls, and perhaps a facility for individuals traveling with livestock (e.g., hotel). Persons interviewed by the team included local traders, those traveling from other districts in the province, and traders from two of the nomadic (Kuchi) tribes. The general consensus was that the tentative location chosen for the slaughter facility, the land on the opposite side of the hill from the current market, would well accommodate the grange—located adjacently to the slaughter facility. It was a convenient location just off the main road and sufficiently close to town. It had an important asset; the hill would act as a visual and distance barrier between the facilities and the capital city of Qalat.

Exhibit 1. One butcher shares his thoughts about the location of the new facility.

Pre-Bid Conference

As soon as the contractors settled, officials from RampUp South, flanked by local government, non-government and military partners, outlined their overall objective to be a fully-functioning single site. It would be an inspected slaughter facility with an adjacent livestock holding facility and market. Both were to be operated in a sustainable manner without external funding once initial construction was complete. They were working with NATO and non-government organizations to obtain funding for the livestock market. The purpose of the conference was to facilitate securing a private investor to build the slaughter facility and act as the private entity for operation in what would be a public–private partnership—one of the first in Qalat. Once they had gained input from the contractor firms, they intended to work with local officials, butchers, and livestock traders to solidify the location for the slaughter facility and market. Even though it was apparent—the plan had been in the works for several weeks if not longer—this was the first time Mohammad and the other contractors had heard about the plan.

Bismillah, the Chief Operating Officer for RampUp South, said: "One successful bidder will assist our team in designing the slaughter facility and then after completing construction, will be responsible for operating and maintaining it for five years."

The intensity with which he shared his vision drew the audience in and created a level of excitement Mohammed thought to be in stark contrast to the usual meetings of disgruntled residents that seem to fill the town hall. Bismillah explained that the US military's Agribusiness

Development Team, working alongside the Provincial Reconstruction Team (PRT), had been working with local government and businessmen like himself for almost three years. They were seeking secure funding for what would be an adjacently located grange. He was hopeful this funding would be forthcoming, but said the slaughter facility would be built regardless of whether the grange could be moved to an adjacent location or if it stayed as an open-air market on the opposite side of the hill.

Plan of Action

Mohammed returned home and immediately started putting together a bid that matched the initial plans for an "open-air facility with a non-porous, easily cleaned slaughter-floor and running water" as outlined at the meeting (Exhibit 2). He included "two non-meat animal waste holding areas with concrete flooring and sides" that were a required part of the design so as to reduce potential groundwater contamination, varmints, and insects. Mohammed smiled as he realized that these waste-holding areas would allow him to capture additional value of slaughter that was now widely wasted in the process.
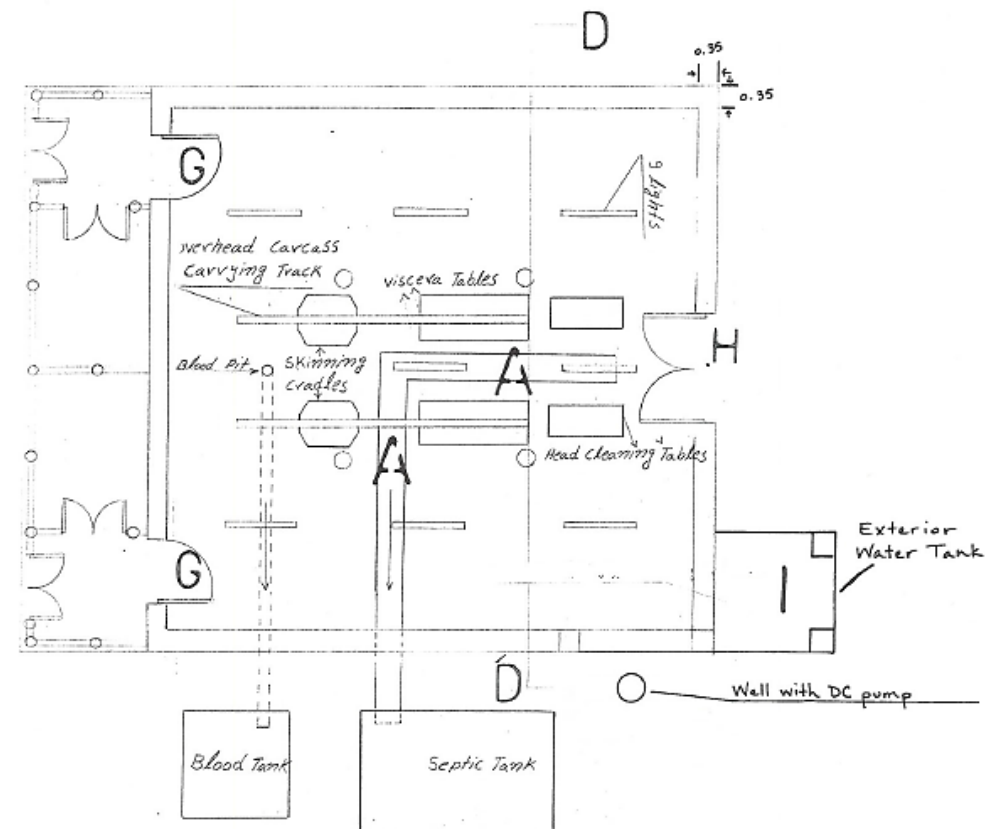
Exhibit 2. Initial draft of slaughter facility plan

While the intent was to establish rules associated with the slaughter, dressing, and meat handling, including controls to governing the operation of the facility, it was not part of the bidding process. Mohammed felt fairly comfortable in his assumption that there would not be many changes from what currently occurred on the hillside.

However, an important question on the minds of the potential bidders at the conference had been how the mayor intended to make sure butchers would use the facility at a cost, given that they were currently using the public hillside.

In what impressed him as a previously developed answer in case the question arose, Bismillah told the audience that "an enforcement mechanism or appropriate incentives would be implemented to ensure full use of the facilities" and that "government guarantees of enforcement of associated rules would be obtained prior to the beginning of facility construction."

The RampUp South team reinforced their statement by reminding the bidders that it was a public –private venture and local government had a significant stake in the outcome. They would provide the land and in return receive 25% of net slaughter revenues (revenue less direct cost of slaughter)—not an insignificant sum, especially important as revenue streams were down as aligned with the withdrawal of NATO troops.

One bidder pointed out that it was the private partner that would build the facility and pay all the operating and maintenance costs. If the slaughterhouse was not used to the degree anticipated, it would be difficult to recoup their initial investment. At that point, the Mayor stepped forward and outlined their tentative plan to enforce the use of the facility.

The Mayor explained the tentative plan enforcing the slaughterhouse use included requiring butchers to be registered and requiring meat sold in Qalat to have a stamp offered only to meat slaughtered at the slaughterhouse. The presenter also indicated they planned to fine or suspend the business license of those not complying. The team appeared very confident that the system put in place would be effective. Further, Mohammed thought, "If I accept the contract as the private member of the partnership, I personally will be motivated to work to ensure enforcement of the use of the facility." While most of his competitors were of the mindset that it was the government's job to make sure everyone played by the rules, he knew he would need to come up with an alternative plan if corruption, lack of resources, or any other potential factor did not result in a slaughter-house requirement for butchers being strictly enforced.

He specifically wondered how hesitant livestock buyers would be to use the slaughterhouse at a cost. He knew its use would require further costs associated with transportation as butchers often hired rickshaws to move the meat to their shops in town—a distance that would increase with the new slaughter location. The cost would be less and the rule easier to enforce if the grange was co-located with the slaughterhouse, but he knew that plan might never be realized.

Budget

Mohammad sat down with his son after the meeting to pencil out some of the financial estimates. His son had come up with a nice schematic of what the finished facility would look like to include in their proposal (Exhibit 3). Mohammed knew he could construct the facility for approximately 1,400,000 Afghanis ($20,000 USD), and perhaps much less if he did not include the cost of his labor and that of his other family members. He thought this bid might be a little high, but he believed it would be a good number to use as that is what he would charge the NATO organizations if they had contracted him to build the facility; He figured his fellow contractors would be thinking along the same lines. He had nearly that much in savings from previous NATO-sponsored projects he had completed during the past decade.

His estimate included the facility and also a 120 meter deep 8-inch diameter well and a submersible pump. He expected he would need to drill at least one more well and perhaps purchase two additional pumps over the next five years. These costs he included in the annual operating costs.

After just a moment's thought, Mohammed decided he didn't expect the facility to last much beyond the five-year contract, and he certainly did not intend to put in much additional money for upkeep to extend its life. "I can't think much beyond the next five years in this unstable environment," he thought.

Mohammed assigned an operating cost of 1050 Afghanis ($15 USD) per day for basic repairs and to cover other costs associated with being open regardless of the level of facility use. He figured in an annual cost of 140,000 Afghanis ($2,000) for the combined salary of himself and his son.

His thoughts shifted to the revenue side. While the butchers would be a captive audience if the rules were enforced, he knew they would eventually move their slaughter to their homes or otherwise work to circumvent the use of the slaughterhouse. He decided he could charge 50 Afghanis for slaughter averaged over the number of sheep and cows (weighted based on his expectation of one cow for every four sheep slaughtered) and that his average cost associated with the slaughter would be 20 Afghanis[3]. He also figured he could get about 10 Afghanis for the non-meat components of each cow slaughtered and about four Afghanis for sheep. He thought it was better to ignore this potential source of revenue for now because he wasn't sure of his right to these byproducts and whether there would be a sufficient market given the quantity of slaughter he anticipated. He recalled that he would have to provide 25% of the revenues to the city.

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[3] Note an exchange rate of 70 Afghanis to $1 USD is used.

Exhibit 3. A pictorial depiction of the draft slaughter facility when completed.

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Mohammed had his son sit down and work out the calculations, asking him to tell him the number of animals that would need to be slaughtered each day in order to cover his investment cost and pay his operating costs and their salaries.

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[4] Note an exchange rate of 70 Afghanis to $1 USD is used.

Livestock Numbers

As his son worked the budget, Mohammed looked over the tally of livestock numbers provided by RampUp South at the pre-bid meeting. They had conducted animal counts on five different days over a one-month-period.

He knew he might need to adjust the numbers. First, they were taken in March. Typically, the number of animals sold increases later in the spring and over the summer. He did, however, think livestock numbers in March might be a good estimate of livestock numbers averaged over the entire year because there tended to be fewer livestock sold during the winter months. Second, he knew the team only counted the number of animals in the market and did not attempt to estimate the number sold for slaughter. Mohammed figured about half the animals were from out of town, and that those traders usually sell their animals within one or two days so they can return home. The other half he estimated to be local, and his experience suggested one-third of the animals they brought along to market would be sold on any given day.

Day	Time	Number of head
Sunday	11:30 to 13:00	275 sheep and 80 cattle
Tuesday	09:00 to 11:00	155 sheep and 30 cattle
Wednesday	10:00 to 12:00	317 sheep and 57 cattle
Thursday	08:00 to 09:30	477 sheep and 82 cattle
Saturday	09:00 to 10:30	306 sheep and 45 cattle

Exhibit 4. Sample number of livestock observed at the grange in one day during a one-month-period in March.

The Decision

Mohammed felt he had all the information he was able to collect or estimate, even if it was not all the information he would like to have to make his decision. He began to go through the budget, first with straight analytics. He would have many factors to consider and ponder over the next couple of days before he decided whether this was the right path for him and his family.

1. Identify the different groups of participants in this case and define what motivates them (to include financial interests). Do the interests of the different groups align? How do they conflict? How are these relationships likely to contribute to or detract from the success of the venture?

2. Identify appropriate policy options to meet the goal of associated with the end-state of butchers using the less convenient private–public slaughterhouse for a fee as compared to the current state of butchering without cost on public land near their shops. What additional costs do they impose on market participants and how might that affect their likelihood of use?

3. What is the break-even number of livestock that must be slaughtered on an average day for the venture? What assumptions did you make to calculate this number?

4. What is the anticipated number of animals that will be slaughtered each day? On what information did you base this estimate?

5. Identify the financial risks associated with adverse changes in policy or the market. While your consideration may be largely qualitative, provide quantitative estimates where possible or specify what additional information you would need to do so.

6. Would you recommend investing in the facility? Should you invest in the facility? Justify your response.

7. Is there any negotiation that, if effective, would change (the strength of) your response to the above question?