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RESEARCH

Commodity-based Trade and Market Access for Developing Country Livestock Products: The Case of Beef Exports from Ethiopia *Karl Rich, Brian Perry and Simeon Kaitibie*

Ethiopia is the largest livestock producer in Africa and one of the largest in the world. Despite increasing growth in livestock exports, large-scale trade volumes have traditionally been constrained by animal diseases. However, commodity-based approaches to trade provide optimism that market access for African livestock exports can be enhanced, but only if technically appropriate and cost-effective systems can be developed. This paper examines the economic feasibility of a proposed two-phase SPS certification system aimed at enhancing Ethiopian livestock exports.

Baseline model results indicate that under current input prices, the proposed system is not economically feasible for exports to targeted Middle Eastern markets. However, the problem is primarily due to the current high cost of inputs, especially feed, and not the marginal costs of the SPS certification protocol, which are only 5% of the breakeven value of the final product. The model estimates that the average export price of beef would be over US$1,000 per ton greater than the average import-unit-value of Brazilian and Indian meat in Middle Eastern markets. On the other hand, improvements in feed use through better rations or more integrated supply chains lower system costs.

An important lesson of the paper is that while technical solutions at a local level can be designed to address global market access issues, downstream issues concerning cost, marketing, and product differentiation can transcend matters of SPS barriers. Even without SPS certification, Ethiopia is not competitive in price-sensitive markets for beef relative to Brazil and India. Conversely, even with SPS certification, the costs of Ethiopian meat in target markets remain above those of competitors with equal or higher standards. Ethiopia's best hope will be to compete on quality and differentiating its product relative to competitors over and beyond higher disease-free and food safety standards.

Export Implicit Financial Performance: The Case of French Wine Companies *Jean-Laurent Viviani*

For export oriented firms the accurate measure of three export performances is crucial to obtaining a complete understanding of the economic health of the firm. This paper addresses the issue of how best to measure the financial performance of export activities.

The study presents a new export financial performance measurement approach based on portfolio theory. The company maximizes global return for a given risk or minimizing risk for a given return across domestic and export activities. The higher the contribution of export activities to global financial performance the greater should be the export intensity. This methodology calculates the implicit expected margin, the implicit margin risk of export activities, and the implicit correlation coefficient between domestic and export activities. The study setting is French wine companies selling either domestically and internationally, or both, from 2001-2005.

Export activities of French wine companies are found to be positive but not statistically significant margin to risk relationship than purely domestic firms. Said another way, it is not statistically significant that for the same level of risk; an exporting company obtains a better margin than a purely domestic company. In the case of French wine companies, this improvement of financial performance seems due to diversification rather than higher financial performance of export activities.

Managers of agribusiness firms might look at the diversification benefits of exports, not simply the higher margins. At the same time the higher margins of exporting may come with more highly correlated risk. Analyzing export financial performance measures and their decomposition may provide a more complete understanding of the economic performance and associated management strategies of the firm.

Entrepreneurial Supply Chains and Strategic Collaboration: The Case of Bagoss Cheese in Bagolino, Italy *Vincent Amanor-Boadu, Piercarlo Marletta, and Arlo Biere*

Many small businesses and their small towns and communities are struggling to sustain their competitiveness in the face of increasing competition resulting from globalization. Almost as a backlash to the globalization trend, there has also been increased demand for certain local and/or traditional products, especially local food products. Interestingly, the technologies facilitating globalization also increase the potential for small businesses and their towns to collaborate in creating expanded markets for these local and/or traditional products. These opportunities and challenges create the need to develop innovative governance systems and improve intellectual property (IP) protection to enhance small local business competitiveness.

In this paper, we argue that the development, implementation and management of entrepreneurial supply chains can foster strategic collaborations that lead to the protection of IP embedded in local and/or traditional food products while enhancing the economic performance of supply chain participants. We define entrepreneurial supply chains as inter-firm relationships characterized by a mutual recognition of need for, and dependence on, one or more valuable assets that are inexhaustible in use but easily depreciated with misuse or abuse. The essence of entrepreneurial supply chains is their ability to facilitate participant alignment, and through that alignment, remove any inherent advantages associated with moral hazard and/or opportunism.

The research uses Bagòss cheese, produced in the small Italian village of Bagolino, as a case study to illustrate the characteristics of entrepreneurial supply chains and test the effect of IP protection and the governance system on performance. Because of the complexity of the relationships among the critical variables in the Bagòss supply chain, and the multiple feedback effects from those complex relationships, we use a system dynamic modeling approach for

simulating alternative governance and IP scenarios. The results show that sharing ownership of the common asset while ensuring ownership of products and customers under the entrepreneurial supply chain governance structure reduce moral hazard and/or opportunism risks across the supply chain. This, in turn, reduces the need to implement conformation systems such as inspection and penalties which increase associated transaction costs. The results also indicate that increasing and enforcing IP protection has the potential to increase prices and improve performance. Finally, the results indicate that recruiting organizations experiencing positive externalities from the supply chain's efforts—e.g., local governments which receive increased sales tax revenues—to help defray some of the intellectual property protection costs is beneficial to the supply chain. The study provides insights into organizing supply chain governance systems that minimize inherent incentives for opportunism and moral hazard, thereby reducing total transaction costs for their participants.

Willingness to Pay for Improved Milk Quality in Northern Kenya Using Experimental Auction *Francis Obuoro Wayua, DeeVon Bailey, Mohamed Shibia, Moses Mamo, and D. Layne Coppock*

Pastoralists in northern Kenya depend on milk as a major source of protein in their diets. African pastoralists have traditionally held most of their financial asset portfolio in the form of livestock and have limited options to obtain outside cash income. This part of Africa is subject to frequent, severe droughts and livestock losses during drought periods can be very high. During drought periods, pastoralists are forced to sell livestock to try to raise money to buy grain or other sources of protein. As a result, local grain prices are often rising during times when local livestock prices are falling. These conditions place pastoralists in extremely precarious economic circumstances. Because drought stress causes milk production to decline, pastoralists are left with little or no milk for their household to consume or sell during these periods. Increasing cash income during wet periods would provide the poorest pastoralists with cash that could be used to buy grain for human consumption. Pastoralists may be able to diversify income by selling milk in nearby towns and cities. However, milk sold in open-air markets in communities in northern Kenya is often of low quality in terms of its sensory characteristics and is also often adulterated before sale. These markets are characterized by poor consumers who need to make choices about milk quality with virtually no information other than their own sensory perceptions. This study uses experimental auctions to determine if consumers in the border town of Moyale, Kenya are willing to pay for enhanced milk sensory characteristics and assurances.

The results suggest that even poor consumers are willing to pay for enhanced sensory characteristics and assurances if these can be communicated in a trusted manner. Older, relatively well-informed women are the group most willing to pay the highest prices for milk quality. The results also indicate that participants in this market are anxious to receive more information and assurances about the milk they consume. This may provide opportunities to pastoralists to devise methods for providing and certifying these types of assurances. Doing so may increase pastoralist incomes from milk sales while likely improving the overall quality of milk being sold in the Moyale market.

The results suggest that economic incentives exist for improving the quality of milk sold in these markets. Some of this improvement may be marginal and slow because infrastructure issues create time and distance barriers to providing high quality fresh milk. However, even small

improvements could potentially add value to the milk being sold in open-air markets. Pastoralists could also consider moving to town and perhaps purchasing feed for cows so that fresh milk could be provided in a timely manner to consumers. Participants in these markets appear to be demanding more information about the milk they are buying. Pastoralists could provide this information and assurances as economic incentives appear to be present to do so.

Export Chains of Fresh Apples in Qixia, Shandong China *Xiaoyong Zhang, Huanguang Qiu, and Zhurong Huang*

In just two decades, China has made a remarkable leap from nowhere to become the world's largest apple producer and exporter. China's emergence in the global apple market has gained substantial attention. The central question is how China made the transition from one extreme to the other. Particularly, how the apple chains in China connect millions of small-scale apple producers with modern sophisticated western consumers.
By applying two qualitative research techniques, focus group discussions and individual in-depth interviews, we were able to discuss these issues with various chain actors, such as the producers, collectors, importers, exporters, etc. This study demonstrates that the Chinese apple export chains are highly coordinated through long-term loyal network relationships and vertical integration. Five types of chain governance mechanisms have been distinguished that link small-scale apple farmers in China with export markets. They were named as 'multi party network', 'preferred farmers', 'nucleus farm', 'cooperatives' and 'contracting'. The five modes have different objectives, chain co-ordination mechanism, and institutional environments embedded. These institutional innovations have perfected chain performances by improving the efficiency of price transmission and generating higher profit margins for chain actors, in particular for small-scale farmers.

Two policy observations can be drawn from our Chinese experiences. The first observation is that globalization is beneficial to improving food safety and quality in China. During the process, globalization was not the goal but was instrumental to improve the product's quality and safety. The second observation is that China has a very reactive institutional mechanism that is capable to responds to the international demand for food safety in efficient ways.
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Of Junk Food and Junk Science *Robert Collins and Gregory A. Baker*

We examine the claim, found frequently in the popular press, that junk food is the cause of the obesity epidemic in the U.S. We use data on the incidence of obesity in the U.S. and U.S. junk food consumption to test the hypothesis that junk food consumption Granger-causes obesity and vice-versa. The results of the Granger causality tests indicate no causality, in either direction, between junk food consumption and obesity rates.

We propose a rudimentary structural model of obesity in order to address the issues of specification error, simultaneity, etc., that plague much research on obesity. We show that because of the dynamic nature of weight status, there is no necessary reason to expect to find a statistical relation between a person's observed weight and the amount he or she is currently eating or exercising. Studies which regress weight, obesity, or the probability of obesity on eating and exercise patterns have serious specification error.

Our findings have significant implications for policymakers and food industry managers. Significantly, they argue against a simplistic explanation of the obesity problem and, therefore, a simple solution. A better understanding of the causes of obesity should lead to the development of policies that will effectively address the obesity problem. A more complete understanding of the causes of obesity should also allow food companies to profitably design, package, and market products that will enable consumers to make wise, healthful food choices.

Do Market Oriented Firms Demonstrate Clarity on Their Value Discipline? Evidence from Illinois Beef Producers

Eric T. Micheels and Hamish R. Gow

Over the past two decades, the concept of a market orientation has been extensively developed and tested. Findings suggest market oriented firms achieve superior performance due to their ability to market products and services that more accurately match consumers' expressed and latent needs. It has been stated that one consequence of a market orientation is the firm's ability to express clarity on their value discipline and its value proposition; however, this hypothesis has yet to be empirically tested. Using a sample of Illinois beef producers, we develop and test a value discipline scale based on quality, relationships, pricing and production as these are major components of a customer's value proposition and we further analyze the impact a market orientation as well as other dynamic capabilities have on value discipline clarity.

In order to determine if market oriented firms demonstrate clarity in their choice of value discipline, scales were developed to measure both the market orientation as well as the value discipline of the firm. Existing scales to measure market orientation, innovativeness, and entrepreneurship were modified to relate to an agricultural audience. A new scale was developed

to measure the choice of value discipline based on several factors. These scales were included in a survey of 1570 members of the Illinois beef association.

To measure value discipline clarity we employ a half-taxi metric (Miller, 2002) and measure the distance from the point to a boundary of the value triangle. We then use the firm's market orientation and its square, along with other dynamic capabilities to explain this distance using an OLS regression.

Using factor analysis and OLS regression, we analyzed the 343 usable responses and found high levels of market orientation to positively affect the clarity of value discipline choice. Moderate levels of market orientation were found to negatively affect value discipline clarity. This U-shaped relationship is similar to those found by Narver and Slater (1990) and Atuahene-Gima, Slater, and Olson (2005). Taken together, these results begin to confirm the hypothesis of Slater, Narver, and Tietje (1998) that market oriented firms have a clearer focus of their means of providing value. Innovation and organizational learning were also found to influence value discipline clarity.

These findings suggest that, along with the performance benefits of a market orientation, market oriented firms may have increased clarity of their value proposition. This awareness may allow firms to strategically build capabilities through targeted allocation of resources which are important to their specific value discipline rather than investing in capabilities which are not as vital to their means of providing value. Further, this awareness may be important when choosing partners in value chains. It may be that value chains where firms are more closely aligned in terms of value disciplines may outperform those value chains were value disciplines are more heterogeneous.

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Commodity-based Trade and Market Access for Developing Country Livestock Products: The Case of Beef Exports from Ethiopia

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Abstract

While Ethiopia is Africa's largest livestock producer, sanitary and phytosanitary (SPS) barriers and animal diseases have traditionally constrained market access. A system dynamics model examined the feasibility of a proposed SPS certification system under a number of scenarios. Model results indicate that the system may not be viable for beef exports to Middle Eastern markets. However, the binding constraint is high domestic input costs rather than the costs of SPS compliance. Sensitivity analyses reveal that while investments in feed efficiency and animal productivity would enhance Ethiopia's export competitiveness, the competitive nature of international beef markets may still prevent market access.

Keywords: SPS, livestock, market access, system dynamics, Ethiopia

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Introduction

Livestock serve a variety of livelihood, risk management, and income-generating functions in the developing world. Where market access is possible, livestock can act as a potential pathway out of poverty for rural producers and other actors throughout the marketing chain, as such access increases the potential scope for sales and makes livestock activities more remunerative (Rich & Perry, 2009). However, market access from Africa has often been stymied by a variety of constraints, including the prevalence of highly contagious transboundary diseases such as foot-and-mouth disease (FMD). These diseases have been mostly eradicated in the developed world, but the fear of their entry from endemic reservoirs in the developing world precludes large-scale livestock product exports into lucrative markets in the European Union, United States, and Japan. Moreover, international trade regulations for meat products require zonal freedom from disease and do not as yet distinguish between products (e.g., bone-in meat vs. deboned meat) in terms of their relative risk of spreading disease. Commodity-based approaches to trade, which instead focus on the process by which products are produced (rather than their regional origin) in assessing their risk of disease, offer the potential for developing countries to export meat products that are lower in risk. Such new standards are being increasingly discussed in international circles (Rich & Perry, 2009; Thomson et al., 2004; Scoones & Wollmer, 2008). However, in order to ensure greater market access, such an approach requires indigenous local systems throughout the supply chain for livestock that demonstrate the risk of disease or pathogen introduction is minimal.

At the same time, the costs of these systems could potentially be high enough to limit the potential for exports. A number of past studies have examined the cost of compliance in developing countries with increased SPS standards in developed ones. Henson, Saqib, and Rajasenan (2004), for example, found that in the case of fish exports from Kerala, the cost of compliance with increased EU standards ranged from 2.5% to 22.5% of turnover, with six of the 14 firms surveyed facing increased costs of 10% or more of turnover. Aloui and Kenny (2004) found that compliance with EUREPGAP standards in Morocco represented 8% of the farm gate cost for efficient farmers and up to double this for an average farmer. Peterson and Orden (2008) estimated compliance costs among Mexican avocado growers exporting to the United States at 15% of the producer price for growers and an additional 5% of the wholesale margin for exporters. In an example among developed world trading partners, Calvin, Krissoff, and Foster (2008) showed that compliance with Japanese phytosanitary protocols raised the costs incurred by U.S. apple growers by 15 cents per pound, or 13.5% of the landed price in Japan. These costs by themselves were enough to make U.S. apples uncompetitive with Japanese ones. While these costs of compliance present non-trivial burdens on producers, the World Bank (2005) argues that they can also represent a means of gaining competitive share in target markets and acting as "a catalyst for progressive change" in terms of modernizing various aspects of agro-food supply chains (xi). Indeed, Jaffee (2003) showed that for green beans from Kenya, while the costs of compliance were about 6 percent of the free on board (FOB) value of exports, the benefits in terms of higher profit margins and export growth have been significant. Moreover, the losses incurred by not complying with standards can be significant – Nin Pratt et al. (2005) found that regional trade bans associated with Rift Valley Fever reduced value-added in the Somali region of Ethiopia by US$132 million, or 42% of the value-added generated in that part of Ethiopia. However, none of these papers couched these issues in the context, costs, competitiveness, and

feasibility of specific systems required to facilitate market access for livestock products, particularly in the wake of potential new standards for their access. This remains an important research gap, particularly in assessing the feasibility of commodity-based trade as a global solution for developing world market access.

This paper examines the feasibility of a proposed two-phase SPS certification system designed to enhance beef exports from Ethiopia and which could serve as an indigenous model of a commodity-based approach to trade from the developing world (Thomson et al., 2009). Of particular emphasis is the competitiveness of products derived from such systems vis-à-vis entrenched global exporters of beef. Ethiopia is the largest livestock producer in Africa and one of the largest in the world, maintaining 43.1 million head of cattle, 23.6 million sheep, and 16.4 million goats in 2006. Moreover, Ethiopia's exports of meat (the majority of which were sheep and goat carcasses) have increased rapidly in recent years, with FAO data showing a rise from US$6.3 million in 2003 to nearly US$32 million in 2005. Despite increasing growth in livestock product exports, most exports from this sector remain concentrated in informal sales of live animals, with limited benefits in terms of foreign exchange and value-adding opportunities. In 2004, the Ethiopian Government set a target to increase exports to 30,000 tons of meat by 2008. This target was not met for several reasons. One reason in particular is that the overwhelming majority of this increase will need to be achieved through the export of beef products, since the quantity (and average carcass weight) of sheep and goat meat required to achieve this figure is not feasible in light of domestic supply and demand for such products. At the same time, low productivity, the prevalence of livestock diseases (such as FMD, contagious bovine pleuropneumonia (CBPP), peste des petits ruminants (PPR), and lumpy skin disease (LSD)), low development of market mechanisms, and the high incidence of informal cross border trade, have meant that the contribution of livestock to foreign exchange earnings has traditionally been modest compared to apparent potential.

A methodological novelty of the paper is the use of a dynamic cost-benefit model using system dynamics to assess both the feasibility of meeting SPS standards and to identify constraints to competitive meat exports from Ethiopia. Baseline results reveal that under current conditions for inputs (animals, feed resources, equipment, and capital expenses), the proposed system is not economically feasible for the export of beef products to Middle Eastern markets. However, it is not the marginal costs of SPS certification that inhibits Ethiopian meat exports, but rather the high cost of inputs, especially feed. Indeed, SPS certification costs represent less than 5% of the breakeven value of the final product, whereas the costs of animal feed in the proposed system are between 33%-42%, depending on the type of feeding ration used. Correspondingly, under baseline conditions, the model estimates that the average FOB product weight of beef would be over US$1,000 per ton greater than the average cost, insurance, and freight (CIF) import unit value of Brazilian and Indian meat in markets in the Middle East, such as Bahrain, Qatar and Saudi Arabia.

Improvements in feed use through better rations could lower the cost of the system considerably. Indeed, using best-cost rations, the model computes the FOB product value of improved, SPS-certified beef at US$3,562 per ton. While this is still somewhat more expensive than competitors in the Middle East, sensitivity analysis reveals that lower animal purchase costs or reduced system margins could bring forth noticeable cost savings that would enhance competitiveness.

An important lesson of the paper is that while technical solutions at a local level can be designed to address global market access issues, downstream issues concerning cost, marketing, and product differentiation can transcend technical matters of SPS barriers. In particular, Ethiopia remains in somewhat of a marketing quandary: its products are too costly without certification for low-value, price-sensitive markets in Africa and too costly with certification relative to competitors in the Middle East. Access to the European Union is theoretically possible given preferential, duty-free access to that market, but only if commodity-based approaches are accepted by international standard setting bodies. In the short- to medium-run, Ethiopia will need to focus on other types of marketing approaches to facilitate access to markets in the Middle East, such as product freshness, but the potential size of such markets is unlikely to be large enough to meet government goals for exports.

Overview of the Proposed SPS System

The SPS certification system proposed here is technically feasible, meets international standards, complies with export market requirements, and is designed in line with developing a disease-free compartment within Ethiopia (Zepeda & Salman, 2006; Anon., 2007). The system would first entail the pre-selection of animals in local markets, followed by the initial testing, vaccination, and quarantine of animals over a 21-day period in its first phase (Phase 1). In the second phase (Phase 2), quarantined animals from Phase 1 would then be finished in a feedlot system to bring them up to export weight (400 kg).

Prior to purchase, animals would be visually inspected by trained personnel for physical fitness, body condition, hair coat, alertness, salivation, eye discharge, mouth lesions, lameness, and any other abnormalities. The purchased animals would then be collected and kept for up to three days at temporary collection sites pending transportation to the Phase 1 SPS certification facility. Within 1–3 days, animals would then be transported to the Phase 1 SPS certification facility using specially designed, disinfected, and sealed vehicles. Animals would be loaded, transported, and unloaded humanely. Standard operating procedures (SOPs) for animal handling would be prepared for the certification process, and training and supervision conducted. Animals leaving purchase sites would be accompanied by animal health certificates to be provided by the animal health inspector representing the private sector.

Phase 1 facilities are conceived as small quarantine sites that handle approximately 130 head of cattle every four weeks (three weeks of testing and handling, one week idle for cleaning). They would be owned and run by private entrepreneurs but certification is only made by a "competent authority." Phase 1 operators can charge a fee by either selling animals at a premium or charge a fee to Phase 2 operators for the use of Phase 1 infrastructure. The facilities would be subject to regular inspection and monitoring by the Ministry of Agriculture and Rural Development (MoARD), as well as by representatives of importing countries or companies as required. Upon entry to Phase 1, animals would be ear-tagged, tested for FMD, and vaccinated for FMD, CBPP, and LSD. At day 14, animals would be re-tested for FMD; those that test positive are removed from the facility and sold on domestic markets. If any animals have clinical signs of FMD, the entire batch would be removed.

After 21 days in Phase 1, animals would be certified as "disease-free" and then transported to a Phase 2 feedlot. This facility has a capacity of approximately 5,000 head of cattle and holds

animals from other Phase 1 facilities. Animals stay in Phase 2 until they reach 400 kg. This helps to ensure a more consistent supply of animals from pastoral areas and allows for the sourcing of younger bulls. Animals would be vaccinated against FMD and other diseases again should they remain in the facility longer than their duration of immunity from the first vaccination (e.g., six months in the case of FMD). In the event of clinical FMD outbreaks, all affected animals (and those in adjacent pens) would be removed from the facility. The remaining animals would be followed up for 21 days and may also be tested for FMD if necessary. The whole facility would be properly decontaminated. Likewise, proper decontamination and disposal procedures will also be followed in case of outbreaks of other diseases.

The proposed investment will necessitate the expansion of existing slaughter capacity as well as the development of feedlots to both improve off-take levels and improve biosecurity measures. It is expected that feedlots created within the SPS certification framework and the attendant supply chain will sufficiently cater to the capacity requirements of export-oriented abattoirs as well as satisfy demand in the export market for meat products. The benefits of this system are in its ability to ensure to trading partners the ability of Ethiopia to produce higher quality, certified, disease-free meat.

Methodology

The feasibility of the proposed system was evaluated using a dynamic cost-benefit analysis that was undertaken following principles and simulation techniques from the system dynamics literature (Sterman, 2000; McGarvey & Hannon, 2004). System dynamics (SD) models capture the flows and feedbacks inherent in dynamic systems. Because the proposed certification model involves a dynamic process of storing and moving animals, an SD framework presents important advantages in conducting a cost-benefit analysis. First, one can compute the evolution of costs and benefits arising from each step of the process, allowing the practitioner to assess the evolution of profits and costs. This is important since the proposed system will have a number of high, upfront costs and the benefits will not be realized immediately. Second, an SD framework can capture feedbacks between phases and market phenomenon that could impact the system. For instance, a rejection of animals from Phase 1 could have ramifications on the movement (and price) of animals for export in future time periods. Moreover, the proposed system would have important implications on feed demand and tradeoffs between domestic and export meat markets that could be modeled. Increased demand for feed, for example, would raise prices, which will correspondingly impact the profitability of the system. Finally, the use of an SD framework allows the user to visually identify and analyze potential bottlenecks and conduct sensitivity and scenario analysis of key parameters to assess the optimal mix of interventions necessary to improve the system.

The model is programmed in STELLA 9.0.2 (http://www.iseesystems.com), which denotes these dynamic relationships graphically. Figure 1 illustrates the mechanics of the two-phase system process in STELLA. Each box in the figure represents the stock of animals at each point in time (one week). The wide arrows between stocks represent the flows of animals between one state to another, while the circles are parameters associated with disease incidence and other market relationships. The thin arrows that link parameters, flows, and stocks denote relationships between them. For example, the flow “Movement to Holding” is a function of the stock “Phase 1

pretesting" and the parameter "Probability of disease on arrival". In STELLA, the actual nature of the functional relationship is written as an equation that can be accessed by double-clicking on the graphical map of the model.

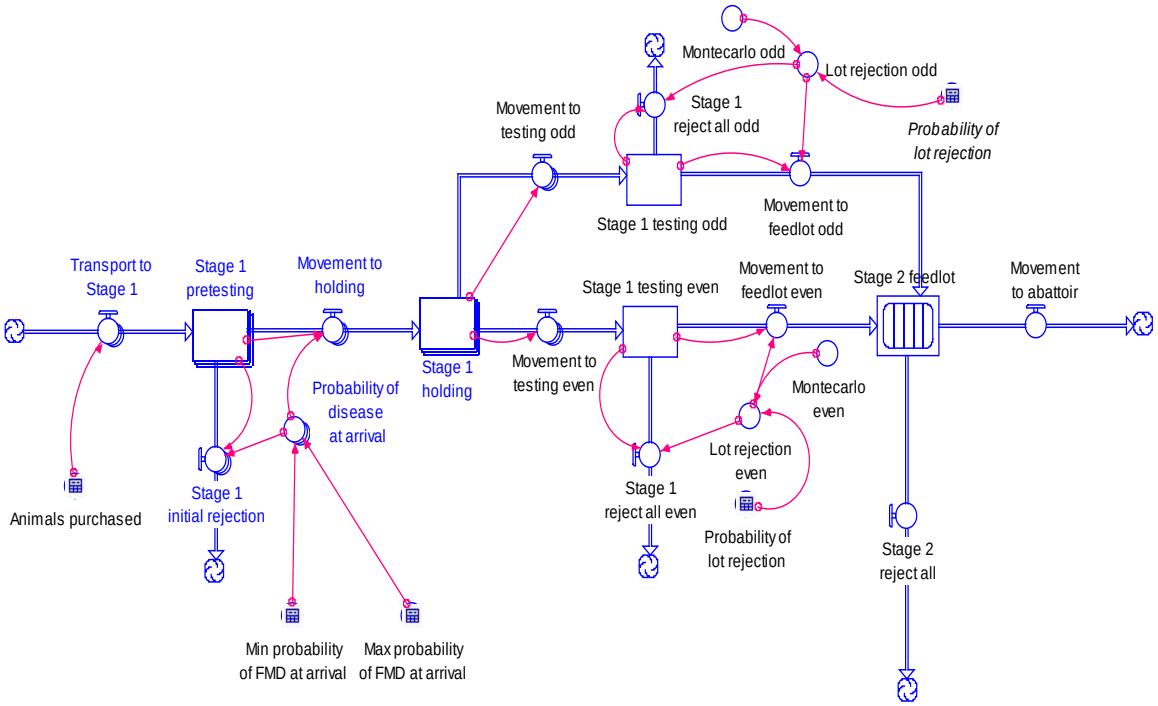

Figure 1: STELLA diagram of the two-phase SPS certification process.

The starting point of the model is a representative network of Phase 1 and Phase 2 facilities. Eight Phase 1 facilities are required, given that each Phase 1 facility supplies the Phase 2 facility once every four weeks. In Phase 1, purchased animals are transported, tested, and inspected during the first week ("Phase 1 pretesting"). The baseline assumes that animals enter the system at 250 kg. After the first week, a portion of animals are rejected and sold on the domestic market ("Phase 1 initial rejection"), with the remainder moved to holding. Note that in both the Phase 1 and Phase 2 models, there are parameters related to disease incidence that determine the probability of animals being rejected from the system. Animals are held for a week ("Phase 1 holding") and then re-tested during the third week ("Movement to testing"). A cohort of animals moves to the Phase 2 facility[1] if all animals test negative for disease; otherwise, the entire cohort is rejected. The odd and even distinction in the model is a modeling technique to preserve identification of the individual cohort that is being re-tested prior to movement to the Phase 2 facility. Beginning with the fifth week of the model, two cohorts of animals move into Phase 2 every week. Given an assumed baseline daily rate of weight gain of 1 kg/day, this implies that animals stay in Phase 2 for a period of 22 weeks (150 days divided by 7, rounded up to the next

[1] More specifically, each stock and flow in Phase 1 is denoted as an array so that each cohort can be identified. However, because Phase 2 does not preserve cohorts and because flows to sub-models without arrays must also be array-free, each pair of Phase 1 facilities is separated into even and odd components to maintain consistency with the rest of the Phase 1 part of the model.

integer week), after which they are moved to the abattoir for slaughter[2]. The "Phase 2 feedlot" stock in the model is actually a sub-model that represents the week-by-week movement of animals during each week they remain in the Phase 2 facility. In the case of clinical FMD outbreaks in particular pen(s), all animals in the pen(s) and probably in adjacent pen(s) will be removed from the facility. The animals in other pens will be followed up for 21 days and if required, these animals may also be tested for FMD. If there is clinical FMD in all of the pens of Phase 2, the entire feedlot is rejected, with animals diverted into the domestic market at a loss. Animals sold in the local market are valued at the per-kilogram price times their weight at exit. In the model, the salvage value distinguishes between each cohort that is rejected from the system and thus the system keeps track of the implicit value of all system animals.

Upon reaching 400 kg and assuming that the feedlot has not been rejected, two cohorts of animals move to slaughter per week (recall that two cohorts enter every period, with the model preserving a first-in, first-out system). Animals are converted to meat equivalent based on a conversion rate of 30.25% (based on expert consultation with the Texas AgriLife Research team) and moved to storage (one week) after which the meat is either exported or sold domestically. The model assumes that high-value cuts are sold overseas, with offal and trimmings (5% of the live weight) kept in the domestic market. The amount of beef generated by a representative network in the SD model in a given year is approximately 1,300 tons of boneless beef equivalent. It is envisaged that 10,000 tons of the government's goal of 30,000 tons of overall meat exports will be comprised of high-value beef exports from this system. This would suggest that 8 feedlot networks (with each network containing one Phase 2 feedlot and eight Phase 1 facilities) are required to meet the government's volume goals for beef exports.

Data

The economic feasibility of the system was assessed using primary and secondary data. An initial rapid assessment of the feedlots and abattoirs located in Awassa, Melge Wondo, in and around Adama, Debre Zeit/Bushoftu, Addis Ababa and Sebeta, and site interviews with Shallo Quarantine Station, the National Veterinary Institute (NVI), and the National Animal Health Diagnostic and Investigation Centre (NAHDIC) provided a basic picture of the present marketing system. From this rapid assessment, initial surveys of feedlots and abattoirs were developed and carried out by the Texas AgriLife Research team from December 2006 to January 2007, with follow-up visits occurring from February to April 2007. These data were used to construct enterprise budgets to reveal the nature and profitability of the current system, the flows of animals for export, specific costs of production, and gross margins.

As the proposed system entails additional costs related to certification that are currently not incurred by the industry, additional data were collected from a series of expert informant interviews of veterinary officials, engineers, government officials and estimates from existing feedlots and abattoirs. These data included:

[2] Because movement between states is on a weekly basis, it is necessarily the case that animals exiting the system may be slightly over 400 kg. For example, in the baseline, an animal at exit will be 404 kg based on an entry weight of 250 kg + 154 kg gained in the feedlot at 1 kg/day (note that an animal stays in the feedlot for the full week in which it reaches 400 kg).

1. Initial and recurrent costs of training staff in "good manufacturing" practices to comply with SPS measures;
2. Capital investments on fences, land, paddocks, boreholes, and trucks devoted to the maintenance and viability of the certification system itself;
3. Laboratory, diagnostic, and vaccine costs, some of which may be incurred by the public sector;
4. The costs incurred of rejecting animals out of the export system and into the domestic market;
5. Additional costs related to certification, including tagging, marking, and other types of traceability measures;
6. Relative profitability in foreign markets as a result of this system, based on a comparison of Ethiopian meat to competitors.

Results

In this section, we examine the economic feasibility of the proposed SPS system using the dynamic cost-benefit model described earlier. We first examine the feasibility of the system based on the data parameters provided in the last section and identify potential bottlenecks to its profitability. We also distinguish between costs related to SPS compliance and those inherent in improving quality. We then conduct a series of sensitivity analyses on various cost and disease incidence parameters to identify those parameters that might significantly impact competitiveness in export markets. The implications of the model and possible modalities required to promote cost savings will be discussed in later sections.

Baseline Results

The baseline scenario involved running the model with the parameters presented above over a 260-week (five-year) period to capture the range of costs and benefits associated with the system from each cohort produced. For the first 25 weeks of the model (3 weeks in Phase 1 and 22 weeks in Phase 2 in the baseline), the only revenues that are generated are derived from the salvage value of animals rejected due to disease in Phase 1. From the 26th week onwards (once animals reach 400 kg or more), two cohorts of fattened animals exit the system en route to slaughter. At this point, revenues are generated at Phase 2 from sales to the abattoir, assuming that the facility meets its costs plus a 10% margin. Likewise, once animals are slaughtered and sold for export, we assume that the abattoir receives a 10% margin on top of the value of costs incurred. While this ensures profitability in the system, these profits occur with a delay, as model results show that non-recurrent investments are paid for only after year five.

Table 1 summarizes the breakeven costs of the two-phase system given prevailing feed rations used at present by two sample feedlots, one with high feeding costs and the other with lower feeding costs. The breakeven computations include the margins paid between Phase 2 and the slaughterhouse and the slaughterhouse and export. The FOB breakeven price ex-slaughterhouse from the system is ETB (Ethiopian Birr) 4,721/animal for animals from the low-cost feedlot and

Table 1. Breakeven price computation of two-phase system in the baseline

Cost component	Value (ETB/animal)	
	Lower- cost feedlot	Higher-cost feedlot
Entry cost of purchased animals into Phase 1	2,250	2,250
Added costs from Phase 1	526	526
Revenues from Phase 1 (rejected animals)	275	276
Total costs of animal after exit from Phase 1	2,501	2,500
Entry cost of animals into Phase 2	2,501	2,500
Added costs from Phase 2	1,620	2,452
Total costs of animal after exit from Phase 2	4,121	4,952
Phase 2 margin (10%)	412	495
Entry cost of animals to slaughterhouse (Phase 2 cost + Phase 2 margin)	4,533	5,447
Added costs from processing	525	525
Revenues from hides and skins	163	163
Revenues from domestic sales (offal and trimmings)	603	606
Net total costs of animals from slaughterhouse	4,291	5,203
Slaughterhouse margin (10%)	429	520
FOB breakeven costs of certified animal (slaughterhouse costs + margin), ex-slaughterhouse (ETB/animal)	4,721	5,723
Final weight (kg)	402	404
FOB breakeven costs of certified meat @ product weight (30.25% conversion rate), ex-slaughterhouse (US$/ton)	4,310	5,203

Source: Model simulations. Note that totals may not exactly sum due to rounding.

ETB 5,723/animal for animals from the high-cost feedlot (the model assumes an exchange rate of US$1=ETB 9 that prevailed in late 2007/early 2008). The large difference in the two feedlots can be attributed to the much higher cost feed ration used by the high-cost feedlot that adds nearly 800 ETB per animal to the costs incurred in Phase 2 (Table 1). Converting these prices to US$/ton and boneless meat equivalent yields an FOB product value of improved, SPS certified beef of US$4,310/ton (low-cost feedlot) and US$5,203/ton (high-cost feedlot).

How do these costs compare with prices prevailing in target markets in the Middle East? In Table 2, we compiled average import unit values (CIF) for the most recent year available (2006 for Qatar and Saudi Arabia; 2007 for Bahrain) for fresh boneless beef in selected markets in the Middle East where data were available. These figures are a weighted average of different cuts and qualities imported into each market and do not provide specific information on particular

Table 2. Average import unit values for fresh boneless beef to selected Middle Eastern markets by selected sources, most recent year

Market	All sources	Brazil	India	Pakistan
Bahrain (2007)	5,254	3,203	2,223	4,417
Qatar (2006)	5,084	2,796	2,301	NA
Saudi Arabia (2006)	3,151	3,009	3,061	NA

Source: UN COMTRADE. Note that 2006 figures for Bahrain are US$5,116 (all sources), US$3,526 (Brazil), US$1,407 (India) and US$3,491 (Pakistan)
Values in US$/ton. NA: not applicable

cuts (and whether such cuts are high- or low-value) that a particular supplier sells in a given market. Nonetheless, they serve as a proxy to compare the competitiveness of fresh boneless beef based on our conversion rate (30.25%). We further distinguish between the values from all sources, Brazil, India, and Pakistan – markets that Ethiopian meat would compete with in the short- and medium-term. Based on these figures, we note that the average FOB price engendered by the Ethiopian SPS system is much higher than the average CIF prices in the Middle East for

Table 3. Differentiation of SPS costs of compliance in two-phase system

Cost component	Value (ETB/animal)	
	Lower-cost feedlot	Higher-cost feedlot
Added costs from Phase 1	526	526
SPS costs of compliance	170	170
Other costs (feed, transport, handling etc.)	356	356
Percentage of SPS costs in added Phase 1 costs	32.2	32.2
Added costs from Phase 2	1,620	2,452
SPS costs of compliance	33	32
Feed costs	1,547	2,379
Other costs	42	42
Percentage of SPS cost in added Phase 2 costs	1.9	1.2
Added costs from processing	525	525
SPS costs of compliance	4	4
Processing costs	520	520
Percentage of SPS cost in processing costs	0.80	0.80
Total costs of SPS compliance (all phases)	204	204
FOB breakeven price ex-slaughterhouse	4,721	5,723
Percentage SPS costs of compliance as a share of breakeven value ex-slaughterhouse	4.3	3.6

Source: Model simulations. Note that totals may not exactly sum due to rounding.

meat from Brazil, India, and Pakistan (for the high-cost feedlot). In the case of the lower-cost feedlot, adjusting the FOB price for transportation costs utilizing improved road-sea links analyzed in earlier Texas AgriLife Research studies (US$370/ton) lands Ethiopian meat at a value lower than the average import unit value in Bahrain and Qatar, but still at a premium over Brazilian and Indian meat. While one could argue that the quality of the product produced in the certified system is superior to products from India and Pakistan, and possibly on par with that from Brazil, the ability of Ethiopia to obtain higher prices would rely on its ability to market and differentiate its product accordingly, which will add further costs that are not computed here. Indeed, it is likely that Ethiopian beef would need to be sold at a discount (relative to the quality of the meat) to gain market share in initial attempts at market penetration.

Despite the higher costs of Ethiopian meat in these Middle Eastern markets, we demonstrate in Table 3 that these costs are generally not attributable to the SPS system itself. Indeed, we find that the total costs to comply with higher SPS standards are only 4.3% (for the lower-cost feedlot) and 3.6% (for the high-cost feedlot) of the final, FOB breakeven price. We find that the vast majority of SPS costs of compliance occur in Phase 1 and represent about 32% of the total added costs in Phase 1. Nonetheless, the main input responsible for higher costs in the two-phase system is the cost of feed: ETB 1,547/animal (lower-cost feedlot) and ETB 2,379/animal (higher-cost feedlot). These costs strongly suggest modalities to lower feed costs as a way to improve competitiveness in foreign markets.

SPS System Competitiveness Using Best-cost Rations

In order to explore the feasibility of the two-phase SPS system under different feeding regimes, we applied two different types of best-cost rations derived by the Texas AgriLife Research team. One of these is predominately a maize-wheat middlings mix, while the other is mainly wheat middlings; each also contains smaller amounts of molasses and oilseed cakes. The breakeven analysis based on these rations and different entry weights is summarized in Table 4 and contrasts markedly with baseline results reported in Table 1.

In all cases, the wheat middlings ration (the identified ‘best-cost’ ration) yields markedly lower-cost animals (and meat) relative to the baseline. For the wheat middlings ration, the FOB breakeven cost per animal ranges from ETB 3,927/animal based on a 200 kg entry weight to ETB 4,244/animal for a 300 kg entry weight (Table 4). Comparing like entry weights with the baseline (250 kg) reveals a difference of ETB 635/animal between the best-cost ration and the baseline lower-cost feedlot ration. Converting to boneless meat equivalent and US$/ton yields an FOB export value of improved, SPS certified Ethiopian meat that ranges from US$3,562 to 3,818 per ton (Table 4). The maize-wheat middlings ration adds about ETB 200 to 400 more per animal (depending on entry weight) relative to the predominantly wheat middlings ration, but is still less costly than the lower-cost feedlot ration (cf. Table 1).

Table 5 reveals the breakdown of SPS costs of compliance under the use of best-cost rations. The percentage of SPS costs as a share of the breakeven value is slightly larger in this case because the breakeven value is lower than in the baseline. Nonetheless, these costs only represent 4.6–5.2%

Table 4. Breakeven price computation of two-phase system using best-cost rations

Cost component	Value (ETB/animal)					
	Maize-wheat middlings ration			Wheat middlings ration		
	200 kg entry	250 kg entry	300 kg entry	200 kg entry	250 kg entry	300 kg entry
Entry cost of purchased animals into Phase 1	1,800	2,250	2,700	1,800	2,250	2,700
Added costs from Phase 1	526	526	526	526	526	526
Revenues from Phase 1 (rejected animals)	221	274	331	223	276	335
Total costs of animal after exit from Phase 1	2,105	2,501	2,895	2,103	2,500	2,891
Entry cost of animals into Phase 2	2,105	2,501	2,895	2,103	2,500	2,891
Added costs from Phase 2	1,700	1,342	997	1,366	1,097	844
Total costs of animal after exit from Phase 2	3,805	3,843	3,892	3,469	3,597	3,735
Phase 2 margin (10%)	380	384	389	347	360	374
Entry cost of animals to slaughterhouse (Phase 2 cost + Phase 2 margin)	4,185	4,227	4,281	3,816	3,956	4,109
Added costs from processing	525	525	525	525	525	525
Revenues from hides and skins	163	163	163	163	163	163
Revenues from domestic sales (offal, trimmings)	609	602	609	607	604	612
Net total costs of animals from slaughterhouse	3,938	3,988	4,034	3,570	3,714	3,858
Slaughterhouse margin (10%)	394	399	403	357	371	386
FOB breakeven costs of certified animal (slaughterhouse costs + margin), ex-slaughterhouse (ETB/animal)	4,332	4,386	4,437	3,927	4,086	4,244
Final weight (kg)	406	401	406	405	402	408
FOB breakeven costs of certified meat @ product weight (30.25% conversion rate), ex-slaughterhouse (US$/ton)	3,918	4,016	4,016	3,562	3,729	3,818

Source: Model simulations. Note that totals may not exactly sum due to rounding.

Table 5. Differentiation of SPS costs of compliance in two-phase system

Cost component	Value (ETB/animal)					
	Maize-wheat middlings ration			Wheat middlings ration		
	200 kg entry	250 kg entry	300 kg entry	200 kg entry	250 kg entry	300 kg entry
Added costs from Phase 1	526	526	526	526	526	526
SPS costs of compliance	170	170	170	170	170	170
Other costs (feed, transport, handling etc.)	356	356	356	357	356	357
Percentage of SPS costs in added Phase 1 costs	32.2	32.2	32.2	32.2	32.2	32.2
Added costs from Phase 2	1,700	1,342	997	1,366	1,097	844
SPS costs of compliance	31	32	31	32	32	31
Feed costs	1,627	1,269	924	1,293	1,024	771
Other costs	42	42	42	42	42	42
Percentage of SPS cost in added Phase 2 costs	1.8	2.3	3.1	2.2	2.8	3.6
Added costs from processing	525	525	525	525	525	525
SPS costs of compliance	4	4	4	4	4	4
Processing costs	521	521	520	520	520	520
Percentage of SPS cost in processing costs	0.80	0.80	0.80	0.80	0.80	0.80
Total costs of SPS compliance (all phases)	204	204	204	204	204	204
FOB breakeven price ex-slaughterhouse	4,332	4,386	4,437	3,927	4,086	4,244
Percentage SPS costs of compliance as a share of breakeven value ex-slaughterhouse	4.7	4.7	4.6	5.2	5.0	4.8

Source: Model simulations. Note that totals may not exactly sum due to rounding.

of the breakeven price, depending on the ration and entry weight. Table 5 further highlights the marked difference in feed costs attributable to the best-cost ration relative to the baseline.

Even with the noticeable reduction in breakeven costs from the use of best-cost rations, in the best-case scenario (200 kg entry weight with the predominantly wheat-middlings ration), the FOB price of SPS certified Ethiopian meat remains somewhat above that of Brazilian and Indian meat in target Middle Eastern markets. This suggests that an examination of other parameters is required to assess where further scope for cost-savings could be realized. We address these issues in the sensitivity analysis.

Sensitivity Analysis

The sensitivity analyses highlighted changes in a variety of parameters using the best-cost rations analyzed in the previous section. We focused on the following set of alternative simulations:

- A reduction in feed prices (by 10% and 20%) to simulate an easing of feed prices relative to current levels.
- A widening of the range of animal rejections in Phase 1 to simulate sub-optimal purchasing and inspection practices for purchased animals, in terms of detecting diseased animals prior to entry into Phase 1.
- The introduction of government subsidies for SPS-related costs. The baseline assumes that all SPS costs are incurred by the private sector – this simulation considers 50:50 cost sharing by the government and private sector.
- Reduction in the margin between Phase 2 and the slaughterhouse and slaughterhouse to export from 10% to 5% and 0%. The latter case could represent a fully integrated system owned by one firm, for instance, or the subsidization of certain costs.
- Alternate purchase prices for live animals, including simulating lower purchase prices (ETB 5.75/kg and ETB 7.5/kg) and higher prices (ETB 10/kg). Lower purchase prices could be interpreted as reducing the transactions costs at purchase between producer and buyer or improved productivity, for example.
- Alternative conversion rates for boneless meat to simulate lower and higher processing efficiency, respectively.
- Reduced transportation costs between different phases (50% lower costs).
- Reduced wage labor costs in each phase (50% lower costs).

Table 6 summarizes the results of this battery of sensitivity analyses, focusing on the FOB breakeven price in meat equivalent and US$ per ton. A reduction in feed costs results in some cost savings, particularly when feed prices fall by 20%. Under the wheat middlings ration, a 20% fall in feed prices reduces the breakeven FOB price by over US$250 per ton for animals entering at 200 kg (Table 6). This highlights the critical importance of feed in the feasibility of the system and finding ways to improve feed availability and productivity. The change in the probability of rejection range had no noticeable impact on the breakeven price, while subsidizing SPS costs saves approximately US$100–125 per ton. On the other hand, reducing margins has a marked impact on the system's viability, with zero margins resulting in a best-case breakeven FOB value of US$2,924 per ton. Of course, the realism of this simulation would necessitate other ways that

returns on investments could be realized. For example, one interpretation might be that it reflects government underpinning some of these costs through subsidies.

Lower purchase prices for live animals (from better productivity or supply chain efficiency) also have an important impact on the viability of the system. If we assume the purchase price of ETB

Table 6. Results of alternative scenarios based on sensitivity analysis of selected parameters

Scenario	FOB breakeven costs of certified meat @ product weight (30.25% conversion rate), ex-slaughterhouse (US$/ton)		
	200 kg entry	250 kg entry	300 kg entry
Maize-Wheat Middlings BCR (from Table 4)	3,918	4,016	4,016
Wheat Middlings only BCR (from Table 4)	3,562	3,729	3,818
Maize-Wheat Middlings BCR, 10% lower feed prices	3,741	3,881	3,924
Wheat Middlings only BCR, 10% lower feed prices	3,431	3,621	3,753
Maize-Wheat Middlings BCR, 20% lower feed prices	3,572	3,746	3,823
Wheat Middlings only BCR, 20% lower feed prices	3,289	3,512	3,657
Wheat Middlings only BCR, probability rejection range 5-20%	3,555	3,706	3,822
Wheat Middlings only BCR, 50% subsidy on SPS costs	3,453	3,615	3,714
Wheat Middlings only BCR, 5% margin Phase 2-slaughterhouse, slaughterhouse-export	3,237	3,387	3,469
Wheat Middlings only BCR, 0% margin Phase 2-slaughterhouse, slaughterhouse-export	2,924	3,060	3,142
Wheat Middlings only BCR, purchase price ETB 5.75/kg	2,936	2,945	2,894
Wheat Middlings only BCR, purchase price ETB 7.5/kg	3,274	3,365	3,389
Wheat Middlings only BCR, purchase price ETB 10.0/kg	3,754	3,973	4,110
Wheat Middlings only BCR, boneless conversion rate 25.3%, domestic trimmings 10%	3,534	3,721	3,841
Wheat Middlings only BCR, boneless conversion rate 34%, domestic trimmings 0%	3,706	3,859	3,942
Wheat Middlings only BCR, 50% lower transport costs	3,416	3,588	3,682
Wheat Middlings only BCR, 50% lower labor costs	3,407	3,573	3,670

BCR: best-cost ration.
Source: Model simulations.

5.75/kg that prevailed in late 2006, we also obtain breakeven FOB meat values that are less than US$3,000/ton (Table 6). Interestingly, we also see under this scenario that the returns to heavier animals are higher than those when purchase prices are higher. This is because under lower purchase prices for live animals, the cost of feed outweighs the effect of the purchase price for the animal, making it more cost-effective to use heavier animals. This suggests that the price per kilogram of entry animals needs to be considered as a critical decision-making component by producers in understanding when it is profitable to engage in exporting beef. The impact of alternative conversion rates in processing, lower transport costs, and lower labor costs is relatively small (Table 6).

Finally, as a thought exercise, we computed the price per ton of meat produced by only Phase 1 of the system (i.e. without the feedlot). The idea here was to examine the breakeven costs of only engaging in the simple quarantine and inspection activities of Phase 1 (i.e., without the feedlot), based on the entry of a 300-kg animal. The results in Table 7 are striking and reveal that a partial SPS system would be less competitive. In particular, because animals are not improved as far as weight gain, the Phase 1 system alone adds costs without adding quality. Rather, it may well make more sense to combine SPS certification with meat quality improvements (as envisioned by the proposed system) and charge a higher price rather than sell lower-quality, but SPS certified meat at above-market prices.

Table 7. Feasibility of system assuming only Phase 1 and wheat middlings best-cost ration

Cost element	ETB per animal
Exit costs from Phase 1 at 300 kg (see Table 4)	2,891
Margin for certification system (10%)	289
Entry cost at slaughterhouse	3,180
Processing costs of abattoir (includes transport to port)	525
Revenues from hides and skins	163
Revenues from trimmings and offal (5% of live weight or 15 kg @ ETB 30/kg)	450
Exit costs from slaughterhouse	3,092
Margin for slaughterhouse (10%)	309
FOB breakeven costs of certified animal (slaughterhouse costs + margin), ex-slaughterhouse (ETB/animal)	3,401
FOB breakeven costs of certified meat @ product weight (30.25% conversion rate), ex-slaughterhouse (US$/ton)	4,164

Source: Model simulations

Discussion

Based on the baseline results, the proposed model suggests that the binding constraint to the feasibility of the proposed SPS certification system is feed ingredient prices. In particular, the rapid price inflation over 2007 in Ethiopia resulted in a near-doubling of feed prices that puts the prices of Ethiopian beef above those of competitors in targeted Middle Eastern markets. With improved, best-cost feed rations, Ethiopian beef would cost around US$3,600–3,800 per ton

FOB Ethiopia, higher than the prices of meat from Brazil, India, or Pakistan in Middle Eastern markets, though still much lower than the average price from all sources.

Given the pessimism of the baseline results in target markets and in the absence of technical interventions to improve this system, we consider first if there are alternatives to the SPS system, in terms of finding other markets that might have lower SPS standards than those in the Persian Gulf. Scoones and Wollmer (2008), for example, highlight the potential of regional markets within Africa. To do this, we assessed a number of markets in Africa and the Middle East on a variety of dimensions, including per capita consumption of beef products, beef consumption growth, dependency on imported beef, market size, GDP per capita and GDP growth, to determine which markets might be poised for entry by Ethiopian products. For those high-potential markets (based on an index of these factors), we collected import unit value data as available. We then compared those import prices (see table 8) to 2005–06 Ethiopian export prices (US$2,244/ton FOB for half-carcasses or quarters) based on Ethiopian company-level sales to Africa (proxied by sales to Congo-Brazzaville). This comparison highlights that Ethiopia is potentially competitive in beef markets with lower standards, including Algeria, Cote d'Ivoire, Gabon, and Lebanon. Ethiopia has exported to markets such as Egypt recently; in 2005–06, it exported over 934 tons of beef at an average FOB export price of US$1,724/ton, somewhat above the average CIF price for fresh boneless beef in Table 8.

Table 8. Assessment of import prices in key identified markets for Ethiopian beef

Market (date of reporting)	Fresh carcasses	Fresh bone-in beef	Fresh boneless meat	Frozen carcasses	Frozen bone-in beef	Frozen boneless meat
Algeria (2006)	3,670	4,220	4,247	1,982*	1,955*	2,398
Cote d'Ivoire (2006)	14,713	16,574	15,453	1,538	2,296	1,406
Egypt (2006)	NA	NA	1,356	2,167	1,797	1,847
Gabon (2006)	8,358	7,135	6,165	3,141	1,143	1,377
Jordan (2006)	1,551	3,091	2,328	NA	1,763	1,552
Lebanon (2004)	1,999	2,860	2,598	NA	2,967	1,904

*Prices for 2005. Prices in US$ per ton
NA: not applicable
Source: UN COMTRADE.

However, while the prices revealed in Table 8 are encouraging for non-certified Ethiopian beef in certain African markets, two complications make such a scenario unlikely. First, if one looks at the lucrative markets for beef (i.e. fresh beef) in markets such as Algeria, Cote d'Ivoire, and Gabon where prices are high, the actual volumes traded are tiny: less than 1% of total imported volumes as shown in Figure 2. The overwhelming volume of imports are in frozen beef, where prices are not only lower, but are dominated by Brazil and India, exporters with standards equal to or exceeding those of Ethiopia and whose landed prices are even lower than Ethiopia's (Figure

3). If one considers Angola and the Democratic Republic of Congo, lower-value markets that have seen combined imports of beef rise from 42,000 tons in 2004 to over 69,000 tons in 2006, one sees a similar pattern of overwhelmingly high (over 99%) imports of frozen beef from low-value competitors, particularly India. Indeed, these low prices from Brazil and India serve as a

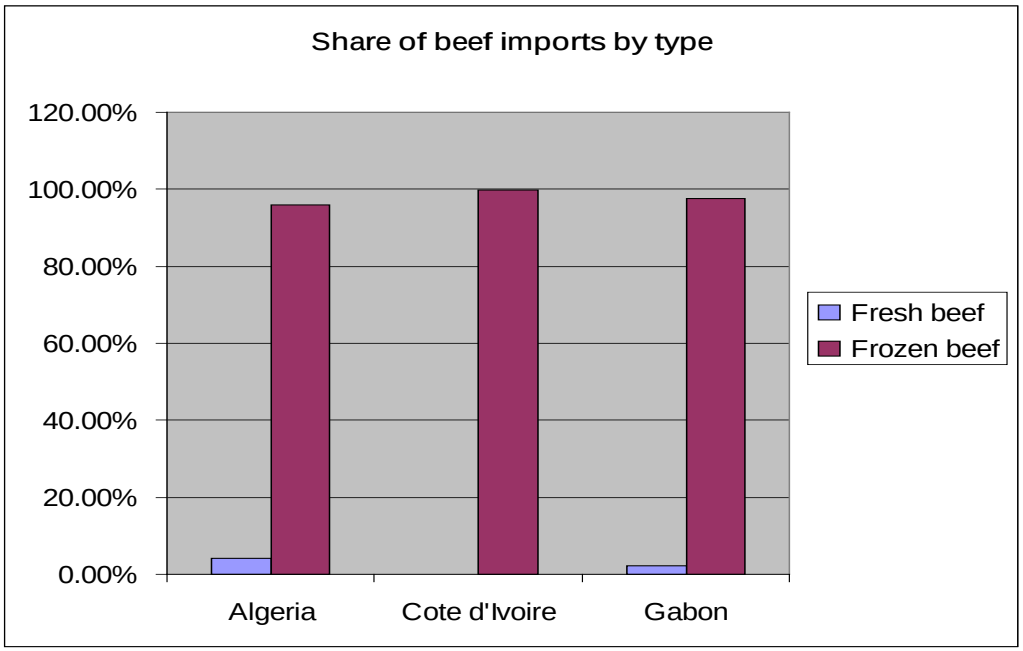

Figure 2: Proportion of imported beef by type in Algeria, Cote d'Ivoire, and Gabon.
Source: UN Comtrade

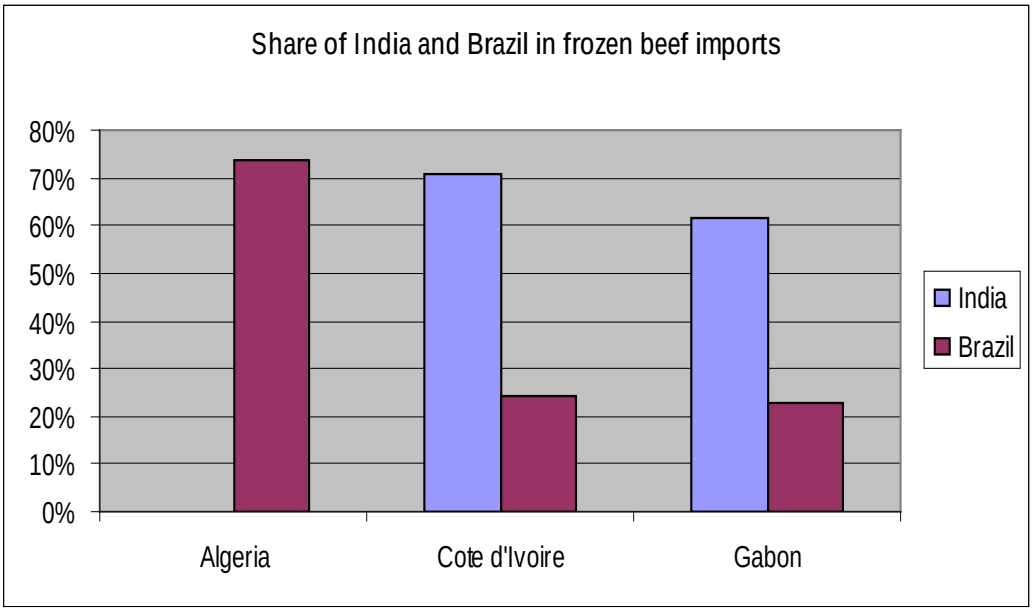

Figure 3: Share of beef imported by Algeria, Cote d'Ivoire, and Gabon from Brazil and India.
Source: UN Comtrade

precautionary tale for those advocating commodity-based trade as a panacea for future African meat exports, as African suppliers may not appreciably benefit (cf. Scoones & Wolmer, 2008). In price-sensitive regional markets in Africa, it is unlikely that consumer willingness to pay for higher-quality products will be sizable in either the short- to medium-term.

The case of Algeria shows an additional area in which Ethiopia is further disadvantaged. Algeria receives a large proportion of imported beef from the European Union, which is traditionally a high-cost producer. However, because the highly protected European market allows for high prices to prevail in domestic markets, European meat producers are able to sell high-value cuts domestically and effectively dump lower value cuts to third markets, including Algeria. By contrast, Ethiopia does not have such flexibility as it must export high-value cuts to remain profitable. This highlights the need for Ethiopia to raise standards in such a way that allows it to market different cuts based on their demand and economic profitability in different markets and further suggests the need to develop certification programs that facilitate this process.

We also considered whether Ethiopia could potentially compete in even higher-value product lines with the SPS system, where various non-price attributes will take greater precedence. On the one hand, one area in which Ethiopia has a marked advantage over Brazil is in its geographical proximity to the Middle East. Consequently, Ethiopia would conceivably have the ability to supply fresh beef instead of frozen beef (as is the case from Brazil) and supply growing markets for foodservice, restaurants, supermarkets, and hotels in the region (USMEF, 2008). Two issues govern the feasibility of such a prospect. First, it is not clear whether consumers of frozen Brazilian beef would pay higher premiums for fresh Ethiopian-sourced beef, particularly since most beef in the Middle East is labeled by country-of-origin and consumer perceptions of such products are unknown. Second, if we look at the current market for fresh, boneless beef itself in the Middle East, UN Comtrade data reveal that the overall import market for such products is relatively small in the region (18,205 tons); by comparison, frozen beef imports are about 80% of total beef imports in Saudi Arabia. Moreover, the high-value grain-fed market (meat originating from Australia and USA) is only about 11% of this total (just over 2,000 tons). While Ethiopia could potentially compete on price under the SPS system with Australia and USA in certain market channels (assuming its product is of similar quality), the size of the market for such a product falls well short of the government's 30,000 ton target.

A final potential avenue for Ethiopian beef exports could be high-value markets such as the European Union that are increasingly deficit in high-quality beef (Agritrade, 2008). Indeed, one significant advantage held by Ethiopia is that it maintains duty-free, quota-free access to the European Union by virtue of the Everything but Arms (EBA) initiative that allows such market access to least-developed countries. By contrast, countries such as Brazil do not have similar preferential access and are forced to pay high (50-100%) over-quota duties on beef exports (Rich & Perry, 2009). This could provide Ethiopia with a significant cost advantage relative to Latin American competitors. On the other hand, this would necessitate a wider acceptance of aforementioned commodity-based approaches in international standard setting bodies such as the OIE. While such initiatives are under discussion, there has not been as yet any clear consensus on what constitutes a commodity-based approach, though the aforementioned system in Ethiopia has been cited as one potential model (Thomson et al., 2009).

Conclusions

The simulation and sensitivity analyses highlighted the importance of lower feeding costs (or lower animal costs) in improving the competitiveness of the proposed two-phase SPS system. Whether Ethiopian beef could compete on price or quality against existing competitors is an open question and one that will likely necessitate significant investments and efforts in marketing and product differentiation. Sullivan (2007) highlights the potential of retail and food service providers (particularly hotels and restaurants) in Middle Eastern markets. The latter is a strategy that Namibia has followed in the European Union and avoids many of the hurdles in the retail sector of developing a brand reputation based on one's country of origin. The rise of organized retail in the Middle East will further provide opportunities for meat products, including those from Ethiopia, but will require cultivating access to these supply chains on the basis of providing consistent volumes and quality. Given the nature of competition in international beef markets, Ethiopia will likely be forced to compete on quality, exporting a diversity of cuts on the basis of demand and competitiveness in different regions, and in differentiating its product relative to competitors over and beyond higher disease-free and food safety standards. Consequently, programs like the proposed two-phase system will be required in order to meet those demands and will be essential in the highest-value markets (e.g., European Union).

While the study mainly focused on the economic feasibility of the proposed SPS system, an important consideration is determining the beneficiaries from such a program, particularly smallholder farmers. The sensitivity analysis highlighted a few potential entry points for smallholders. First, the development of a more integrated supply chain for livestock and meat products would have strong pro-poor benefits in terms of reducing intermediaries and raising farm-gate prices for producers, potentially providing greater incentives for disease control efforts at the farm level. Second, the model strongly highlighted the need for better integration between feed markets and livestock markets. A crucial success factor for the viability of the SPS system is improved feed through animal nutrition and enhanced feed resources. While better rations are an important component of improved livestock products, the long-term sustainability of such a system will be the development of a market-oriented feed sector, which will depend on integrating smallholder producers with markets and disseminating improved technologies to enhance productivity. A significant expansion of the feed industry could thus open up important income-generating opportunities for smallholders in the feed supply chain. A final poverty impact of this system includes the various downstream beneficiaries from the expansion of livestock exports, in terms of employment opportunities in certification facilities, feedlots, abattoirs, and other supply chain support functions. Indeed, achieving the government's aim of 30,000 tons of meat exports would imply a considerable expansion of livestock supply chain activities that could have quite strong pro-poor impacts.

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Export Implicit Financial Performance: The Case of French Wine Companies

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Abstract

Noting the difficulties of measuring a company's export performance and especially financial performance, we develop a new measurement approach grounded on modern portfolio theory. The export intensities and the global financial performance of exporting companies being known, this approach allows deducing the export margin ratio, export risk and correlation of domestic activities with export activities. Using a sampling from French companies in the wine industry from 2001-2005, these implicit financial export performance characteristics are estimated. Main results found: export activities permit a better global margin-risk relationship essentially due to diversification gains because export financial performance seems to be inferior to the domestic one for a great majority of companies.

Keywords: export, financial measures, performance, wine industry

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Introduction

Although existing for thousands of years, the wine industry has been exposed for many years to the combined effects of globalisation and exacerbated international competition. Anderson (2004) points out the main characteristics resulting from the globalisation of the wine industry:

- A tendency for supplies to converge: which spells growing quality from new world countries owing to the dissemination of know-how and technologies.
- A tendency for demand to converge in a context of falling consumption per head in the old world producing countries coupled with an increase of varying magnitude in importing countries and the new world countries, while low quality wine consumption falls across the board.
- A process of internationalisation whereby exports grow much faster than production.
- Consolidation and multinationalisation of companies: national and international mergers while the strategies of large international groups lead to the emergence of a world oligopoly (Coelho and Rastoin 2005) which disrupts the competition environment via strategies of differentiation, policies of massive promotion, and optimisation worldwide of the productivity and logistic chain.

For the French wine industry, globalisation within the context of oversupply has become structural, offering both threats and opportunities. The major opportunity stems from the growth in foreign markets which offer an alternative to a stagnating, not to say declining, home market. Threats are due to an extended competition on all market segments, notably that of quality wines which have developed a competitive advantage by implementing efficient commercial policies, and competitive costs related to firm size and lighter regulations in New World countries. It is quite clear that their share of the world trade has been growing steadily.

From a macroeconomic point of view, wine and spirits is the first exporting sector of the French food industry and one of the most important exporting sectors producing more than 9 billion Euros in 2007[1].

Taking into account the strategic importance of French wine industry exporting at a company and country level it seems relevant to investigate the financial performance of companies in this particular industry.

Studies on export performance determinants are numerous emphasizing the importance of the issue in the literature (for different overviews, see Madsen (1987), Aaby and Slater (1989), Gemünden (1991), Chetty and Hamilton (1993), Zou and Stan (1998) and Leonidou et al. (2002)). However, despite considerable research, the evidence on the factors affecting export performance is largely fragmented and often contradictory (Aaby and Slater 1989; Cavusgil and Zou 1994; Zou and Stan 1998). One important explanation is the lack of agreement on how to conceptualize and make operational a measure of export performance.

Concerning the conceptual problem, performance is a multidimensional concept, in which no single criterion is adequate. This problem results in a variety of measures emphasizing different

[1] DGDDI (French customs).

performance dimensions (Diamantopoulos, 1998). The literature offers a number of ways to dimensionalize export performance. One can make the distinction between financial, strategic and perceptual outcomes (Zou et al. 1998) economic, non-economic (market related, product related) and generic measures (degree of satisfaction, perceived export success …); (Katsikeas et al. (2000)) or examine sales, profit and growth-related measures (Shoham 1996) to quote some of the more classical typologies. These different measurement schemes make it difficult to compare findings in different studies. One solution is the construction of scales based on the set of different variables (Bijmolt and Zwart (1994)).The aggregation of various performance measures into a single measure of export performance partially overcomes the difficulty of performance measures (Katsikeas et al. 2000; Lages and Lages 2004).

The issue is also complicated by the recognition that operationalization of performance measures often seem to be driven by the definition itself, most likely because of issues related to data availability (Boulding and Staelin, 1995). It is difficult to access to archival data because companies do not report the financial details of their export activities. Specification and assessment of costs and benefit associated with export activities are also problematic because such costs are inherently related to how a company views these activities (Leonidou *et al.* 2002). Thus both objective and subjective export performance data are dependent of companies' view of their exporting activities.

The importance of the various performance dimensions (effectiveness, efficiency, adaptability) varies across stakeholder groups. Efficiency which is concerned with the outcome of business activities relative to the inputs employed to implement them is an essential dimension for investors and also for managers (Walker and Ruckert, 1987[2]). Financial performance measures aim to measure value creation for shareholders or investors (shareholder and debt holders). In the export performance literature, financial performance measures used are profit-related measures. Sousa (2004) built a review of empirical literature published between 1998 and 2004 about export performance measures. He gathered about 50 different export performance indicators and found that the most frequently used ones were "*export intensity (export-to-total sales ratio), export sales growth, export profitability, export market shares, satisfaction with overall export performance, and perceived export success" (p 8).* He makes the distinction between objective (quantitative and calculated using financial data and cost analysis) or subjective (attitudes, perceptions: qualitative measures using scales) profit-related measures. A small number of studies use objective measures (export profitability, (2 studies), export profit margin, (3 studies), and export profit margin growth (1 study)). These measures are often criticized due to the lack of data, they may not be known with any degree of certainty (Smiee and Anckar 1998). When managers are unwilling or unable to provide objective financial data (Katsikeas *et al.* 1996; Yang *et al.* 1992), subjective measures of profitability (perceived values of the variables) can be the solution but they are also subject to several sources of bias. Company officials are under no obligation to disclose information on exports and are often reluctant to disclose information on a single segment of their business. So, indicators used to represent export profitability are qualitative scales indicating the perceived profitability of exports in comparison to domestic activity or the export performance of competitors (Bilkey, 1982; Moini, 1992; Rose and Shoham, 2002). The majority of exporters are SME (that is the case in the French wine industry) lacking appropriate export accounting mechanisms. However, Bilkey (1982) reported that

[2] For the authors the two other dimensions are effectiveness and adaptability.

"*management's perceptions of the relative profitability of exporting are somewhat "rubbery" but not necessarily erroneous yardstick for evaluating export marketing practices"*. We can find a confirmation of these results in the strategic literature where there is evidence of the reliability of subjective self-reported performance measures and of significant correlation between subjective and objective measures (Dess an Robinson 1984; Pearce et al. 1987; Venkatraman and Ramanujam 1986, 1987; Dawes 1999).

Profit-related measures used in export performance determinants literature describe only one dimension of financial performance: the expected gain due to export activities. Two other important dimensions are missing: the risk of export activities and their contribution to diversification gains (the contribution of export activities to the overall risk of the company). Those two last dimensions are sometimes taken into account in theoretical studies (Stahrl and Khoury 1986) but are not used in empirical ones. Assuming that company's managers are rational, and following the portfolio theory (Markowitz, 1952, 1959) they must choose their various activities so as to maximize the return to risk relationship of the overall company. Following this approach, companies undertake export activities only if they contribute to ameliorate the return to risk ratio of the company. This objective can be achieved in two ways: the return to risk ratio of export activities is higher than domestic ones and/or export activities offer a diversification gain (their low correlation with domestic activities justify their introduction in the company's portfolio of activities). The more export activities are interesting (following these criteria), the more the company has to invest in them.

To measure the three dimensions of financial performance (profit, risk and diversification) of exports it will be necessary to know the return and risk generated by export activities and the correlation with the domestic ones. Unfortunately these data are hardly available to researchers and often to companies' managers specifically in small and medium sized companies. To overcome this difficulty we propose a strategy directly inspirited by a methodology commonly used in finance. The objective of the method is to deduce the value of some parameters of interest by applying a quite generally accepted model to available data. A famous example of this strategy is the so-called implicit volatility (Latane and Rendleman, 1976) where the volatility of future asset returns is estimated by using market data and inverting the famous Black and Scholes (1973) formula. In our case, we want to infer from data available in companies financial statements, the return, risk and correlation of export activities using a simple model of portfolio theory.

In short the present study contributes to the financial export performance measures in two ways. First, it proposes a more complete set of measures of financial export performance and second, a way to overcome the lack of data availability to make operational these measures. Finally it illustrates the approach on a sample of companies in the French wine industry.

The article is structured as follows: In the second section the portfolio model applied to companies activities (domestic and export) is constructed and some adaptations are made to obtain a testable form. The third section describes the sample selection method, data and estimation procedures of the various parameters. The fourth section is devoted to results presentation and analysis. The fifth section offers conclusion.

Theoretical Framework

We present a simple expected utility maximization model of optimal proportions of domestic and export activities.

To know the success of export (particularly in SMEs), an important issue is how pleased the owner-manager is with the internationalization project. The management anticipation of the performance of export seems to us one of the main drivers of export decision. But contrary to the qualitative methodology presented above we will not use data on management anticipation or satisfaction but we try to infer these variables from the actual decision taken. The more the company exports the more management is supposed to be satisfied with export (cf. the disconfirmation of expectation proposed by Shoham (2000)). More specifically, in our approach proportions of domestic and export activities are supposed to be the result of expected utility optimization behaviour. Companies seek the combination of domestic and export activities so as to maximize expected utility of profit:

$$(1) \qquad E[u(\pi)] = E[u(\tilde{m}_D S_D + \tilde{m}_X S_X)]$$

with

π : profit,
$\tilde{m}_D$: random margin of domestic activities (in % of sales),
$\tilde{m}_X$: random margin of export activities (in % of sales),
S_D : domestic sales,
S_X : export sales,
U(.) : utility function,
E(.) : denotes expectation.

This approach supposes that total sales are given at this step meaning that companies have the opportunity to sell their products on the domestic market and in various foreign countries. We suppose that the choice of these foreign countries have been made at a preceding step and depends of various internal and external factors that will not be studied here. In short the opportunity set (the various export markets accessible to the company) is given. We are only interested in the consequences of the foreign countries markets choice made by the company on the margin and the risk of export activities. In other words the domestic and foreign activities represent a given universe and we concentrate on the optimal combination of these given activities. Accordingly, the sales constraint is the following: $S_D + S_X = S$ (S means total sales) and dividing equation by S constraint becomes: $s_D + s_X = 1$.

Moreover export and domestic margin are supposed to be constant whatever the level of sale or the market share of the company on the domestic and exports markets. But we can imagine that some French wine companies export to avoid a lower domestic margin due, for instance, to a saturated domestic market. Constant margins suppose perfect competition which is probably not the case on markets where differentiation and quality play an important role. Our choice is dictated by the fact that the sensibility of margins to the volume of sales is not available.

To solve the previous program, (1), it is common in empirical studies to use an approximation formula which incorporates agent risk aversion. Assuming a normal distribution, equation (1) becomes [3]:

$$(2) \qquad E\left[u\left(\tilde{m}_G\right)\right] = E\left[\left(\tilde{m}_D s_D + \tilde{m}_X\left(1 - s_D\right)\right)\right] - \frac{\lambda}{2} V\left[\left(\tilde{m}_D s_D + \tilde{m}_X\left(1 - s_D\right)\right)\right]$$

with

$\tilde{m}_G$: global margin ratio of the company,
λ : coefficient of risk aversion, $\lambda > 0$,
V(.) : variance.

It is possible to show by direct calculation that equation (2) is exact for an exponential utility function ($U\left(w\right) = -e^{-\lambda w}$)[4]. This function is characterized by a constant absolute risk aversion (CARA) and increasing relative risk aversion. For other utility functions equation (2) gives only an approximation.

By using simple properties of expectation and variance operator in equation (2) one can obtain:

$$(3) \qquad \begin{aligned} &E\left[u\left(\tilde{m}_G\right)\right] = \left(\overline{m}_D s_D + \overline{m}_X\left(1 - s_D\right)\right) \\ &-\frac{\lambda}{2}\left[V\left(\tilde{m}_D\right) s_D{}^2 + V\left(\tilde{m}_X\right)\left(1 - s_D\right)^2 + 2 s_D\left(1 - s_D\right) Cov\left(\tilde{m}_D, \tilde{m}_X\right)\right] \end{aligned}$$

$\overline{m}_D = E\left(\tilde{m}_D\right)$
$\overline{m}_X = E\left(\tilde{m}_X\right)$
Cov(.,.) : covariance.

First order condition of expected utility maximization is:

$$\frac{dE\left[u\left(\tilde{m}_G\right)\right]}{ds_D} = \left(\overline{m}_D - \overline{m}_X\right)$$
$$-\frac{\lambda}{2}\left[V\left(\tilde{m}_D\right) 2 s_D - V\left(\tilde{m}_X\right) 2\left(1 - s_D\right) + \left(2 - 4 s_D\right) Cov\left(\tilde{m}_D, \tilde{m}_X\right)\right] = 0$$

By isolating s_D in the preceding equation it comes:

$$(4) \quad s_D{}^* = \frac{\overline{m}_D - \overline{m}_X + \lambda\left[V\left(\tilde{m}_X\right) - Cov\left(\tilde{m}_D, \tilde{m}_X\right)\right]}{\lambda\left[V\left(\tilde{m}_D\right) + V\left(\tilde{m}_X\right) - 2 Cov\left(\tilde{m}_D, \tilde{m}_X\right)\right]}$$

[3] This objective function is a direct adaptation to our specific framework of a currently used utility function simplification in finance. The passage from (1) to (2) goes back to Pratt (1964).
[4] Various other utility functions, such as the logarithmic, quadratic, linear, and power, to cite the more common, exist in the literature.

The importance of domestic activities depends on:

- The deviation between expected domestic and export margins, the more export activities are profitable in comparison to domestic ones the greater export intensity is,
- The domestic and export risk, export intensity is a positive function of domestic risk[5],
- Correlation between the two activities (emphasis on the diversification function of export),
- The coefficient of risk aversion.

From the previous theoretical model we can get three equations:
The optimal combination of activities, (equation 4),
Expected margin decomposition for an exporting company:

$$(5) \quad \overline{m}_D s_D^* + \overline{m}_X \left(1 - s_D^*\right) = \overline{m}_G$$

$$\overline{m}_G = E\left(m_G\right)$$

- Risk decomposition for an exporting company:

$$(6) \quad V\left(\tilde{m}_D\right) s_D^{*\,2} + V\left(\tilde{m}_X\right)\left(1 - s_D^*\right)^2 + 2 s_D^*\left(1 - s_D^*\right) Cov\left(\tilde{m}_D, \tilde{m}_X\right) = V\left(\tilde{m}_G\right)$$

The solution of the system formed by the two equations (4) and (6) is (see Appendix 1):

$$(7) \quad \begin{aligned} V\left(\tilde{m}_X\right) &= \frac{V\left(\tilde{m}_G\right)\left(1 - 2 s_D^*\right) + s_D^{*\,2} V\left(\tilde{m}_D\right) - 2 A s_D^*\left(1 - s_D^*\right)}{\left(1 - s_D^*\right)^2} \\ Cov\left(\tilde{m}_D, \tilde{m}_X\right) &= \frac{V\left(\tilde{m}_G\right) - s_D^* V\left(\tilde{m}_D\right) + A\left(1 - s_D^*\right)}{\left(1 - s_D^*\right)} \\ A &= \frac{\overline{m}_D - \overline{m}_X}{\lambda} \end{aligned}$$

We get a system of only three equations for nine unknowns. So we must deduce the value of six unknowns from the financial data. From the empirical data, we can obtain quite easily the expected global margin $\left(\overline{m}_G\right)$ and the variance of global margin $\left(V\left(\tilde{m}_G\right)\right)$ of exporting companies. The choice by a company of a specific risk reward relationship will enable us to induce it's coefficient of risk aversion, λ. We suppose that the actual combination of activities is equal to the optimal one, so $(1 - s_D^*)$ is set equal to the observed export intensity. To obtain the expected margin and margin standard deviation of domestic activities, we suppose that the opportunity set for domestic activities of exporting companies is similar to the one of purely domestic one. Hence $\overline{m}_D$ and $V\left(\tilde{m}_D\right)$ are deduced from the mean and variance of margin ratio of purely domestic companies. The solution of the system of equations (4), (5), (6) gives us the value of the three remaining variables: expected export margin, export margin standard deviation, and correlation between export margin and domestic margin. The procedure is detailed

[5] The sign of the derivative of export intensity on export risk is not determinate.

under *Estimation of the Expected Domestic Margin and Risk of Domestic Activities for Exporting Companies*.

Sample Selection, Data and Estimation Procedure

Sample Selection and Data

To empirically test the relevance of the approach outlined above we use the survey called "Enquête Entreprises Aval de la Filière Vin[6] – 2006" (EEAFV-2006) which is about the determinants of the performance in French wine companies. It was carried out by Supagro, the Superior School of Agronomy in Montpellier, South of France, in the Languedoc Roussillon wine region. It provides data about the strategies and strategic choices chosen by companies and the elements impacting their financial, strategic, trade performance.

Data was collected through two different and complementary ways: a questionnaire was sent to the companies of the industry. The questionnaire was pre-tested on a dozen companies before it was used by researchers meeting firm managers like in a poll. Only companies with a turnover superior to three million euros were taken into account. Data were completed with financial statements from 1996 to 2005 available on Diane-SCRL[7] database.

The analysed unit is the company and more particularly companies owning a managerial autonomy: subsidiaries or firms controlled by a group are excluded. All French producing regions are gathered in this study, concerned companies. The final sample gathers 214 companies.

The questionnaire was divided into eight thematic parts (description of the company and human resources, firm relationship with suppliers, firm products, selling and relationships with downstream companies, governance, strategy, financial elements, and innovation) which gave indications about the firm resources and strategy and even some details about external determinants of export behaviour.

Variables are defined as the following:

- Export intensity: mean on the period 2001-2005 of the annual ratios $\frac{Export\,turnover}{Total\,turnover}$.

  The data was first extracted from Diane database, when data were not available in Diane, declarative data of the questionnaire were used.
- Expected margin ratio: mean on the period 2001-2005 of the annual ratios $\frac{EBITDA}{Total\,turnover}$ (EBITDA, Earnings Before Interest Taxes Depreciation and Amortization) extracted from Diane.
- Variance of margin ratios: variance on the 2001-2005 period of the annual margin ratios.

[6] English translation: Survey about companies in the wine Industry – 2006.
[7] This database is constructed by Bureau van Dijk (www.bvdep.com). It contains financial data on French listed and non listed companies, the European and World counterparts are Amadeus and Orbis.

The sample was divided in 2 groups:

- Companies with only domestic activities: in fact to obtain a large enough sub-sample we select companies with mean export intensity on the period 2001-2005 inferior to 5 %.
- Export companies: only companies with mean export intensity on the period 2001-2005 superior to 15 % are chosen.

Table 1 describes the main characteristics of the two sub-samples and gives the probability of significant differences between companies included in each of them.

Table 1. Comparison of domestic and export companies of the sample

	Domestic companies	Export companies	Signification Probability (d)
Sample size (number of companies)	46	90	
% export			
- Sample mean		0.4363	
- Standard deviation (a)		0.2154	
- Minimum		0.1518	
- Maximum		0.9295	
Global turnover (mean 01-05)			
- Sample mean	9 814	45 109	0.000
- Standard deviation (a)	8 850	54 302	
- Minimum	2 610	3 256	
- Maximum	45 469	308 366	
Global margin mean			
- Sample mean	5.92 %	7.84 %	0.2596
- Standard deviation (a)	4.68 %	10.92%	
- Minimum	-0.74 %	-14.92 %	
- Maximum	17.37 %	69.43 %	
Global margin standard deviation			
- Sample mean	1.80 %	2.42 %	0.1962
- Standard deviation (b)	2.12 %	2.87 %	
- Minimum	0.12 %	0.046 %	
- Maximum	9.93 %	15.72 %	
Margin to Risk Ratio (MRR) (c)			
- Sample mean	5.28	6.83	0.3963
- Standard deviation (a)	4.89	11.82	
- Minimum	-1.34	-0.98	
- Maximum	18.07	87.19	

a. Cross-sectional standard deviation.

b. For each company the time series standard deviation of margin is calculated then the cross sectional standard deviation of all standard deviations is computed.

c. The margin to risk ratio is defined as: $MRR = \frac{\overline{m}}{\sigma(\widetilde{m})}$

d. Test of mean equality between the two samples with different variances.

We can see from Table 1 that:

- Export companies are significantly larger than domestic ones. The fact that small companies do not export could be explained not only by their anticipation of poor financial performance of exports but also by the lack of capabilities to export.

- The mean and standard deviation of margin ratios of export companies are higher than domestic ones but deviations between expected margin and risk are not significant.
- The financial performance ratio (MRR) is also higher but not significant for export companies.

So export activities generate higher margin expectation and risk but without generating significantly higher global financial performance.

Procedure for Estimating Financial Export Performance

We develop an estimation procedure of the three dimensions of export financial performance (expectation and variance of margin ratios and correlation between domestic and export margin ratios) including the following steps:

(1) Estimation of the coefficient of risk aversion
(2) Estimation of the expected domestic margin and risk of domestic activities for exporting companies
(3) Determination of the dimensions of exports financial performance (expected margin, risk and correlation with domestic activities)

Estimation of the Coefficient of Risk Aversion

In order to compute financial performance of export it is necessary to obtain the value of the coefficient of risk aversion. It seems to us inappropriate to give a unique value for this coefficient to all companies by using estimates given in literature because these estimates do not concern companies but essentially individual investors and are widely dispersed (see Giamouridis (2005) for a recent review). On the other side we do not get enough data to make sophisticated estimation of these coefficients as proposed by Walls and Dyer (1996) in the context of the oil industry. This method supposes the capability to compute the certainty equivalent of risky prospect. In the oil industry the exploratory budgets are known and can be interpreted as the certainty equivalent of the risky prospection activity. Such data as a certainty equivalent of risky activities are not available in the context of the French wine industry. Moreover, such a sophisticated estimation will be out of the scope of this paper because our objective is not to obtain precise value of risk aversion coefficient but to have the possibility to compare the degree of risk aversion of companies in the sample. Here again we develop a methodology directly inspired by portfolio theory simplifying the Walls and Dyer approach.

Following portfolio theory the position of investors on the risk return efficient frontier depends on their degree of risk aversion (cf. Figure 1). We suppose that the observed global return to risk relationship of each company reveals their relative risk aversion coefficient. Knowing the opportunity set, a company is more risk adverse if it chose a lower global standard deviation[8]. In Figure 1, company 2 chooses a lower level of risk than company 1. We can infer that it is more risk adverse than company 1.

The actual return to risk ratio of a company depends also on its managerial skill and various other specific characteristics and business environment. To reduce the impact of these factors on

[8] See below equation (11) and its comments for a more in depth analysis.

the estimation of risk aversion coefficient we conduct, using the sample of exporting companies, an Ordinary Least Square, (OLS), of margin ratios on standard deviation of these ratios[9]:

$$(8) \qquad m_{Gi}^{e} = \alpha_G + \beta_G \sigma_{Gi}$$

m_{Gi}^{e} can be interpreted as the expected global margin ratio of company, i, having a global given risk σ_{Gi}. The deviation between the actual margin ratio $\overline{m}_{Gi}$ of a company and m_{Gi}^{e} is a measure of performance of company i[10]. In Figure 1 we can see that company 1 has a better performance that a company on the line with the same risk level. That is just the contrary for company 2.

Supposing that each company chooses a point on the risk return line so as to maximize a negative exponential utility function[11], the following program has to be solved for company, i:

$$(9) \qquad E\left(u\left(\tilde{m}_i\right)\right) = E\left(\tilde{m}_i\right) - \frac{\lambda_i}{2} V\left(\tilde{m}_i\right)$$

(10) Using equation (8), equation (9) becomes: $E\left(u\left(\tilde{m}_i\right)\right) = \alpha_G + \beta_G \sigma_{Gi} - \frac{\lambda_i}{2} \sigma_{Gi}^2$

The first order condition for the expected utility maximization (10) is:

$$(11) \qquad \frac{dE\left(u\left(\tilde{m}_i\right)\right)}{d\sigma_{Gi}} = \beta_G - \lambda_i \sigma_{Gi} = 0 \Leftrightarrow \lambda_i = \frac{\beta_G}{\sigma_{Gi}}$$

In the context of a linear relationship between risk and return, the coefficient of risk aversion has a very simple interpretation. A company has a low risk aversion if it chooses a high global risk level $\left(\sigma_{Gi}\right)$ even when risk is not well rewarded (β_G is low). In this context, the coefficient of risk aversion depends on the opportunity set (the same global line (8)). Hence the method can be used here only because we compare risk aversion of companies facing the same opportunity set.

[9] Note that in portfolio theory the relation between risk and return on the efficient frontier can be quadratic or linear if a risk free asset exist or if a "zero covariance portfolio" can be constructed (see Merton (1972) or Huang and Litzenberger (1988) Chapter 3 for a pedagogical presentation). We choose a linear relationship to simplify computation but we acknowledge that a quadratic one is probably more appropriate in the context of absence of a risk free rate. Note that in this paper we do not try to compute efficient frontier but only to find an empirical relation between margin and risk. We choose not to compute the efficient frontier because our objective is not to find for a given investor the best portfolio of exporting companies but to deduce from the risk level chosen by a company its level of risk aversion relatively to other companies in the same sector.

[10] This measure has the same philosophy as the one proposed by Jensen (1968). We compare the actual performance of the company with companies with similar risk. Note that in the Jensen approach, risk is measure by beta; here the risk is measured with sigma.

[11] Walls and Dyer (1996) used the same utility function to elicit risk aversion of oil companies.

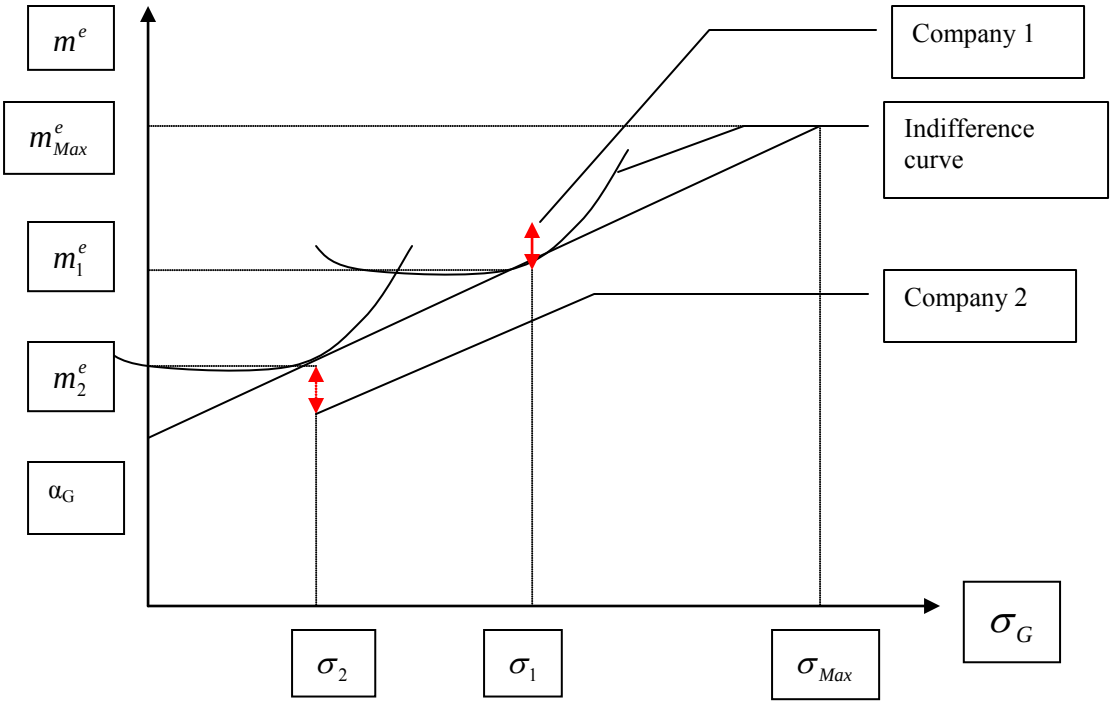

Figure 1. Choice of the risk - return relationship

Estimation of the Expected Domestic Margin and Risk of Domestic Activities for Exporting Companies

Using now the sample of domestic companies the same procedure is applied to obtain the implicit domestic expected margin and margin risk.

First, by OLS the opportunity set (relationship between their expected margin and margin standard deviation) of purely domestic companies is obtained:

$$(12) \qquad m^e_{Di} = \alpha_D + \beta_D \sigma_{Di}$$

m^e_{Di}, σ_{Di} : expected domestic margin and standard deviation of domestic margin of purely domestic companies.

As already stated, we suppose that exporting companies have the same opportunities that domestic ones concerning their domestic activities meaning that they face the domestic line as far as their domestic activities are concerned.

So our objective is to calculate the position on the domestic line that an exporting company would have chosen if it was purely domestic. As we have already calculated the coefficient of relative risk aversion for exporting companies (equation (11)), the expression of expected utility

is now:

$$(13) \qquad E\left(u\left(\tilde{m}_{Di}\right)\right) = \alpha_D + \beta_D \sigma_{Di} - \frac{\beta_G}{2\sigma_{Gi}} \sigma_{Di}^2$$

The optimal level of risk chosen on the domestic line is given by the first order condition of equation (13):

$$(14) \qquad \frac{dE\left(u\left(\tilde{m}_{Di}\right)\right)}{d\sigma_{Di}} = \beta_D - \frac{\beta_G}{\sigma_{Gi}} \sigma_{Di} = 0 \Leftrightarrow \sigma_{Di} = \frac{\beta_D}{\beta_G} \sigma_{Gi}$$

By observing equation (14) one can see that if exporting companies face situation where domestic risk is less rewarded than their global activities ($\beta_D < \beta_G$) they would had chosen a less risky point in the margin to risk domestic activities opportunity line.

The expression of the expected domestic margin of exporting companies $\left(m_{Di}^e\right)$ can be deduced using the classical properties of expectation and equations (12) and (14):

$$(15) \qquad m_{Di}^e = \alpha_D + \frac{\beta_D^2}{\beta_G} \sigma_{Gi} = m_{Di}^e = \alpha_D + \beta_D \left(\frac{\beta_D}{\beta_G} \right) \sigma_{Gi}$$

It is clear from equations (15) that the implicit domestic expected margin of exporting companies is given by the domestic market line where the risk of purely domestic companies is replaced by the risk level that exporting companies would have chosen if they were purely domestic.

Determination of the Dimensions of Exports Financial Performance

It is now possible to estimate the implicit expected margin on export activities, the implicit export margin risk and the implicit covariance between export and domestic margin by replacing the variables in equations (5) and (7) by their expressions given by equations (8), (11), (12), (14).

Estimations of implicit expected margin of export $\left(\hat{m}_{Xi}^e\right)$, risk $\left(\hat{V}\left(m_{Xi}^e\right)\right)$ and covariance between export and domestic activities $\left(\hat{Cov}\left(m_{Xi}^e, m_{Di}^e\right)\right)$ are given by[12]:

$$(16) \qquad \hat{m}_{Xi}^e = \frac{\left(\alpha_G - \alpha_D s_{Di}\right)\beta_G + \sigma_{Gi}\left(\beta_G^2 - \beta_D^2 s_{Di}\right)}{\beta_G\left(1 - s_{Di}\right)}$$

$$(17) \qquad \hat{V}\left(m_{Xi}^e\right) = \frac{\beta_G^2 \sigma_{Gi}^2 + s_{Di}\beta_D^2 \sigma_{Gi}^2 \left(s_{Di} - 2\right) - 2 s_{Di} \sigma_{Gi} \beta_G \left(\alpha_D - \alpha_G\right)}{\beta_G^2 \left(1 - s_{Di}\right)^2}$$

[12] Demonstration in Appendix 2.

$$(18) \qquad \hat{Cov}\left(m_{Xi}^{e}, m_{Di}^{e}\right) = \frac{\left(1-s_{Di}\right)\beta_{D}^{2}\sigma_{Gi}^{2} + \sigma_{Gi}\beta_{G}\left(\alpha_{D}-\alpha_{G}\right)}{\left(1-s_{Di}\right)\beta_{G}^{2}}$$

By comparing equations (16), (17), (18) and (5), (7) one can see we have replaced the optimal proportion of domestic activities by the observed one.

In Appendix 3 we demonstrate that unfortunately the method above does not insure that the implicit coefficient of correlation between domestic and export margin will be in the interval (-1, 1). That is the case for company with a very low standard deviation of global margin.

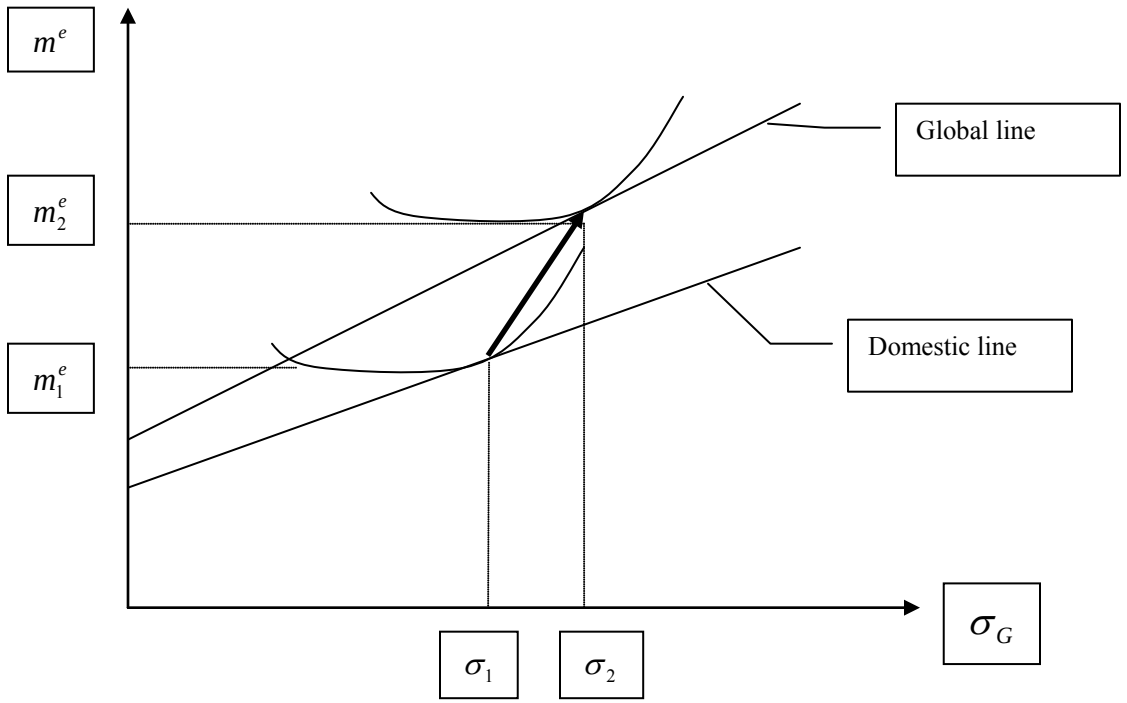

Figure 2. From domestic to global position of a company

The method presented above relies heavily on the assumption that the domestic line of exporting company is identical to the domestic line of purely domestic companies. So it seems to us interesting to investigate consequences of the impact of variation of domestic line characteristics (intercept and slope) on the characteristics of implicit export performance. Calculations in Appendix 4 show that if the line of domestic activities of exporting companies is above the line of purely domestic companies (exporting companies are more efficient on their domestic activities than purely domestic ones):

- implicit expected margin of export will be overestimated,
- implicit export margin standard deviation will be overestimated,
- covariance between domestic and export margin will be underestimated.

It is of course the reverse if the line of domestic activities of exporting companies is below the line of purely domestic companies.

Note that the impacts of estimation errors on margin expectation and risk are on the same direction hence they partially compensate in the MRR which is a ratio of the two.

Empirical Results

To obtain the implicit characteristics of export we use a two step procedure:
- first we estimate the global and domestic lines (equations(8) and (12)),
- second we calculate implicit characteristics of export using equations (16), (17), (18).

Estimation of the Global and Domestic Lines

Using the sample of domestic companies, the OLS coefficients are computed:

$$(19) \qquad m_D^e = \underset{(0.000)}{0.047} + \underset{(0.039)}{0.674}\,\sigma_D \quad AdjR^2 = 0.073$$

Using the sample of exporting companies, we obtain the following relationship between global margin and global risk:

$$(20) \qquad m_G^e = \underset{(0.001)}{0.04915} + \underset{(0.002)}{1.2086}\,\sigma_G \quad AdjR^2 = 0.091$$

From the comparison of these two straight lines (see Figure 2) we can deduce that:
Export permit to obtain a better relation between risk and return because the global line (20) is above the domestic line (19) whatever the level of risk. The global line dominates the domestic one. Following portfolio theory, every company in the French wine industry have a commercial interest to export because it can obtain a better margin for the same level of risk. Note that this result does not permit to conclude to a financial interest to export[13] because the margin ratio does not take into account the investment necessary to export. If investments necessary to undertake export activities are similar to those of domestic activities we can say that export activities are more profitable than domestic one. But if export activities necessitate higher investments, it could be the case that commercial gains are offsets by those supplementary investments leading

[13] To be more rigorous, in financial analysis, the ratio of results obtained by the studied activities on the turnover of these activities is a financial measure of commercial performances. Financial performances are measured by the ratio of results divided by investment necessary to implement the studied activities. Using classical chain rules of ratio we get: $\frac{\text{Result}}{\text{Turn over}} = \frac{\text{result}}{\text{turn over}} \frac{\text{turn over}}{\text{Assets}}$. An higher margin ratio of exports activities, $\frac{\text{result}}{\text{turn over}}$, can be more than compensated by a lower $\frac{\text{turn over}}{\text{Assets}}$ of these activities.

to a lower profitability of export activities. In fact, exports necessitate specific investments/costs: production costs (new labels and packing), marketing and distribution costs (export market analysis, prospecting and investigation, cost of the export team, new distribution channels etc…), administrative costs (documentation, compliance of foreign countries laws), financial costs (protection against exchange rate risk and counterparty risk, costs for financing export activities). Export offers a better remuneration of risk because the slope of the line is steeper for exporting companies than for domestic ones (1.2086 against 0.674). From this analysis, one can deduce than, *ceteris paribus*, less risk adverse exporting companies obtain a higher deviation between global and domestic margin for a same level of risk.

From the *Estimation of the Expected Domestic Margin and Risk of Domestic Activities for Exporting Companies,* the position of company, i, on the domestic line is known. The standard deviation of global margin is calculated from the data. Using equation (14) the expected domestic margin is calculated. Following the theoretical framework of section 2, explanation of the movement from the position on the domestic line to the position on the global line is export activities (cf. Figure 2). The characteristics of export explaining the passage from position 1 to position 2 are solution of the system of equations (5) to (7).

Global Sample Results

From equations (16) to (18) we compute for each export company the implicit mean and standard deviation of export margin, the coefficient of correlation between export and domestic activities and the margin to risk ratio. Summary statistics of results are given in Table 2.

Table 2. Exports characteristics and implicit financial performance

	Sample Mean	**Sample Cross-sectional Standard Deviation**	**Min**	**Max**
Implicit margin mean of export	11.33 %	7.48 %	5.60 %	55.88 %
Implicit margin standard deviation of export (risk)	5.65 %	6.69 %	0.40 %	45.76 %
Implicit coefficient of correlation	-0.086	0.4816	-2.73	0.45
MRR export	2.97	1.82	1.22	13.98

By comparing Table 1 and 2, we can see that implicit mean and standard deviation of export activities are higher to those of purely domestic companies. This result is simply a consequence of the positive impact of exports on the mean and standard deviation of the overall margin we observed in our comment of Table 1.

The sample mean of implicit coefficient of correlation between domestic and export activities is slightly negative indicating that exports aims to play an important role in diversifying companies' risk. Implicit coefficients of correlation are not necessarily between -1 and 1[14]. It is the case here for five coefficients over 90 that are below -1 (it is the reason why we observe a -2.73 in the "min" column of Table 2. For those companies the global risk is very low and in particular below the level permitting to obtain coefficient above -1 defined in Appendix 3.

[14] See Appendix 3 for a demonstration.

The sample mean of implicit export financial performance ratio (MRR) is below the one of domestic companies (2.97 against 5.28 (see Table 1)). The higher margin of export activities is more than compensated by the higher risk they generate. In short, export activities in the French wine industry seem to be better justified by the diversification gains they offer than by their intrinsic performance.

To explore if the implicit performance measure is redundant with existing performance measures, we calculate the coefficients of correlation of the expected implicit margin and the margin to risk ratio of export with three classical measures of export performance: export intensity, export growth rate and export intensity growth rate calculated for the 2001-2005 period (Table 3). All coefficients of correlation are very low meaning that traditional performance measures are not good proxies of financial performance of exports. Even if export intensity is a determining variable of the model, the correlation with margin to risk ratio is very low and even negative with the implicit margin. The correlation between the variation of export or export intensity and the margin to risk ratio is negative during the period and slightly positive for implicit margin.

Table 3. Correlation between performance measures

Coefficient of Correlation	Export Intensity	Export Growth Rate	Export Intensity Growth Rate
Implicit margin	-0.131	0.088	0.093
Margin to risk ratio	0.075	-0.084	-0.086

Sample standard deviations of the variables are large probably because companies in the sample are in very different situations (different regions of production, types of wine -effervescent or not – different wine qualities …). It is the reason why we implement the cluster analysis described in the following paragraph.

Clusters Analysis

We conduct a hierarchical ascendant analysis using Ward criterion based on the three dimensions of export financial performance—return, risk and diversification. Then we calculate the statistical characteristics of the other variables for each class.

Table 4. Cluster analysis

Clusters	1	2	3	4	5
N (number of companies)	30	11	45	2	2
Sample mean of global margin	5.06 %	14.67 %	7.79 %	29.67 %	-8.49 %
Sample standard deviation of global margin	0.78 %	4.28 %	2.13 %	14.65 %	11.22 %
MRR global	12.75	3.34	4.30	1.84	-0.63
Global turnover	60 906	19 983	43 561	15 558	10 745
% Export	47.05 %	37.53 %	43.27 %	30.11 %	47.29 %
Sample mean of implicit export margin	6.88 %	16.80 %	10.38 %	51.53 %	29.15 %
Sample standard deviation of export margin	1.66 %	10.60 %	4.81 %	41.78 %	21.02 %
Correlation	-0.40	0.12	0.05	0.17	0.26
MRR export	4.76	1.60	2.26	1.23	1.39

Half of the companies in the sample (cluster 3, N = 45) have implicit performance of export below the global mean (MRR export equals to 2.26 inferior to 2.97). This can be explained by the fact that the margin ratio of export is quite high but risk is even higher. Implicit diversification gains are substantial (coefficient of correlation closed 0) but not sufficient to obtain a good global performance. Global performances of companies in this cluster are inferior to those of domestic companies (MRR = 4.30 against 5.28). Companies of cluster 1 (N = 30) obtain a very good global performance that seems to be due more too very important diversification gains (negative correlation between domestic and export margin) than pure export performance (although they obtain the best implicit export performance of the five cluster these performance is inferior to domestic performance of purely domestic companies in table 1). Companies of the three other clusters are relatively small companies with higher global and export risk. They obtain contrasted global and export performance. Companies of cluster 4 (N = 2) obtain better global and export margin than companies of cluster 2 (N =11) by taking much more risk. Companies in cluster 5 (N = 2) are risky with a negative global margin but their expected export margin is positive.
Similar export intensity can be associated with very different financial export performances.

Conclusion

Noting the difficulties in measuring export performance of companies the paper is a first attempt to develop an approach grounded on modern portfolio theory. This approach allows deducing the margin ratio, the risk and the correlation with domestic activities of export activities knowing export intensities, domestic and global financial performance of companies. It can offer a complementary point of view to the traditional purely subjective approaches based on Likert scales.

Using a sample of French companies in the wine industry these implicit export performance characteristics are estimated. The estimation procedure necessitates determining the coefficient of risk aversion of the company. Moreover it relies heavily on the hypothesis of an identical opportunity set for purely domestic companies and exporting companies for their domestic activities.

Main results from the empirical study are as follows: exports activities help to obtain a better (but not significant) global margin-risk relationship essentially due to diversification gains because export financial performance seems to be inferior to the domestic ones for a great majority of companies. This result leads us to question the rationality of export behaviour by French wine companies. Are companies' financial performances of exports justifying their high export intensity ratio? How could such ratios be explained? A simple explanation could be the decay of wine consumption in the French domestic market. All companies could not be successful or even survive if they have remained purely domestic.

The paper is only a preliminary investigation of the idea to use portfolio theory to measure export performance. The theoretical part could be improved by using more sophisticated portfolio theory tools (more realistic utility functions, better procedure to estimate risk aversion, non linear relationship between risk and margin). As already stated, the quality of implicit export performance measures estimation depends on the quality of the estimation of the financial

performance of their domestic activities. For these last estimations to be reliable the sample of domestic companies should reflect the financial characteristics of domestic activities of exporting companies. In our case, domestic companies are in the same sector and the same country of exporting ones but their size is smaller. We should also check if other control variables (product quality and demand, wine sector and region, production in bulk or bottle…) are similar. As in most studies based on paired samples the quality of results depends heavily on the quality of the comparison sample. Finally results more significant (for instance for the margin to risk relationship) could be obtain using a larger sample of wine companies.

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Appendix 1. Solution of the system of equations (4, 6)

System of equations [4] and [6] is written in normal form:

$$\begin{cases} \left(1-s_D^*\right)^2 V\left(\tilde{m}_X\right)+2s_D^*\left(1-s_D^*\right)Cov\left(\tilde{m}_D,\tilde{m}_X\right)=V\left(\tilde{m}_G\right)-s_D^{*\,2}V\left(\tilde{m}_D\right) \\ \left(s_D^*-1\right)V\left(\tilde{m}_X\right)+\left(1-2s_D^*\right)Cov\left(\tilde{m}_D,\tilde{m}_X\right)=A-s_D^*V\left(\tilde{m}_D\right) \end{cases}$$

The resolution by the Cramer method is:

$$D=\begin{vmatrix} \left(1-s_D^*\right)^2 & 2s_D^*\left(1-s_D^*\right) \\ -\left(1-s_D^*\right) & \left(1-2s_D^*\right) \end{vmatrix}=\left(1-s_D^*\right)^2$$

$$D_{V(\tilde{m}_X)}=\begin{vmatrix} V\left(\tilde{m}\right)-s_D^{*\,2}V\left(\tilde{m}_D\right) & 2s_D^*\left(1-s_D^*\right) \\ A-s_D^*V\left(\tilde{m}_D\right) & \left(1-2s_D^*\right) \end{vmatrix}=V\left(\tilde{m}_G\right)\left(1-2s_D^*\right)+s_D^{*\,2}V\left(\tilde{m}_D\right)-2As_D^*\left(1-s_D^*\right)$$

$$D_{\mathrm{cov}(\tilde{m}_D,\tilde{m}_X)}=\begin{vmatrix} \left(1-s_D^*\right)^2 & V\left(\tilde{m}\right)-s_D^{*\,2}V\left(\tilde{m}_D\right) \\ \left(s_D^*-1\right) & A-s_D^*V\left(\tilde{m}_D\right) \end{vmatrix}=V\left(\tilde{m}_G\right)\left(1-s_D^*\right)-s_D^*\left(1-s_D^*\right)V\left(\tilde{m}_D\right)+A\left(1-s_D^*\right)^2$$

The solution of the system is:

$$V\left(\tilde{m}_X\right)=\frac{V\left(\tilde{m}_G\right)\left(1-2s_D^*\right)+s_D^{*\,2}V\left(\tilde{m}_D\right)-2As_D^*\left(1-s_D^*\right)}{\left(1-s_D^*\right)^2}$$

$$Cov\left(\tilde{m}_D,\tilde{m}_X\right)=\frac{V\left(\tilde{m}_G\right)-s_D^*V\left(\tilde{m}_D\right)+A\left(1-s_D^*\right)}{\left(1-s_D^*\right)}$$

$$A=\frac{\overline{m}_D-\overline{m}_X}{\lambda}$$

Appendix 2

Expressions of the implicit export margin, the implicit margin risk and the implicit covariance between domestic and export margin

$$\hat{m}^{e}_{Xi} = \frac{\alpha_G - \alpha_D s_{Di} + \beta_G \sigma_{Gi} - \left(\beta_D^2 \sigma_{Gi} / \beta_G\right) s_{Di}}{\left(1 - s_{Di}\right)}$$

$$= \frac{\left(\alpha_G - \alpha_D s_{Di}\right)\beta_G + \sigma_{Gi}\left(\beta_G^2 - \beta_D^2 s_{Di}\right)}{\beta_G\left(1 - s_{Di}\right)}$$

$$A_i = \frac{\left(\beta_D^2 \sigma_{Gi} / \beta_G\right) + \alpha_D - \alpha_G - \beta_G \sigma_{Gi}}{\left(\beta_G / \sigma_{Gi}\right)\left(1 - s_{Di}\right)} = \frac{\sigma_{Gi}^2\left(\beta_D^2 - \beta_G^2\right) + \beta_G \sigma_{Gi}\left(\alpha_D - \alpha_G\right)}{\beta_G^2\left(1 - s_{Di}\right)}$$

$$\hat{V}\left(m^{e}_{Xi}\right) = \frac{\beta_G^2 \sigma_{Gi}^2\left(1 - 2s_{Di}\right) + s_{Di}^2 \beta_D^2 \sigma_{Gi}^2 - 2s_{Di}\beta_D^2 \sigma_{Gi}^2 + 2s_{Di}\beta_G^2 \sigma_{Gi}^2 - 2s_{Di}\sigma_{Gi}\beta_G\left(\alpha_D - \alpha_G\right)}{\beta_G^2\left(1 - s_{Di}\right)^2}$$

$$= \frac{\beta_G^2 \sigma_{Gi}^2 + s_{Di}\beta_D^2 \sigma_{Gi}^2\left(s_{Di} - 2\right) - 2s_{Di}\sigma_{Gi}\beta_G\left(\alpha_D - \alpha_G\right)}{\beta_G^2\left(1 - s_{Di}\right)^2}$$

$$\hat{Cov}\left(m^{e}_{Xi}, m^{e}_{Di}\right) = \frac{\beta_G^2 \sigma_{Gi}^2 + s_{Di}\beta_D^2 \sigma_{Gi}^2 + \sigma_{Gi}^2\left(\beta_D^2 - \beta_G^2\right) + \sigma_{Gi}\beta_G\left(\alpha_D - \alpha_G\right)}{\left(1 - s_{Di}\right)\beta_G^2}$$

$$= \frac{\left(1 - s_{Di}\right)\beta_D^2 \sigma_{Gi}^2 + \sigma_{Gi}\beta_G\left(\alpha_D - \alpha_G\right)}{\left(1 - s_{Di}\right)\beta_G^2}$$

Appendix 3. Analysis of the correlation coefficient

$$\hat{Cor}\left(m_{Xi}^{e}, m_{Di}^{e}\right)^2 = \frac{\left[(1-s_{Di})^2\beta_D^4\sigma_{Gi}^4 + \beta_G^2\sigma_{Gi}^2(\alpha_D-\alpha_G)^2 + 2(1-s_{Di})\beta_D^2\beta_G\sigma_{Gi}^3(\alpha_D-\alpha_G)\right](1-s_{Di})^2\beta_G^4}{\left[\sigma_{Gi}^2\beta_G^2 + s_{Di}\beta_D^2\sigma_{Gi}^4(s_{Di}-2) - 2s_{Di}\sigma_{Gi}\beta_G(\alpha_D-\alpha_G)\right](1-s_{Di})^2\beta_G^4\beta_D^2\sigma_{Gi}^2}$$

$$\hat{Cor}\left(m_{Xi}^{e}, m_{Di}^{e}\right)^2 = \frac{(1-s_{Di})^2\beta_D^4\sigma_{Gi}^4 + \beta_G^2\sigma_{Gi}^2(\alpha_D-\alpha_G)^2 + 2(1-s_{Di})\beta_D^2\beta_G\sigma_{Gi}^3(\alpha_D-\alpha_G)}{\left[\sigma_{Gi}^4\beta_G^2\beta_D^2 + s_{Di}\beta_D^4\sigma_{Gi}^4(s_{Di}-2) - 2s_D\sigma_{Gi}^3\beta_G\beta_D^2(\alpha_D-\alpha_G)\right]}$$

$\hat{Cor}\left(m_{Xi}^{e}, m_{Di}^{e}\right)^2 \le 1$ implies that

$$\beta_D^4\sigma_{Gi}^4 - 2s_{Di}\beta_D^4\sigma_{Gi}^4 + s_{Di}^2\beta_D^4\sigma_{Gi}^4 + \beta_G^2\sigma_{Gi}^2(\alpha_D-\alpha_G)^2 + 2\beta_D^2\beta_G\sigma_{Gi}^3(\alpha_D-\alpha_G) - 2s_{Di}\beta_D^2\beta_G\sigma_{Gi}^3(\alpha_D-\alpha_G)$$
$$\le \sigma_{Gi}^4\beta_D^2\beta_G^2 + \sigma_{Gi}^4 s_{Di}^2\beta_D^4 - 2\sigma_{Gi}^4\beta_D^4 s_{Di} - 2s_{Di}\sigma_{Gi}^3\beta_D^2\beta_G(\alpha_D-\alpha_G)$$

$$\beta_D^4\sigma_{Gi}^4 + \beta_G^2\sigma_{Gi}^2(\alpha_D-\alpha_G)^2 + 2\beta_D^2\sigma_{Gi}^3\beta_G(\alpha_D-\alpha_G) - \beta_D^2\beta_G^2\sigma_{Gi}^4 \le 0$$
$$\beta_D^2\sigma_{Gi}^4\left(\beta_D^2-\beta_G^2\right) + \beta_G\sigma_{Gi}^2\left[\beta_G(\alpha_D-\alpha_G)^2 + 2\beta_D^2\sigma_{Gi}(\alpha_D-\alpha_G)\right] \le 0$$

If we are in the reasonable case where $\beta_D^2 \le \beta_G^2$ (exporting companies obtain a better reward for risk than purely domestic ones) the first term of the equation above is negative.
The second term is negative if $\beta_G(\alpha_D-\alpha_G)^2 + 2\beta_D^2\sigma_{Gi}(\alpha_D-\alpha_G) \le 0$ or if

$$\sigma_{Gi} \ge \frac{\beta_G(\alpha_G-\alpha_D)}{2\beta_D^2}$$

In the reasonable case where $\alpha_G \ge \alpha_D$ the right hand side of the inequality is positive. So to be sure to obtain coefficient of correlation in the interval [-1, 1] the global risk must not be too small.

Appendix 4. Analysis of the consequences of error in the coefficients of the domestic line of exporting companies

Derivatives of the Implicit Expected Export Margin

$$\frac{dm_X^e}{d\alpha_D} = \frac{-s_D}{1-s_D} \leq 0$$

Implicit export margin decreases when the intercept of the domestic line increases.

$$\left|\frac{-s_D}{1-s_D}\right|'_{s_D} = \frac{-1}{(1-s_D)^2} < 0$$

The impact of error decreases when export intensity increases.

$$\frac{dm_X^e}{d\beta_D} = \frac{-2s_D\sigma_G\beta_D}{(1-s_D)\beta_G} \leq 0$$

Implicit export margin decreases when the slope of the domestic line increases.

$$\left|\frac{-2s_D\sigma_G\beta_D}{(1-s_D)\beta_G}\right|'_{s_D} = \frac{-2\sigma_G\beta_D}{\beta_G(1-s_D)^2} < 0$$

The impact of error decreases when global risk or export intensity increases.

Derivatives of the Implicit Variance of Export Margin

$$\frac{dV(m_X^e)}{d\alpha_D} = \frac{-2s_D\sigma_G}{(1-s_D)^2\beta_G} \leq 0$$

Implicit variance of export margin decreases when the intercept of the domestic line increases.

$$\left|\frac{-2s_D\sigma_G}{(1-s_D)^2\beta_G}\right|'_{s_D} = \frac{-2\sigma_G}{\beta_G(1-s_D)^2} < 0$$

The impact of error decreases when global risk or export intensity increases.

$$\frac{dV(m_X^e)}{d\beta_D} = \frac{2s_D\beta_D\sigma_G^2(s_D-2)}{(1-s_D)^2\beta_G^2} \leq 0$$

Implicit variance of export margin decreases when the slope of the domestic line increases.

$$\left|\frac{2s_D\beta_D\sigma_G^2(s_D-2)}{(1-s_D)^2\beta_G^2}\right|'_{s_D} = \frac{-4\sigma_G^2\beta_D}{\beta_G^2(1-s_D)^3} < 0$$

The impact of error decreases when global risk or export intensity increases.

Derivatives of the Implicit Covariance

$$\frac{dCov(m_D^e, m_X^e)}{d\alpha_D} = \frac{\sigma_G}{(1-s_D)\beta_G} > 0$$

Implicit covariance increases when the intercept of the domestic line increases.

$$\left|\frac{\sigma_G}{(1-s_D)\beta_G}\right|'_{s_D} = \frac{\beta_G}{\beta_G^2(1-s_D)^2} > 0$$

The impact of error increases when global risk or export intensity increases.

$$\frac{dCov(m_D^e, m_X^e)}{d\beta_D} = \frac{2\beta_D\sigma_G^2(1-s_D)}{(1-s_D)^2\beta_G^2} > 0$$

Implicit variance of export margin increases when the slope of the domestic line increases.

$$\left|\frac{2\beta_D\sigma_G^2(1-s_D)}{(1-s_D)^2\beta_G^2}\right|'_{s_D} = \frac{2\sigma_G^2\beta_D}{\beta_G^2(1-s_D)^2} > 0$$

The impact of error increases when global risk or export intensity increases.

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Entrepreneurial Supply Chains and Strategic Collaboration: The Case of Bagòss Cheese in Bagolino, Italy

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Abstract

Many small towns and communities are struggling to sustain their competitiveness in the face of increasing globalization. Yet, through entrepreneurial supply chains, some communities are organizing themselves to forge local solutions to their global challenges. The essence of entrepreneurial supply chains is its ability to facilitate alignment of all participants in the chain, eliminating moral hazard and opportunism risks. It is argued that this governance system and an ability to protect the common assets from infringement by outsiders are necessary for the success of these solutions. The research uses Bagòss cheese, produced in the small Italian village of Bagolino, to illustrate the characteristics of entrepreneurial supply chains and test the effect of the identified necessary conditions for their successful implementation.

Keywords: entrepreneurial supply chain, Bagòss cheese, globalization

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Introduction

O'Hara and Stagl (2001) argue that increasing globalization has altered the relationship between economics and society because local alternatives are emerging as strong competitors to imports in local markets. They view the emergence of community supported agriculture as an example of the evidence that certain characteristics of production are becoming more important to consumers in their choice of products, especially food products. Increasingly, consumers are looking at food production, distribution and consumption as political tools in addressing environmental challenges (Theodoropoulou and others 2008), in dealing with conservation and preservation of culture (Leong 1989) and in contributing to economic development (Arce and Marsden 1993) even as they meet their primary economic purpose.

The importance of these issues is being driven by an increasing proportion of consumers who care about where and how their food is produced and are willing to pay premiums for products that meet their ethical sensibilities, including environmental protection, fair trade and social justice and animal welfare programs. Some firms are responding by emphasizing their sustainable production practices and highlighting their social responsibilities efforts, e.g., organic products, small family farms, habitat protection, etc. Others position themselves as distinct based on their appellation d'origin, such as "Champagne" and "Bordeaux" in French wines and "Vidalia onions" in the U.S. Within the context of the resource-based view of the firm, these idiosyncratic characteristics offer uniqueness in resources that are rare and valuable and are inimitable and non-substitutable (Lippman and Rumelt 1982). These firms' ability to successfully sustain their competitive advantage is supported by the credible threat of retaliation they possess against potential competitors (Day and Reibstein 2004).

This paper's purpose is two-fold. First, we evaluate the concept of entrepreneurial supply chains as business and economic development strategies in small communities within an increasingly global marketplace. The second purpose is to apply the outcomes of the evaluation to Bagòss cheese, produced in the small Italian village of Bagolino, which is dealing with globalization challenges. The application involves the simulation of the Bagòss producers' strategic decisions under alternative governance and intellectual property (IP) conditions. The lessons from the simulation provide insights into how local communities may leverage their solutions using appropriate governance systems and IP protection mechanisms to address their global challenges.

Entrepreneurial Supply Chains and Strategic Collaboration

Traditional supply chains have a dominant champion controlling most of the strategic decisions associated with performance. Champions' power emanates from their control over the distribution of value (Amanor-Boadu, Trienekens and Williams, 2002). In exchange for their share of the value they create, participants conform to champions' specifications of types of input to use, the quality standards of outputs, production processes and quantities, delivery locations and times, etc. Because of this uneven power distribution, opportunism (Simon 1991) tends to be prevalent in traditional supply chains and anonymity becomes valuable (Amanor-Boadu and Starbird 2005). This governance mechanism may also foster moral hazard at points along the supply chain where participants perceive themselves to be powerless (Amanor-Boadu, Trienekens, and Williams 2002); (Starbird, Amanor-Boadu, and Roberts 2008). Here,

participants in the supply chain who perceive themselves as powerless will find it advantageous to shirk on the necessary but unobservable effort required to minimize potential risks to the whole supply chain. Although these traditional supply chains' risks may be addressed with oversight protocols that aim to increase transparency and reduce the value of anonymity, they can be expensive and cumbersome to execute if the partners have competing objectives. Entrepreneurial supply chains offer an effective alternative to traditional supply chains when opportunism or moral hazard risks cannot be otherwise effectively controlled.

Entrepreneurial supply chains are inter-firm relationships characterized by a mutual recognition of need for, and dependence on, a valuable asset that is inexhaustible in use but easily depreciated with misuse or abuse. Participants in entrepreneurial supply chains, therefore, recognize a shared responsibility in protecting and enhancing the value embedded in the enabling asset through social ties and networks (Granovetter 2005). The enabling asset's characteristics define the opportunities that may be exploited and the extent of participants' embeddedness in the governing social ties and networks. These characteristics also define the IP protection methods that may be employed to enforce exclusivity and create tangible value for participants. Although they may operate in the same marketplace, participants in entrepreneurial supply chains compete via blue ocean strategies which involve focused development of alternative strategy maps that specifically avoid price competition and focus on market expansion (Kim and Mauborgne 2005).

The collective success of entrepreneurial supply chain participants is driven by their independent ability to meet their customers' idiosyncratic expectations as well as maintain their collective diversity. Recognizing the foregoing, participants in entrepreneurial supply chains organize themselves around their shared assets while consciously taking personal ownership in maximizing the assets' contribution to their individual performance. Because they are non-linear, entrepreneurial supply chains are usually more extensive and complex than traditional supply chains, encompassing government agencies enforcing use rights and exclusivities, and businesses in multiple industries that depend on the shared assets. Thus, changes in the nexus of entrepreneurial supply chains can have significant effects in seemingly unrelated segments of the local economy in which they operate.

Typology of Entrepreneurial Supply Chains

Three distinct groups of entrepreneurial supply chains may be delimited based on the types of assets: place assets; place/product assets; and place/product/process assets (Figure 1). Entrepreneurial supply chains based on place assets are organized around the unique characteristics of a location, and are, therefore, commonly found in the tourism industry. Their participants leverage the location's unique characteristics to provide customers with idiosyncratic experiences. Thus, the primary source of the participants' collective competitive advantage is the unique, valuable and unsubstitutable location asset they all share. They incorporate these qualities of the location asset into their individual strategies to achieve their business objective. An example of a place-based entrepreneurial supply chain is the Finger Lakes Wine Trails in upstate New York, which are organized to maximize tourist traffic to the Finger Lakes region of New York by exploiting the location's natural beauty and the diversity of its tourism activities. Included in the Wine Trails are vineyards, wineries, restaurants and bed and breakfast

accommodations as well as event organizers and tour bus operators. Individual participant's sources of competitiveness are in how they organize their own production and utilize the common assets to leverage their ability to delight their customers. It is not uncommon to have a participant in these relationships direct a potential customer to another partner who is deemed to be a better provider of a particular solution or product. This behavior of marketing each other elevates the common asset by first knowing their disparate strengths and then bringing their collective strengths together. A similar governance mechanism is found in the wine and tourism region of Southwestern Ontario region of Niagara-on-the-Lake, on the shores of Lake Ontario. Likewise, the ski resort towns of Whistler, British Columbia and in the Swiss Alps as well as resort locations like Acapulco, Mexico have place-driven entrepreneurial supply chains that leverage the location's assets to enhance participants' competitiveness in their industries.
In all these examples, the immobility and inimitability of the common assets are the primary source of IP protection. As such, the participants' ability to establish and secure a first mover advantage is usually critical to their ability to sustain their competitive advantage. A good example of this is how Las Vegas, Nevada has successfully maintained its dominant market share, measured by gross gaming receipts, over Atlantic City, New Jersey despite the latter's efforts over the years (Eadington 1999).

Place/product asset-driven entrepreneurial supply chains are organized around products naturally occurring in a particular location. They also cover entrepreneurial supply chains that are organized around products that, while they may not occur exclusively in a particular location, have been there for such a long time that they have come to be literally associated with the place. They exhibit a natural barrier to competition because of their products' association with a particular location. Therefore, the place name becomes the embedded IP that separates the product from all others.

Italian suits and fashion are good examples of place/product entrepreneurial supply chains. While fine suits may be obtained from many places, being Italian elevates a suit above the others due to the association of quality suits with Italy, allowing industry participants to extract premiums for their products. The participants recognize that their distinguishing factor is quality, and they owe each other the responsibility of maintaining their perceived quality advantage if they are going to succeed individually. The same is true of Cuban cigars or California wines. Another example is Saskatoon berries, which is produced by a shrub that grows throughout the Canadian prairies and the northern plains of the United States (Harris 1972). However, by the fortuitous naming of the fruit, Saskatoon and Saskatchewan have claimed it as their own, marketing it as being authentic only if grown in Saskatchewan. Saskatoon berries' production and marketing have benefited from scientific evidence of its high antioxidant levels (Hosseinian and Beta 2007); (Hellstrom and others 2007) and the increasing appreciation of nutriceuticals' role in health protection and promotion (Morris 2003).
The final type of entrepreneurial supply chains is place/product/process entrepreneurial supply chains. These are organized around a product that is produced in a particular place using a specific process, inputs or production technology. The products produced within this type of entrepreneurial supply chains, therefore, tend to have more controls and standards around them than the other two. They have explicit IP protection protocols that serve to exclude non-conforming products and producers from exploiting the value offered by the supply chain. These protocols may also confer legal protection from suppliers who do not meet the place/product/process characteristics that create value in the marketplace.

Roquefort cheese is an example of place/product/process entrepreneurial supply chains. It is a blue cheese made specifically from the milk of Lacaune, Manech and Basco-Béarnaise breeds of sheep and matured in natural caves near the town of Roquefort in France's Aveyron region. A unique fungus, Penicillium roqueforti, whose spores are used to infect the maturing cheese to give it its unique characteristics, grows in these caves. Roquefort cheese's IP explicitly dates back to 1411 when the village of Roquefort-sur-Soulzon sought and obtained the rights from King Charles VI to age this particular type of cheese in its caves (Aussibal 1983). There were only seven Roquefort producers as of 2003, and the largest is the Société des Caves de Roquefort (a subsidiary of Lactalis), which accounts for about 60 percent of all production and owns several caves. The entry barrier to the Roquefort cheese production is the cave, the place asset that determines the product and the process.

Another example of place/product/process entrepreneurial supply chains is Vintners' Quality Assurance (VQA) employed by Ontario, Canada wine producers. This is not a product, per se, but a label that allows a chain participant to claim a mark of quality. To qualify for this label, the bottled wine must be produced by a winery located in Ontario and be made with at least 75 percent of grapes grown in Ontario (Wine & Vines 2007). Participating wineries are audited every six months to ensure that they are following VQA regulations and all volumes of VQA wines are substantiated with respect to origin and other requirements. For example, the wineries must provide official Grape Growers of Ontario records including a "weigh slip" with the results of an independent test for brix. Additionally, participating retailers are audited at least annually for their use of the VQA labels as well as their sales of VQA wines for authenticity. This supply chain's governance system, thus, encompasses grape growers, wineries, retailers, the Liquor Control Board of Ontario (LCBO), and the government agencies that audit the industry for compliance.

Another example of place/product/process entrepreneurial supply chains is Vidalia onions, grown since the early 1930s only in Vidalia onion production area—encompassing 20 counties in the state of Georgia, U.S. Vidalia onions are characterized by being unusually sweet, a characteristic emanating from the low soil sulfur content in the production area. The Vidalia Onion Act (1986), passed by Georgia's state legislature, authorized a trademark for "Vidalia Onions" and the Georgia Commissioner of Agriculture was given the authority to promote and protect Vidalia onions by assessing royalties on legitimate users and prosecuting violators with fines and/or imprisonment. The IP protection for Vidalia onions was enhanced when the industry received a Federal Marketing Order No. 955 in 1989 from the U.S. Department of Agriculture (Costa and Epperson 2003; Boyhan and Torrance 2002).

From the foregoing, it is clear that government's role in the place/product/process entrepreneurial supply chains is necessary for providing enforceable intellectual property rights or preventing counterfeits by outsiders and opportunism by participants. The Canadian VQA process, for example, focuses on preventing opportunism among participating firms to ensure that they follow all the necessary protocols. The European Community's Council Regulation 1383/2003 (The Council of the European Union 2003), on the other hand, focuses on customs action and measures that may be taken against goods suspected of infringing certain intellectual property rights that have been granted to specific products. The regulation is an expansion and strengthening of existing national laws, such as France's Appellation d'origine contrôlée (AOC), Italy's Denominazione di origine controllata (DOC), and Spain's Denominación de Origen (DO)

system. Infringements, such as selling products not meeting the location and process qualifications, are treated as counterfeit goods, misleading advertisements, or even a public health risks. The regulation is weighed in favor of those who have been granted the rights, and allows for a "a more flexible procedure allowing goods infringing certain intellectual property rights to be destroyed without there being any obligation to initiate proceedings to establish whether an intellectual property right has been infringed under national law" (Article 9, L 196/7). Similar protection is offered in European Union laws under geographical indications— Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) and Traditional Specialty Guaranteed (TSG) — to protect the names of recognized regional foods and beverages. Examples of these are Italian Limone di Sorrento, Scotch Whiskey and French Coquille Saint-Jacques des Côtes-d'Armor.

The foregoing suggests that entrepreneurial supply chains may be assessed on the basis of the mobility of the assets, the depth of IP protection and the extent to which participants need to be engaged for the governance system to work, i.e., exhibit low risk levels for opportunism and moral hazard. Figure 1 summarizes these characteristics for the three types of entrepreneurial supply chains presented here. For example, the high immobility of place systems implies that participants are more independent of each other and require low degree of engagement for the system to succeed. On the other hand, the low immobility of place/product/process systems makes them easily imitable and hence more prone to counterfeiting. These conditions call for high levels of intellectual property protection and high degrees of participant engagement for the system's success in creating unique and valuable solutions (Grant 1991).

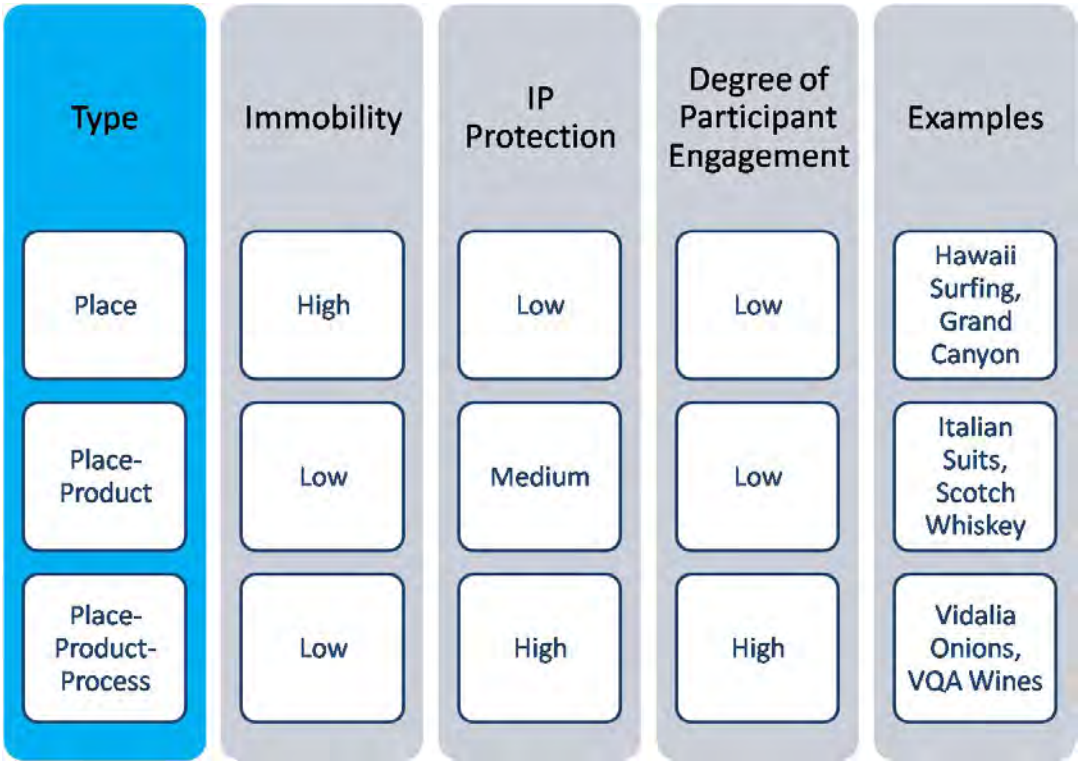

Figure 1. Typology of entrepreneurial supply chains with characteristic differences

Bagòss Cheese: An Entrepreneurial Supply Chain

We use the entrepreneurial supply chain for Bagòss cheese in the village of Bagolino, Italy to illustrate the local solution that emerges as a result of participants acting in concert to address their own global challenges. It shows how the purposeful pursuit of individual economic objectives leads to social benefits, such as environmental protection and conservation, community economic development and enhanced cultural education and preservation.

Authentic Bagòss cheese is a semi-cooked cheese produced under strict milk production and cheese processing methods that have been practiced for centuries. It is produced only in Bagolino using the milk of brown cows that live in Bagolino and are fed only feed grown in Bagolino. The process begins with the immediate filtering of the milk after milking using conifer branches placed at the bottom of a bucket with holes in it (Figure 1). The filtered milk is skimmed and poured into 40-liter vats and left for a day. Rennet, dissolved in spring water, is added to the skim milk and poured into a copper vat and warmed on a wood-built fire to a temperature of between 37°C and 39°C for about 20 minutes before adding powder curd to the warm milk. The mixture is then heated to between 48°C and 50°C to produce an appropriate consistency. It is then cut into the size of rice grains. Saffron is added to the mixture and reheated to form curds (although some producers add the saffron when they add rennet to the skim milk). The curds are separated from the whey, wrapped in canvas, and placed into molds

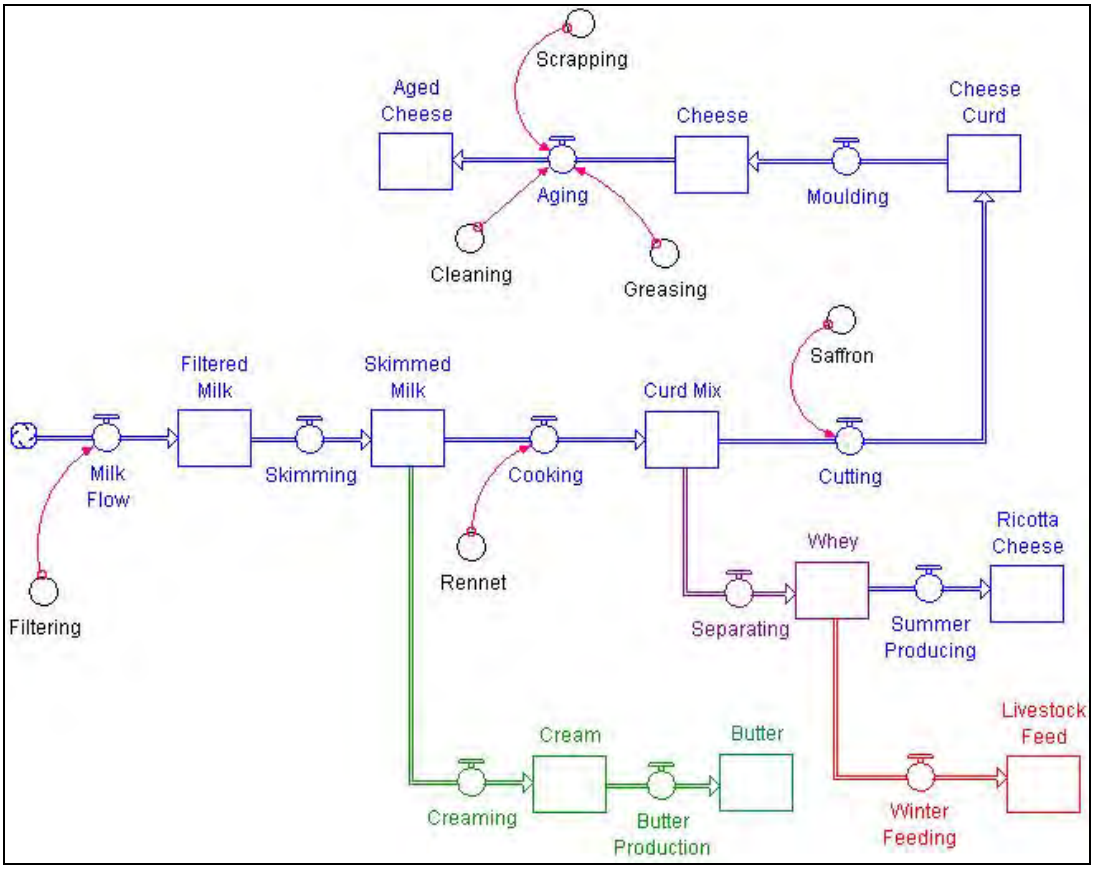

Figure 2. Schematic overview of Bagòss production with process by-products

of 40 cm diameter and heights between 12 cm and 15 cm. These are then placed on wooden planks, and stones placed on top to drain any excess water, a procedure that lasts about three days. The cheese is released from its wrappings after this period and brought to the valley, where it is aged from a year to three years. In the first five weeks of the aging process, the cheese is dry salted twice a week by hand, and during the first six months of aging, it is turned periodically, scraped, cleaned and greased with linseed oil. The final head of authentic Bagòss cheese weighs between 16 kg and 18 kg depending on its age and is produced from between 260 kg and 290 kg of milk.

Bagolino and the Participants

Bagolino is a small village with a 2007 population of 3,916 (National Institute of Statistics (ISTAT) 2007) located in the Caffaro Valley of Brescia Province in the Italian alpine region. About a decade ago, the per capita income per taxpayer in Bagolino was lagging significantly behind that of the Brescia province and a much farther behind the Lombardy region. However, unlike many small alpine communities that are losing population and economic activity and their natural resources becoming wasted, Bagolino saw a 16.5 percent increase in income per taxpayer between 1999 and 2007 compared to 2.7 percent for the Province of Brescia, 7.5 percent for the region of Lombardy and 2 percent for all of Italy. Civic leaders in Bagolino attribute this increase to a focused effort to enhance the importance of Bagòss cheese in Bagolino's economy. Bagòss cheese is one of Bagolino's two main historic assets. The other is the Bagòss Carnival, which, with its masks, colorful costumes, dancers and folk music, is described as a unique phenomenon in Italy, with few competitors in Europe (Sordi 1976). While most tourists come to Bagolino for the Carnival, Bagòss cheese remains the one thing they take with them when they leave. For this reason, Bagolino's dairy producers and the community joined forces more than a decade ago to secure a trademark for their cheese to facilitate promotion and marketing as well as acquire the legal support to prevent infringements under European Community laws. This initiative's importance is underscored by the recognition that about twice as much counterfeit as authentic Bagòss cheese is currently on the market.

The village of Bagolino has 130 farmers, 28 of whom are dairy farmers (ISTAT 2007). We interviewed 23 of these dairy farmers for this research. Together, they farm about 3,000 ha, with an average holding of 136 ha, ranging from 12 to 349 ha. Cow numbers and cow productivity range from eight to 42 and 1,300 kg to 4,900 kg per cow per annum respectively, with an average of about 25 cows per farm and 3,133 kg per cow per year. This productivity contrasts with Brescia province average of 6,451 kg in 2007 (ANARB 2008).

Two of the dairy producers interviewed were too small to process their own cheese, selling their milk to the local processor. The larger producers who process their own cheese also sell any excess milk they have—about 16.9 percent of total milk production of nearly 1,798 metric tons—to the local processor. Total annual authentic Bagòss cheese produced for sale was 138.8 metric tons, distributed as follows (Table 1): Direct-to-consumer (45.8 percent); Local retailers (21.9 percent); Wholesalers (12.0 percent); Outside retailers (15.9 percent); Restaurants (3.9 percent); and Agers (0.7 percent). Fifteen of the 23 producers distributed through local retailers, compared to 14 who sold directly to consumers. Eight, nine and ten producers sold to wholesalers, restaurants and outside retailers respectively, and only three producers sold to agers.

Table 1. Prices and quantity of Bagòss Cheese by channel and age

	Price/kg				Age at Sale				Number
Distribution Channel	Min	Max	Mean	Std. Dev.	< 1 Year	1 - 2 Years	2+ Years	Total	
Consumers	9.50	22.50	15.00	4.15	44,323	18,996	-	**63,318**	14
Restaurants	11.00	25.00	17.22	4.86	-	286	5,070	**5,356**	9
Local Retailers	9.00	16.50	12.97	1.94	30,354	-	-	**30,354**	15
Outside Retailers	11.50	22.00	15.10	3.04	11,434	10,972	-	**22,406**	10
Wholesalers	11.50	19.00	14.13	2.72	16,356	-	-	**16,356**	8
Agers	12.00	13.00	12.50	0.50	999	-	-	**999**	3
Total					**103,466**	**30,254**	**5,070**	**138,790**	

Table 1 also shows that 74.5 percent of total cheese produced is sold within a year of production (i.e., fresh), 21.8 percent is sold between a year and two years, and the remaining 3.7 percent is sold as aged cheese, i.e., two or more years old. Three principal reasons explain the high proportion of fresh sales: labor; cash flow; and aging storage limitations. The farmers note that their most limiting resource is labor and the aging process is labor intensive. By selling a large proportion of their production as fresh cheese, the farmers avoid the labor and space constraints and increase their cash flow. Although they do not make as much money this way, they point out that they avoid shrinkage and other storage risks.

Also presented in Table 1 are the summary price statistics by distribution channel. We found that restaurants, which do not purchase fresh cheese, paid the highest average price, €17.22/kg, a price found to be significantly different from the prices paid by all the other channels at the 10 percent level. Contrarily, agers and local retailers purchase only fresh cheese, paying an average price of €12.50/kg and €12.97/kg respectively. Outside retailers purchase nearly equal proportions of fresh and medium-aged cheese and pay an average price of €15.10/kg, while the direct-to-consumer price ranged from €9.50/kg to €22.50/kg and averaged about €15.00/kg. Bagolino dairy producers depend solely on their own labor and that of their family members, therefore, labor is treated as a residual claimant and cows are treated as capital. Milk production variable costs are defined to include feed purchases, pasture rent, land and building rent, veterinary expenses and fuel and utility expenses while cheese production variable costs include saffron and rennet expenses. Average milk production variable expenses amounted to about €33,113 while cheese production variable expenses (excluding milk) amounted to approximately €2,250 per farm. Feed purchases and pasture rent accounted for almost 75 percent and 8.5 percent of milk production variable expenses respectively while saffron costs accounted for about 79 percent of cheese production variable expenses. Thus, the majority of variable expenses for Bagòss producers is providing food for the cows. This is probably because of the strict production specifications associated with Bagòss production—from rules relating to the breed of cows, housing, and feeding and cheese processing and aging.

Bagolino's dairy farmers graze 1,100 cows and calves on the 22 pastures they have developed in the mountains around their village during the summer months and feed them hay from the valley during the winter months (Figure 2). Due to labor shortage, it is not uncommon to find farmers collaborating in taking care of their cows in the mountains. Dependence on the mountain pastures as part of their production process has caused the farmers to protect the quality of their mountain environment, using goats instead of pesticides, for example, in weed control (Suttini, October 4, 2008). The dairy farmers supply manure to the crop farmers in the valley from whom they purchase hay in the winter. They receive veterinary services from the government and milk quality inspection services from the provincial milk producer association (Stagnoli, October 4, 2008). Valli di Bagolino cooperative provides domestic and international marketing and promotion support for Bagòss cheese, protects the trademark and enforces production standards. Bagolino's local government actively promotes Bagòss cheese (as well as the carnival), creating traffic to Bagolino and consumer awareness about its principal assets. The 17 hotels and 12 restaurants in the village showcase Bagòss cheese and actively promote it because of the benefits it brings. The entrepreneurial supply chain offers customers—tourists, retailers, restaurants, etc.—uniqueness because of its artisanal production system, creating a diversity that allows each producer to develop and maintain loyalty among their own customers.

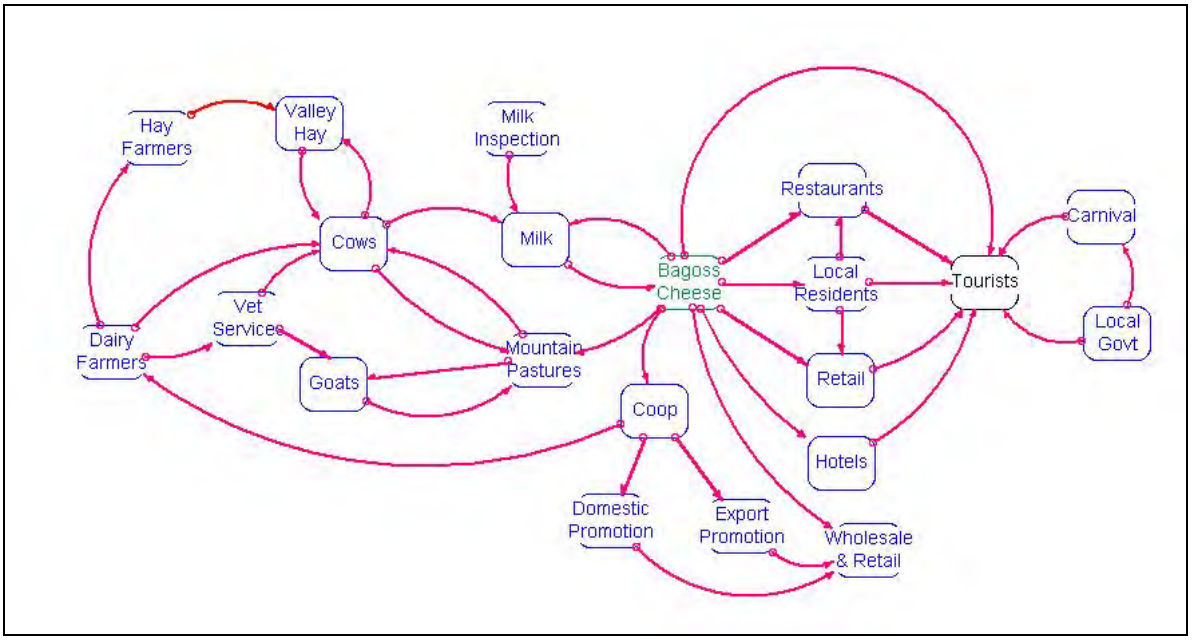

Figure 3. Participating organizations, individuals, products and services in Bagòss Cheese entrepreneurial supply chain

A Local Solution to a Global Challenge

We have argued that entrepreneurial supply chains can offer effective local solutions to global challenges, and the effectiveness of these solutions have been implied to increase as one moves from place to place/product/process structures. The problem that many small communities

involved in these relationships face with their solutions is how to sustain their effectiveness given the dynamic environment of globalization. Focusing on place/product/process entrepreneurial supply chains, we hypothesize that the governance system and the IP protocols are necessary conditions for sustainability in the global marketplace. The chain's governance structure determines the alignment of participants' objectives and the potential risks of moral hazard and opportunism (Amanor-Boadu and Starbird, 2005). The artisanal pride that Bagòss producers bring to their production and participation in the Bagòss entrepreneurial supply chain ensures that their individual objectives are aligned with that of the collective objective of protecting the quality and image of Bagòss cheese. The IP protection protocols provided by the EU government for such products offer significant support for prosecuting and preventing counterfeits from entering specific markets. When the Bagòss entrepreneurial supply chain participants can enforce these regulations and protect their loyal customers from counterfeit products through education, then they can improve their product's value position in the global marketplace, ensuring the sustainability of their local solution.

A System Dynamic Model for Bagòss Cheese

We test the foregoing hypothesis using a system dynamics modeling approach. The approach, grounded in nonlinear dynamics' theory (Lane, 2001), uses well-defined assumptions to describe and analyze complex and dynamic feedback problems (Forrester, 1968; Sterman, 2000). It has been applied extensively in problems with complex inter-relationships: management of complex technology projects (Philbin, 2008); collaboration in supply chains (Pawlak and Malyszek, 2008); the relationship between education and economic growth (Ndiyo, 2007); and assessment of infectious diseases (Pradas-Velasco, Antoñanzas-Villar and Martínez-Zárate, 2008). It is useful in this problem because of its ability to handle the complex feedback relationships among governance, IP protection and dairy producer profitability. The system dynamic models for this research were developed and simulated with iThink®, a simulation software from iseesystems www.iseesystems.com. The simulation models in iseesystem NetSim format may be requested from the communicating author.

In testing the hypothesis, we develop two alternative scenarios relating to the governance and IP protection respectively and compare them to the base scenario which describes the current Bagòss cheese entrepreneurial supply chain. The focus of the analysis is limited to dairy producers since they are considered the nexus of the Bagòss entrepreneurial supply chain. Thus, it is assumed that the success of dairy producers creates positive externalities in the whole community and vice versa. Under the base scenario, producers are in charge of all three principal stages in the chain—milk production, cheese processing and cheese marketing and distribution and, thus, transfer their milk internally for cheese processing and marketing (Table 2). The average milk to cheese conversion rate is 13.31 kg in the base scenario.

The governance scenario assumes a traditional supply chain which is 'owned' by a processor who purchases all the milk produced by Bagolino's dairy producers. Because producers know their milk is co-mingled at the processing plant, they have an incentive to avoid all costs they can avoid and escape any associated direct penalties. Thus, they may cows save on labor by putting on cheaper commercial feed, which also increases cow productivity. This is a direct result of the divergence in chain participants' objectives emanating from the change in governance. As

farmers focus on maximizing profit from milk production and loss focus on maximizing the value of the Bagòss brand, the product losses its advantage in the market as counterfeits compete effectively with the declining distinguishing characteristics. Declining prices may force the

Table 2. Critical Assumptions Defining Alternative Scenarios

Critical Variables	Base	Traditional Supply Chain	Intellectual Property
Milk Production	Producer	Producer	Producer
Local Feed and Pasture	Voluntary	Not necessarily	Compulsory
Milk Price	Transferred Internally at €0.0/kg	Sold to Processor at €0.35/kg	Transferred Internally at €0.0/kg
Cheese Processing	Producer	Processor	Producer
Communal Aging Storage	No	No	Yes
Marketing & Distribution	Producer	Processor	Producer
Own-Price Elasticity	-0.6	-0.6	-0.6
Counterfeit Cheese Control	No	No	Yes
Farmers' Cheese Processing Assets	Fully utilized	Mothballed because of zero opportunity cost	Fully utilized

processor to expand production, which exacerbates price declines. This classic negative feedback effect, if left unchecked, causes a bullwhip effect in other segments of the community: tourism declines, hotels and restaurants lose customers; mountain pastures are left unkempt; sales tax revenue declines; property tax increases; and so on.

The IP scenario assumes the producers invest in enhancing their IP enforcement protocols, prosecuting counterfeit Bagòss sellers. It is also assumed that all other production activities are similar to those under the base scenario except that the producers implement a check-off system to fund their cooperative's efforts to enhance their IP protection policies as well as educate their loyal customers about the differentiating characteristics of authentic Bagòss cheese. By successfully making it difficult for counterfeits to enter the market and helping customers appreciate authentic Bagòss' uniqueness, Bagolino's dairy producers are able to sustain their competitiveness in the artisanal cheese market and engender positive externalities throughout the community's economy.

Simulation Results

We simulated the Bagòss cheese system dynamic model under the specified assumptions for the three scenarios over 20 years. Cow productivity was assumed to be stochastic because of uncertainties in weather, pasture and feed quality and availability but cow numbers were kept unchanged due to EU production controls. Distribution channel allocations were maintained for both the base scenario and the intellectual property enhancement scenario. Because dairy producers are assumed to be the nexus of the system, cheese processing and distribution are ignored in the analysis under the governance scenario. The growth in cheese prices were based on projected increases in cheese consumption of between 0.8 percent (Consortium INRA-

Wageningen, 2002) and 1.6 percent per annum (OECD-FAO, 2007) in the EU-25, and an average own-price demand elasticity of -0.6, after Bouamra-Mechemache, et al. (2008) and Soregaroli and Trévisiol (2005).

The entrepreneurial supply chain currently governing Bagolino's dairy producers involves all but two producers engaged in milk production, cheese processing and marketing of the Bagòss cheese. We modeled the producers' activities as a single firm, working with 574 milking cows which produced an average of 3,113 kg of milk per year which was converted into cheese at rates between 9.6 kg and 16.9 kg per kilogram of cheese. (See Appendix 1 for model equations). Based on these assumptions, the average quantity of authentic Bagòss cheese produced over the 20 years was approximately 141 metric tons, with Bagolino dairy producers accounting for about 76.3 percent.

Average producer revenue from all the channels, including sale of excess milk to the local processor, was about €2.02 million per year under the base scenario simulation while average annual variable cost was approximately €951,945 per year. The average annual gross margin under the base scenario was, therefore, estimated at a little under €1.07 million. The net present value of the gross margin over the 20 years was about €10.74 million, using a discount rate of 7.5 percent.

The system's boundary under the governance scenario was limited to the farm gate because farmers do not process or market cheese under traditional supply chain governance. The producers' physical and labor resources used in processing milk into cheese are assumed to exhibit high asset specificity, leading to a plausible zero opportunity cost assumption for both. For example, the cheese processing equipment cannot be repurposed in Bagolino for anything else, especially given the assumption that cheese is processed by the processor. Additionally, Bagòss producers' skills and competences are not transferable to any other activity because of their specificity. A zero opportunity cost is also assumed for the farmers' cheese processing and marketing time because of Bagolino's remoteness and lack of alternative local employment. Based on the foregoing, then, it is reasonable to argue that these assets, while productive when the farmers are processing Bagòss cheese, have no contributory value under the governance scenario.

Based on the preceding arguments, the average annual milk production under the governance scenario was estimated at about 1,887 metric tons, generating average annual revenue of €948,339. The average annual variable cost under this scenario was estimated to be €614,711, with a gross margin of €333,628. The net present value of the cash flow under the governance scenario for the 20-year simulation was a little over €2.87 million, about 77 percent less than the base scenario's net present value. These values will change if the processing assets could be sold or repurposed in alternative enterprises.

The IP scenario focused on Valli di Bagolino aggressively prosecuting counterfeit Bagòss cheese suppliers and educating consumer to strengthen the Bagòss brand. The effort was funded with a five percent assessment on Bagòss cheese revenues. It was assumed that the ratio of counterfeit to authentic Bagòss declined from the current 2:1 to 0.13:1 over the 20-year simulation period. It was also assumed that for every 12.9 percent decline in the ratio, authentic Bagòss price increased by 1 percent (Freccia, Jacobsen and Kilby, 2003; Rosa, 2006). All other production levels were assumed to be unchanged from the base scenario. The simulation results showed that

average annual revenue was about €2.21 million and average annual variable costs of about €1.02 million, generating a gross margin of €1.9 million. The net present value of this cash flow at 7.5 percent discount rate was about €11.46 million. This was 6.7 percent higher than under the base scenario. The revenue and cost trend profiles for the three scenarios are presented in Figure 4 and Figure 5.

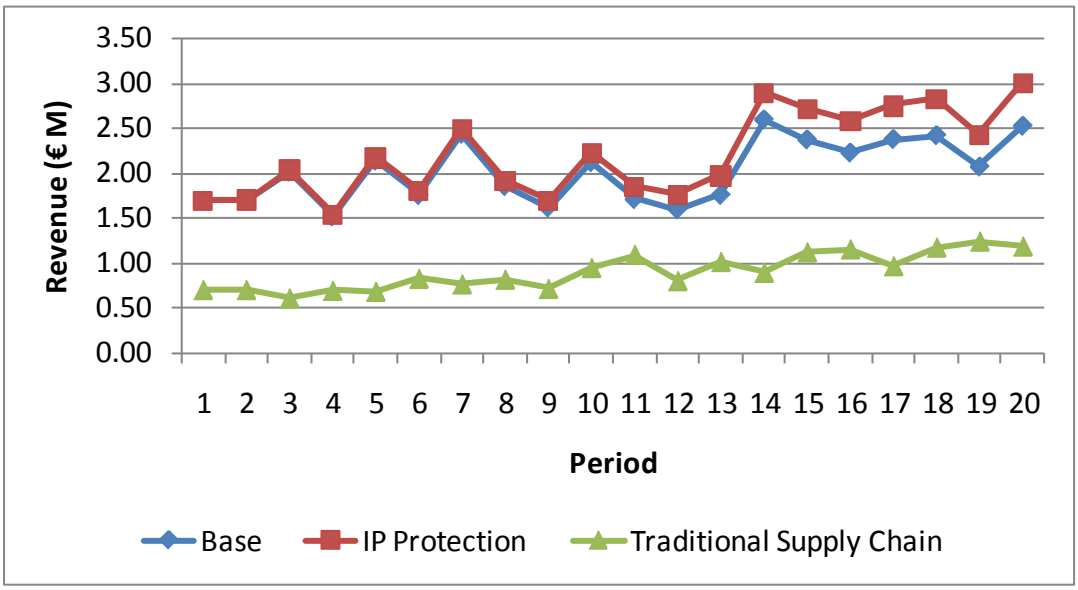

Figure 4. Bagolino dairy producers' revenue under alternative scenarios

While the base scenario and the IP scenario are directly comparable, it is impossible to compare them with the governance scenario at the aggregate level because of the different system boundaries. Therefore, we conducted the comparison of the three scenarios on a per cow basis since the number of cows was kept constant across all scenarios. The gross margin per cow averaged €1,856 under the base scenario compared to €498.11 under the governance scenario and €2,073 under the IP scenario. The net present value of the gross margins per cow over the simulation period for the three scenarios were respectively €18,709, €4,305 and €19,963.
We investigated the trends in the gross margin per cow under the alternative scenarios relative to the base scenario in order to assess the effect of the strategy changes underlying the scenarios on producers. The trends in cumulative difference in gross margins of the governance and IP scenarios relative to the base scenario are presented in Figure 6. They show that traditional supply chain is an inferior governance system to entrepreneurial supply chain governance system because of the nature of the assets supporting the Bagòss solution. Because it is difficult for anyone to provide the requisite incentives to elicit the right behavior about these assets, it is important not to replace individual self-interest with a hierarchical governance structure that does not support alignment of participants' objectives. When individual objectives are all aligned in protecting and expanding the value of the assets upon which they make their living, their individual actions do support the community objective of sustaining the solution's effectiveness in the face of global competition. The cumulative difference between the traditional supply chain governance system and the base scenario entrepreneurial supply chain governance system increases from about negative €1,703 per cow in the first year to about negative €27,160 per cow by the end of the 20 years (Figure 6).

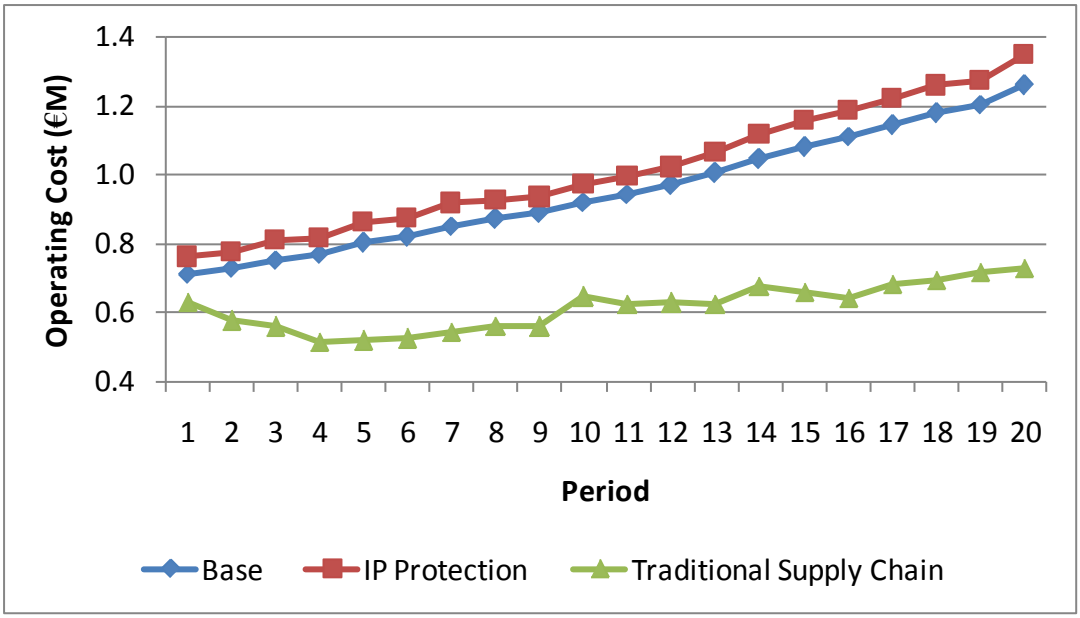

Figure 5. Bagolino dairy producers' operating costs under alternative scenarios

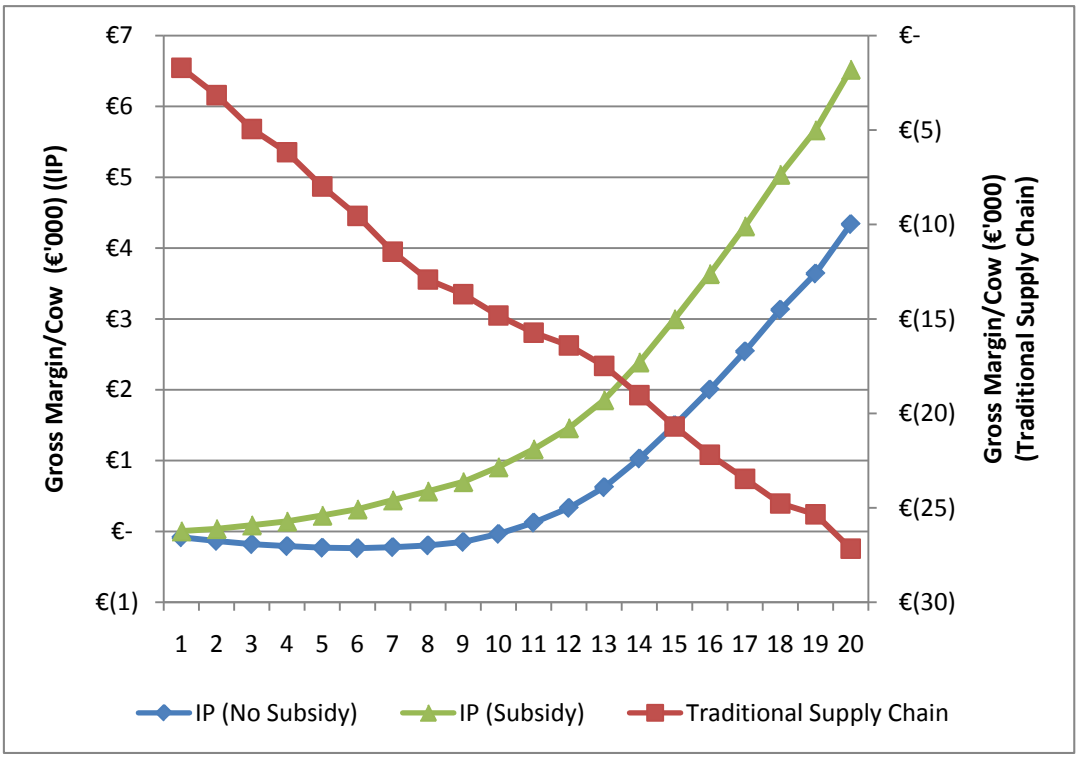

Figure 6. Gross margin per cow: Intellectual property and traditional supply chain relative to base scenario

We had assumed prior that the farmers fund the IP enhancement initiative by themselves. In Figure 6, we investigate another scenario where that initiative is funded fully by the government

because of the positive externalities that a successful Bagòss industry creates in the community. The results show that the producer-funded IP scenario was inferior to the base scenario in the first ten years. However, over the duration of the simulation and as more counterfeit Bagòss is removed from the market, this strategy offered a superior outcome to the base scenario, reaching a cumulative difference value of about €4,339 per cow at the end of 20 years. If the IP enhancement initiative is fully funded by the government, then the IP scenario is superior to the base scenario throughout the whole period, accumulating a difference of about €6,521 per cow by the end of 20 years. This suggests an opportunity for focusing on an IP enhancement strategy to protect the Bagòss brand.

Conclusion and Further Research

This research was motivated by the need to improve our understanding of the emerging inter-organizational relationships that are connecting seemingly unrelated organizations around natural assets such as places and linking those to products and production processes. We noted that the principal characteristic of these relationships is that, unlike traditional supply chains, they do not have a champion or an "owner." As a result, all participants in these relationships recognize their need and dependence on the identified assets for their success, and work to protect, conserve and promote them through nurtured trust and trustworthiness. We called this relationship entrepreneurial supply chains, and defined them as characterized by a mutual recognition of need for and dependence on valuable assets that are inexhaustible in use but easily depreciated with misuse or abuse.

We identified three types of entrepreneurial supply chains based on the depth and characteristics of the assets involved: place; place/product; and place/product/process entrepreneurial supply chains. Participants' commitment level and their responsibilities to the governance system increases as one moves from a place entrepreneurial supply chain to a place/product/process entrepreneurial supply chain.

Using the case of Bagòss cheese in Bagolino, Italy, we illustrated the superiority of entrepreneurial supply chains to traditional supply chains for such assets that are inexhaustible in use but easily depreciated with abuse or misuse. We argued that this superiority emanates from the congruence of individual participants' objectives, such that their selfish pursuit of these objectives contributed to the creation of collective value. Also because of this alignment of participants' objectives, classic problems in traditional supply chains, such as opportunism and moral hazard, are nonexistent.

We also showed that the value created by entrepreneurial supply chains is enhanced when the participants pursue effective IP protection initiatives. In our case, by implementing policies that made it difficult for counterfeit Bagòss to enter the market, they were able to extract a higher price for the authentic product. The value of this IP protection effort was estimated in our model at about 12.3 percent above the scenario where the underlying asset's intellectual property was unprotected.

This research offers significant opportunities for businesses in small communities to work together and with their communities to identify unique products with place and process

idiosyncrasies that can contribute to solutions that help them deal with globalization challenges. It allows for the construction of specific governance systems to match the structural characteristics of the assets that can be brought to support these local solutions.

The foregoing results may be unique to Bagòss because of the short length of the supply chain and the presence of strong regulatory support along the chain. Governments mandate production quotas and milk prices and provide strong IP protection regulation. What changes are necessary for an entrepreneurial supply chain to be effective when the supply chain is long and IP systems expensive to implement? This may be the case in such non-food industries as the fashion industry, which can draw on place/product/process controls to create a differentiated solution. Thus, there is a need for further research to compare the effectiveness of entrepreneurial supply chains in different industries in order to discover the necessary and sufficient conditions for their effectiveness in offering local solutions in the face of global challenges.

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Willingness to Pay for Improved Milk Sensory Characteristics and Assurances in Northern Kenya Using Experimental Auctions

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Abstract

Pastoralists in northern Kenya may be able to diversify income by selling milk in nearby towns and cities. However, milk sold in open-air markets in communities in northern Kenya is often of low quality in terms of its sensory characteristics. The milk is also often adulterated before sale. These markets are characterized by poor consumers who need to make choices about milk quality with virtually no information other than their own sensory perceptions. These conditions are similar in many parts of the world for many different commodities and products. An examination was undertaken using experimental auctions to determine *if* consumers in the border town of Moyale, Kenya are willing to pay for enhanced milk sensory characteristics and assurances. The results suggest that even poor consumers are willing to pay for enhanced sensory characteristics and assurances if these can be communicated in a trusted manner. Older, relatively well-informed women are the group most willing to pay the highest prices for milk quality.

Keywords: willingness-to-pay, milk, Kenya

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Introduction

Milk is a primary source of protein for people living in the semi-arid areas of southern Ethiopia and northern Kenya. In the rural areas of this part of Africa, fresh milk produced from cows is typically consumed by the pastoralist families who own the cows, but fresh milk in excess of what the family consumes is also shipped unrefrigerated by bus to nearby towns and cities to sell in open-air markets. [1] The space of time between when cows are milked and when the milk is actually sold at market can range from a few hours to over a day. There is an active market for fresh milk in these towns and cities, but bacterial growth causes the quality of the milk, in terms of its sensory characteristics and even perhaps its safety, to degrade rapidly when the milk is unrefrigerated. Milk is also often adulterated prior to sale at open-air markets in this part of Africa. Adulteration usually is done by adding water, fillers, or color in an attempt to hide the low quality of the milk (Wayua et al. (2007)).

The study area selected for the analysis described in this paper is Moyale, Kenya. Moyale straddles the border between Ethiopia and Kenya and has a population of over 40,000 residents. It is an important terminal market for pastoral dairy products from both southern Ethiopia and northern Kenya. This area is an arid or semi-arid where pastoralist production systems are the norm. Rainfall is low and variable with mean annual rainfall varying from 150-650 mm. The infrastructure is extremely weak, in terms of roads, schools, and health facilities. Pastoralists in this part of Africa have traditionally held most of their financial asset portfolio in the form of livestock and have very limited options to obtain outside cash income. The study area is subject to frequent and severe droughts and livestock losses during drought periods can be very high on a percentage basis. During drought periods, pastoralists are forced to sell livestock to try to raise money to buy grain or other sources of protein. As a result, local grain prices are often rising during times when local livestock prices are falling. These conditions place pastoralists in extremely precarious economic circumstances (Bailey et al. (1999)).

Because drought stress causes milk production to decline, pastoralists are left with little or no milk for their household to consume or sell during these periods. Increasing cash income during wet periods would provide the poorest pastoralists with cash that could be used to buy grain for human consumption given the historically favorable terms of trade between milk/butter and grain. Grain has more energy per unit volume than milk. Consequently, small-volume milk sales are often part of a survival strategy for food security given the overall volume of milk production can be seasonally insufficient on which the family can depend for food if only milk is consumed. Consequently, cash from milk sales during wet periods can be very important for grain purchases during dry periods. In saying this, one must realize that pastoralists make only a modest amount of income from milk and butter sale to urban consumers (Coppock et al. (2007)). However, even modest increases in cash income might have very consequential positive effects on an individual basis for the poorest pastoralists during drought periods. So, if the revenue from milk sales could be increased, it could be very meaningful for individual small producers, but could also justify small-scale technical or social (cooperative) interventions to yield a higher quality milk product and/or actions to market milk more effectively than is currently being done. This study assumes that actions to enhance the price of milk are the "best" strategies for increasing pastoralists' cash income from their livestock. While milk production might be

[1] A limited amount of milk is also processed through pasteurization at small local milk processing plants.

increased by increasing the number of cows being milked, rangeland in the study area is already overgrazed and adding cows would exacerbate this problem. Also, adding additional cows adds additional risk because of frequent droughts.

This study determines if pastoralists could receive higher prices for the milk they sell if they made efforts to improve the sensory characteristics and assurances about the milk. It is acknowledged that food safety concerns are closely connected to this research question. However, there is at best loose government oversight of these markets and a very limited to no ability for market participants to obtain scientific measures about milk safety. This makes the sensory characteristics of milk sold in these markets and any assurances made by sellers the principal sources of information available to buyers with which to value milk. Consequently, this study examines the connection between sensory characteristics, assurances, and price.

Pastoralists might be able to marginally enhance these characteristics (sensory characteristics and assurances) in the milk they sell through actions such as shipment in sisal-wrapped, water-soaked jerry cans to help reduce the temperature of the milk before and during shipment. Agents might also be established at the markets to ensure that the milk is not adulterated while at the market or the milk could be sold to local processors where it could be fumigated[2] and/or pasteurized. Pastoralists could also cooperate in establishing some type of basic branding or appellation strategies to signal quality to consumers. For example, certain villages could participate in assuring buyers that milk has been handled properly and has not been adulterated prior to sale.

Efforts to improve sensory characteristics and/or assurances for milk will increase production and/or transaction costs for pastoralists and these additional costs need to be covered by higher prices paid by consumers who are buying milk. Consequently, the economic success of actions taken to improve milk characteristics depends on consumer willingness to pay (WTP)[3] for milk with better sensory characteristics and/or assurances compared to the milk that is currently being sold in local open-air markets. In other words, economic incentives need to exist for pastoralists to improve the quality of the milk they are selling. However, if fresh milk demand is constrained because consumers are unable or unwilling to pay for milk with better sensory qualities and assurances than the milk currently being sold in these markets, efforts to further develop these markets by enhancing these characteristics would not be currently possible.

The overarching objective and aim of this study is to provide recommendations to pastoralists in this part of Africa about whether or not higher milk prices can be achieved by improving the sensory characteristics or assurances related to their milk. The study reports, based on experimental auctions, whether or not milk consumers in Moyale are WTP more for milk with better sensory characteristics and/or assurances than for the milk that is typically sold in open-air markets in that city. The study (sampling, focus groups, and experimental auctions) was

[2] Fumigation/smoking of vessels used for milking and milk storage is commonly practiced by pastoral communities in northern Kenya and the Greater Horn of Africa. Plant materials, including grass, shrubs and hardwoods, are used for smoking as well as cleaning the milk containers. Smoking flavors the product, disinfects (sterilizes) the container and is also thought to control fermentation by retarding bacterial growth (Ashenafi (1996); Coppock (1994)).

[3] Willingness to pay or WTP is a term commonly used in the literature as a measure of the monetary value consumers are willing to pay for a good or service. This either be directly observed in the case of existing markets, unobserved in the case of a non-market good, or can be estimated using experimental markets such as is the case here.

conducted during the period of August 16-28, 2007 at a community social hall outside of Moyale.[4] Transportation to and from the venue was provided to participants.

The demographics of participants in the experimental auctions are also used to determine the components of the market (niches) that might be willing to pay more for these enhanced characteristics. This type of information is essential for pastoralists if they pursue strategies to increase prices for the milk they sell.

To our knowledge, no past work has examined WTP for improved sensory characteristics and/or assurances for milk using experimental auctions in the study area. The results indicate that informed older women are willing to pay more for better milk quality in this market when compared with other market participants. Participants in the experimental auction also indicated a general willingness to pay more for additional food safety assurances about milk.

Consequently, there are segments of the Moyale milk market that could potentially be targeted with higher-quality (defined by improved sensory characteristics and assurances), higher-priced milk to increase pastoralists' incomes from milk sales. Improving these characteristics for a portion of the milk sold in these markets might also result in improving overall market quality for the milk sold in Moyale because these markets appear to be competitive and buyers would essentially be forced to improve these characteristics in the milk they sell if they wish to compete with milk being sold with improved sensory characteristics and/or assurances.

Defining Quality

The basis for evaluating quality as it relates to food products is defined and represented in a number of different ways in the literature. For example, some studies examine food quality in terms of food's nutritional value (e.g., You and Nayga, 2005, Kim, Nayga, and Capps, 2001; and Poole, Marshall, and Bhupal, 2002). Other studies define food quality as food's observable (intrinsic) characteristics (e.g., size and color) or non-observable (extrinsic) characteristics[5] (e.g., Kimenju and De Groote (2008); Charatsari and Tzimitra-Kalagianni, 2007; Chilton, Burgess, and Hutchinson, 2006; Travisi and Nijkamp, 2004; Tunçer, 2001; and Northen, 2000).[6] Many other studies have valued food characteristics using experimental auctions (e.g., Shogren et al. (1994); Hayes et al. (1995); Dickinson and Bailey (2002 and 2005); and Onyango, Nayga, and Govindasamy (2006); Goldberg, Roosen, and Nayga (2006)). [7]

In this study milk quality is defined solely by the sensory characteristics and assurances consumers can use in these markets to judge the value of milk prior to consumption (e.g., smell,

[4] Hellu Social Hall, about three km from town.
[5] Extrinsic food characteristics often are related to assurances about production processes used to produce a food product and food safety (e.g., organic, animal welfare, environmental responsibility, social responsibility, absence of genetically-modified organisms, traceability, country-of-origin, etc.).
[6] Many of these past studies examining food quality use a hedonic approach in an attempt to identify the marginal contribution to price of specific characteristics using either regression techniques, experimental auctions, or conjoint analysis (e.g., Charatsai and Tzimitra-Kalogianni (2007).
[7] Lusk and Shogren (2007) provide over 50 citations for valuations made using experimental auctions, most of them for food products.

taste, appearance and texture). The reason for using this definition is that it mirrors the information consumers have for judging the utility of milk in the open-air markets in Moyale. We assume that milk sellers and buyers attempt to judge milk's quality in these markets through sight, smell, and other sensory methods or assurances and base WTP largely on these characteristics. This relies on the premise that obtaining higher prices for fresh milk in these markets is hampered by the general poor sensory characteristics of fresh milk sold at the open-air markets (Wayua et al. (2007)).[8]

Estimating WTP

Establishing WTP for milk quality is an important, but only first step in this market development process because it doesn't consider how pastoralists and markets would need to organize to provide higher quality milk. If consumers are willing and able to pay for improved milk quality (as defined here) and, consequently improved food safety in these markets, overall milk quality should improve because the markets appear to be competitive.[9] However, the poverty that characterizes most of the population in southern Ethiopia and northern Kenya raises a question about consumers' WTP for improved quality, because some researchers in the U. S. have suggested the demand for higher quality is associated with higher incomes and other demographic characteristics (e.g., Kinsey, 1997). We know of no study in this part of Africa that has examined WTP for food quality, in this case for milk, among poor populations. This type of information is important for market development activities not only in the study area for milk, but more generally in Africa because local market development efforts in Africa will typically need to be targeted at relatively poor consumers.

Choice of Experimental Auctions as the Method to Elicit Valuation of Milk Characteristics
There continues to be a substantial discussion in the profession regarding the best method for eliciting values for new or improved (non-market) food products. Contingent valuation (stated preference) compared to revealed or observed preference methods are the two ends of the spectrum related to this discussion. Observed purchases (revealed preference) would be considered the preferred method for establishing WTP for products, but contingent valuation is still often used to elicit valuations for non-market goods and also public goods.

Experimental auctions provide a method for eliciting the value of new goods and services (in this case improved milk characteristics) that does not rely on the hypothetically rating of the survey participants as would be the case with contingent valuation methods. Lusk and Shogren (2007) argue that because contingent valuation methods inflict no consequences on those stating a valuation that "one response is a good as another from an economic standpoint because all responses have the same effect on a person's level of utility" (p.3). There is also evidence suggesting that persons' stated preferences are much higher than their actual WTP (List and Gallet (2001) and Kollmus and Agyeman (2002)). Experimental auctions place participants in an active market laboratory environment where market feedback is provided and choices result

[8] These are also referred to in the literature as information or search characteristics (i.e., Josling, Roberts, and Orden (2004); Hobbs (1997)).
[9] No direct test for a competitive market was undertaken by this study. However, casual observation and communications with market participants suggest that buyers do compete in these markets rather than behaving cooperatively.

in actual economic consequences (Lusk and Shogren (2007)). Although the results are achieved in an artificial environment, the fact that they are obtained in a market setting makes the bidding "incentive compatible." Because individuals submitting bids can be identified and individual information obtained using surveys following the experimental auction, it is possible to account for the heterogeneity in the valuations of participants in the auction (Lusk and Shogren (2007)). This provides significant advantages for identifying possible market niches for the product in question.

Obtaining observed market purchases with the same level of richness as experimental auctions would have been problematic in this study for a number of reasons. First, assuring the safety of participants was of paramount importance. Conducting a market test with non-processed milk in an open-air market presented unacceptable risks. Consequently, we choose to conduct an experimental auction in a controlled environment with participants who dealt in the open-air markets but with "safe" milk but which also had real quality differences in terms of its sensory characteristics. Second, obtaining the same level of data richness with individual information for purchasers would have been difficult if not impossible over a period of time given the difficult field circumstances associated with tracking purchases by individual buyers over time. Lastly, the costs of obtaining data on actual purchases would have been very costly given staff time and travel expenses. This led to the choice of experimental auctions as the method to elicit milk valuation in this study. [10]

Selection of Participants for the WTP Experiments

The experimental design for this study is motivated by Shogren et al. (1994) as modified, described, and applied by Dickinson and Bailey (2002 and 2005). However, the experiments in this study were carried out in the field under less than ideal conditions for recruitment and participation in the experiments. For example, developing a pool of participants meeting certain demographic characteristics (e.g., Dickinson and Bailey (2002 and 2005)) could not be done solely through a published recruiting announcement and self-selection process. Rather, this could only be accomplished through the help of key informants[11] in the markets. These informants were asked to help identify consumers by approximate income and also occupation. A mix of consumers with both low and high incomes was needed to test for the affect of income on WTP. Managers/owners of restaurants, hotels, and other eating establishments were also identified because their milk purchases were considered an important potential market for milk with average quality above that typically sold in the open air markets.[12]

[10] Critics of experimental auctions suggest that sample sizes are too small from which to draw general conclusions. While this criticism may have some validity no general conclusion about the efficacy of experimental auctions has yet been reached (see http://www.eaae.org/eaae/images/docs/seminars/creda%20workshop-auctions%20final.pdf). In the meantime, some caution should be exercised relative to drawing general market conclusions using results from experimental auctions.

[11] Including Moyale District Livestock Production Officer, Moyale County officials, and village leaders.

[12] The only secondary information available about the milk market in Moyale was a focus group study conducted earlier by the authors (Wayua et al. (2007)). The focus groups were designed to ascertain consumer attitudes about milk quality in the Moyale market. Some findings from this author publication are referred to here when they relate to the findings of this study.

Persons selected for the experimental auctions were responsible for milk purchases or making decisions on food purchase for his or her household or business. Participants were asked to participate in the study at two levels. First, participants were formed into focus group to determine their general perceptions of milk quality and marketing (Wayua et al. (2007)) (see Table 1 for a description of the steps used to select participants for the focus groups and then the experimental auctions). This included a discussion of methods the participants used to determine milk quality. Discussions during the focus groups centered on milk quality issues and did not broach the issue WTP so that bids in the auctions were not a function of consensus from the focus group discussions.

Table 1. Steps in Selection of Participants for Focus Groups and Experimental Auctions August 16-28, 2007, Moyale, Kenya

Step	Action and Result
Step 1	Identification of "key" informants in Moyale as contacts to help identify potential participants by income level and occupation. Informants were known to researchers and were familiar with Moyale.
Step 2	With informants help, villages (*ollas*) within Moyale were identified and assigned a general classification for income (low, medium, and high).
Step 3	Informants identified business owners who purchase milk (hotel and restaurant owners by establishment size and sampling stratified based on size.
Step 4	Income-stratified (see Step 2) random sampling of *ollas* performed using the Red Cross's Relief *Register* to select participants in the focus groups. Number of participants was determined by an attempt to have 6-8 participants in each focus group. For example, the target number of participants from a particular *olla* and there were 56 households in the *olla*, then every 6t household (56/9) was selected for the sample.
Step 5	Six moderated focus groups formed by inviting selected participants (two groups high income, two groups low income, and two groups business owners/managers).
Step 6	Participants in focus groups asked to identify members to participate in the experimental auctions.
Step 7	Three experimental auctions held (one group high income (10 participants), one group low income (11 participants), and one group of business owners (10 participants)).

Experimental Auction Participants by Category			
	Male	**Female**	**Total**
Low-income	4	7	11
High-income	0	10	10
Managers of hotel, restaurants, or Other eating establishment	10	0	10
Total	14	17	31

We focus on consumer WTP in this paper because 1) the results of the focus groups are reported elsewhere (i.e., Wayua et al.(2007)) and 2) the methods for determining milk quality and what consumers are willing to pay for milk quality are two connected but separate issues. Thus, this paper concentrates on WTP and the connection between demographics and WTP for milk quality as we have defined it.

The focus groups were selected as a stratified, random sample based on income. Of course, "low" and "high" incomes are relative because the Moyale district is among the poorest in Kenya with the poverty level exceeding 90%. A random sample of business owners/manager stratified by the size of business was also done to include businesses that purchased milk. [13] As a result, participants were selected from three separate groups: 1) managers/owners of retail outlets such as restaurants, hotels, and eating places, 2) households with high incomes that purchased milk from locations other than the open-air market, and 3) households with low incomes that purchase essentially exclusively from the open-air markets in Moyale (see Table 1). [14]

The focus groups consisted of 6-8 participants with two focus groups held per consumer category. Following Dickinson and Bailey (2002 and 2005), a target of 12 participants was desired for each experimental auction. Consequently, at the end of each focus group session the focus group participants were requested to select among themselves six persons to participate in the experimental auctions (so as to make 6*2=12). In doing this selection, the focus group participants discussed freely among themselves and gave a list of six people per focus group to the study organizers. The people on these lists were then invited by the organizers to participate in the experimental auctions on a separate day. Table 1 also reports gender and income-level information for the auction participants.

Conducting the Experimental Auctions

After arriving at the experiment site, participants were endowed with Ksh 50[15] and a glass (one liter) of milk (endowed milk), and told to await instructions. The auction instructions[16] were given orally to the subjects and all clarification questions answered prior to commencement of the experiment. The instructions were explained orally because of high illiteracy rates in the study area. The experiments were conducted by three members of the research staff of the Kenya Agricultural Research Institute (KARI)-Marsabit.

As indicated above, three experiments were conducted; one with business owners/managers, one with high-income consumers, and one with low-income consumers. The experiment consisted of several rounds of subjects bidding in a theoretically demand-revealing (second-price) auction format. When subjects placed bids, they bid on what they would be willing to pay to exchange their endowed milk for each of the four alternative milks that were auctioned during the experiment. Each subject in each group placed bids on the four different auction milks.

[13] Only 48 such business were identified by the key informants necessitating the requirement for a level of opportunity sampling for the business manager group.
[14] Additional detail about size of different *ollas* and assignment by income category is available in Wayua (2007).
[15] At the time of the research, i.e. August 2007, the exchange rate was Ksh. 70.4 per 1 USD.
[16] Instructions were the same as those used by Dickinson and Bailey (2002 and 2005) and are provided as an appendix to this paper for purposes of review.

Descriptions of the baseline (endowed) milk and the four other milks that were auctioned are found in Table 2.

Table 2. Auction milk descriptions provided to experiment participants

Milk Type	Description
Baseline milk	Fumigated* pasteurized fresh milk (processed at a local milk cooperative, i.e. Pastoralist Resource Marketing Cooperative – PARMCO**), adulterated by adding water (milk: water = 75:25)
Milk 1	Factory processed UHT, purchased from shops in Moyale
Milk 2	Cultured fermented milk, with no sugar (processed at PARMCO)**
Milk 3	Non-fumigated pasteurized fresh milk (obtained from a nearby village in Moyale Kenya and processed at PARMCO)
Milk 4	Fumigated pasteurized fresh milk (processed at PARMCO)**

*Traditionally, milk containers are fumigated with smoke of wood chips from a special tree species/shrubs to preserve milk. **Over 90% of milk processed at PARMCO is sourced from Ethiopia. All milk types were from cows.

Extreme care was taken to not expose participants to food safety risks. Consequently, the endowed milk was fumigated and pasteurized to ensure it was safe, but it was then adulterated with water to make it a proxy for lower quality milk (mixture of 75% milk and 25% water). This was considered the only "safe" procedure to determine the difference in WTP for the four alternative "high quality" milks compared to the baseline "low quality" milk. Consequently, this was a proxy for actual conditions in the open-air market and could be considered as generating a lower bound on WTP for milk quality compared to the actual milk sold in Moyale open-air markets. Participants were allowed to inspect the baseline milk and four alternatives through sensory perceptions (i.e., taste and smell). Consequently, most appeared able to perceive that the baseline milk had water added to it although this was not indicated to them by those administering the auction. The four alternative milks that were auctioned as an exchange for the baseline milk during the experiments represented different types of processed milk

After all the subjects' questions were answered, bids from each subject were taken first for Milk 1, then Milk 2, then Milk 3, and finally Milk 4 (this constituted one round of the auction). Ten total rounds were conducted with each group, with minimum changes in bids being Ksh 1. Participants were informed that they could bid a negative price to exchange the auctioned milk for their baseline milk if they wished (would need to be paid to exchange for the baseline milk). Market price information (i.e., the second highest bid for each milk auctioned) was announced after each round and prior to eliciting the next round's bid for that milk. Subjects were told prior to the commencement of the auction that a random draw at the end of the 10th round would be the binding round to determine which of the four auction milks would be sold to the "winner". They were also informed that a second random draw would determine which of the ten rounds

for the randomly-selected milk would be the binding round. [17] Consequently, only one of the auction milks was actually auctioned in each experiment (Dickinson and Bailey (2002 and 2005)). Subjects were fully aware prior to starting the first round that there was a uniform chance that any round for any auction milk might be the binding auction.

At the end of the experiment the "winner" of the auction was identified by random selection of both the binding round and milk that was actually sold. [18] All subjects were then required to consume their milk (either the baseline milk or the auctioned milk in the case of the one "winner") prior to leaving the experiment with their experiment cash. Communication was not allowed among participants during the auction process. Instead participants were requested to ask any questions they had directly to the facilitator. At the end of the auction all participants filled out a brief questionnaire reporting their demographic characteristics and other information that might affect their demand for milk quality.

Testing for the Influence of Demographic and other Characteristics on Bids

Demographic and other participant characteristics are expected to influence the results of experimental auctions (i.e., Casari, Ham, and Kagel (2007); Umberger and Feuz (2004); and Dickinson and Bailey (2002 and 2005)). A brief questionnaire was administered to participants at the end of each auction to obtain these characteristics. The questionnaires were administered orally to those who were unable to fill out the questionnaire by themselves for reasons of literacy.

A regression equation was used to estimate the influence of demographic and other characteristics on participants' WTP for milk quality. The specification of this equation was the following:

$$BID_{ij} = \alpha_0 + \sum_{j=1}^{3} \alpha_j MILK_{ij} + \alpha_4 AGE_i + \alpha_5 GENDER_i + \alpha_6 CHILDREN_i + \alpha_7 INCOME_i +$$
$$\alpha_8 NOTEDUC_i + \alpha_9 BUYER_i + \alpha_{10} NEWS_i + \alpha_{11} OPENMKT_i + \alpha_{12} ASSURE + \varepsilon_{ij},$$

where BID_{ij} was the average bid during the last five rounds by the i^{th} (i=1, . . . , 31) auction participant for the j^{th} milk (j=1,2,3,4). *MILK* represents intercept binary variables measuring differences in *BID* based on the milk being auctioned (Milk 4 was the omitted, base variable). *AGE* was the participant's age in years and *MALE* was a binary variable that took on the value of one if the participant was a male and zero if female. *CHILDREN* was the number of children in the household and *INCOME* was a binary variable with value one if participants fell into the highest income categories (10,000 KSH per month or more) for the sample and zero otherwise. *NOTEDUC* was a binary variable with value one if the person had no formal education and zero otherwise while *BUYER* was a binary variable assigned one if the person was the primary food purchaser for the household and zero otherwise. *NEWS* was the number of newspaper and other reports, such as radio reports, the person had read about food-borne illness during the previous

[17] The purpose for randomly selecting the binding round and milk to be sold was so that each bid was a potential "winner."

[18] One of the ten bidding rounds was randomly selected at the "binding" round and one of the four alternative milks was selected as the milk that was sold as a result of that binding round.

six months and *OPENMKT* was a binary variable with value one if the participant thought the baseline milk was similar to what they could buy in the open-air market or zero otherwise. *ASSURE* ascertains whether or not the participants would be willing to pay for added assurances about food safety and had a value of one if respondents indicated they would place a high value on these types of assurances and zero otherwise. [19] α_0 is the intercept,. $\alpha_1 - \alpha_{12}$ are parameter estimates and ε is random error term.

The economic reasons for selecting the variables for the regression were that one would expect different average bids if participants perceived a difference in milk quality between the four alternative milks ($MILK_i$). However, there is no a *prior* expectation for preferences for Milks 1, 2, and 3 compared to Milk 4 because all four have enhanced characteristics compared to the baseline milk. The important point relating to quality is that each of the alternative milks received average bids that exceeded zero (were preferred to the baseline milk). One might expect that women tend to be more concerned about food safety than men because they are often given primary responsibility for the health of household members. Consequently, the sign of the parameter estimate for *MALE* was expected to be negative. Because food-borne illness can pose greater risks for children than adults, the parameter estimate on *CHILDREN* is expected to be positive.

Economic theory (Kinsey, 1997) suggests that respondents with high incomes are expected to be willing and able to pay more for milk quality so the parameter estimate for *INCOME* is expected to be positive. *NOTEDUC* may play a role in the demand for milk quality if it results in participants having more knowledge about the risks of bacteria in milk that is unrefrigerated. Consequently, uneducated people may not be willing to pay as much for high quality milk as people with more education and the expected sign for the parameter on *NOTEDUC* is negative. Experienced food buyers would be expected to be more discerning about milk quality than others who do not have the primary responsibility for buying food for their household. This suggests that the parameter estimate on *BUYER* should be positive. Participants who have received relatively more information about food-borne illness than other participants in the recent past would be expected to be relatively more sensitive about milk quality than the less informed group. Consequently, the parameter estimate for *NEWS* was expected to have a positive sign. The sign for *OPENMKT* was an important part of the analysis because it indicates whether or not persons perceiving the baseline milk to be similar to what can be purchased from open-air markets would be willing to pay more for higher quality milk. One would expect that if participants perceived the baseline milk as roughly equivalent to what they could buy in the open-air markets that the parameter estimate for *OPENMKT* should be positive assuming that such milk would be considered lower quality, on the average, than the auctioned milks. One would expect a positive parameter estimate for *ASSURE* given that participants would be expected to be willing to pay more for added assurances and information about food safety. The White test was used to test for the presence of heteroskedasticity in the auction data (Greene, 2003). The test revealed that the null hypothesis of homoskedastic error terms for the model specified by equation (1) could not be rejected. Consequently, ordinary least squares (OLS) was used to estimate the parameters of equation (1). The parameters of equation (1) can reveal niches within the market in Moyale that are willing to pay for milk quality. This provides help to

[19] *ASSURE* essentially became a proxy for the value of additional information that could be provided to consumers about milk safety and other characteristics.

pastoralists as they are considering efforts to improve milk quality because it gives insights about which consumers are willing to reward those efforts with higher prices. The following section reports results of the experimental auctions, the parameter estimates for equation (1), and additional analysis regarding WTP for milk quality in the Moyale market are provided in the following section.

Experimental Results and Effects of Demographics and Other Characteristics on WTP

Table 3 (see Appendix 1) reports the responses to the survey of participants and provides basic demographic and other information about the participants. There were a total of 31 participants in the experimental auctions. There were a few more females than males (17 females and 14 males) and almost all were married. The respondents reported having an average of almost four children and an average age of about 37. Over 25% of participants had no formal education *(NOTEDUC)* and 58% indicated that they were unemployed *(EMPLOYED).* A high percentage of participants (67.7%) had income under 5000 Ksh. per month. Less than 50% of the respondents indicated that they had at least some confidence in the government's current food inspection system *(GOVTRUST).* A large percentage of participants indicated that they wanted more information and assurances about the food they consume *(ASSURE, TRACE,* and *PROCED).* In summary, the participants tended to be fairly young, poor people with limited education who have little confidence in their government's food safety inspection system and who would like more information and assurances about the food they buy.

Figure 1 presents the summary data from the experiments (see also Table 1). Figure 1 shows the average percentage bids of the experiments by round. The percentage bids were calculated as the actual bid made by the auction participant divided by the value of the baseline milk as estimated

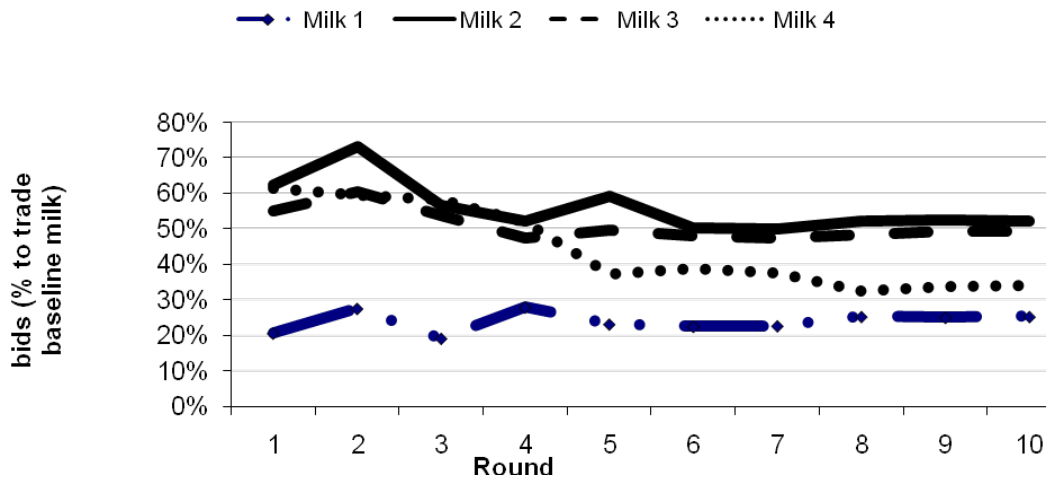

Figure 1. Average percentage bids to replace baseline milk with four alternative milks, Moyale, Kenya.

by the participant. Average percentage bids were the average bids for each round over the 31 participants in the experimental auctions. The patterns of the average bids are very consistent with past studies such as Dickinson and Bailey (2002 and 2005) where average early-round bids

tend to be relatively high compared with later-round bids which tended to converge to a stable value, especially during the last five rounds of bidding. The average percentage bids reported in Figure 1 provide evidence for WTP for quality in milk (i.e., WTP to exchange each of the auctioned milks for the baseline milk). However, additional information about the distribution of bids provides additional detail about the array of bidder opinions. That is, although the average percentage bid is positive for all auction participants, the range and frequency of bids helps one understand how uniform opinions were among the bidders.

Table 4 displays the empirical frequencies of bids for WTP to exchange the baseline milk. This helps to interpret and compare results because the distributions are not normally distributed thus making standard statistical tests not valid for comparing the distributions. The average percentage bid during the last five rounds of bidding for each individual is used to build the bid frequencies reported in Table 4. Using the average bid for the last five round accounts for learning by auction participants and provides a more stable measure of WTP than if all 10 rounds were used in the calculation. An obvious outlier existed for one of the bidders for Milk 4 (see Table 4 extreme positive bid for Milk 4). The outlier was excluded when the regression analysis was performed.

Table 4. Bid Frequencies for Participants in Experimental Auctions, Moyale, Kenya.

Uneven Ranges for Average Bids	**Frequencies**			
During Final Five Rounds	Milk 1	Milk 2	Milk 3	Milk 4
-100% or less	1	0	0	0
-99% - 1%	4	1	1	0
0%	1	2	0	2
1% - 25%	12	10	15	13
26% - 50%	7	7	5	13
51% - 100%	6	5	6	2
101% - 150%	0	6	4	0
151% - 200%	0	0	0	0
200% +	0	0	0	1

The bid frequencies demonstrate relatively large variations in bids but the distributions are skewed to the right. For example, few participants (four bidding on Milk 1 and one bidding on Milk 3) placed negative percentage bids, but the vast majority of bids (95.9% of them) were positive thus indicating WTP for exchanging the baseline, adulterated milk. The variation in bidding raises questions about why opinions among the bidders varied as much as they did. The

regression analysis helps to provide additional insights explaining some of the variation in the data.

The OLS parameter estimates for equation (1) are reported in Table 5. A number of useful results appear in Table 5. For example, Milk 2 and Milk 3 received statistically higher bids than Milk 4 suggesting that processed milk from PARMCO is perceived as being higher quality than UHT milk. This may make sense when one considers that UHT milk can sometimes have a slightly off flavor as a result of its processing at high temperatures. Consequently, this result may be revealing a preference for processed milk that has a flavor similar to fresh milk. The results provide strong statistical evidence that older, female participants in the experimental auctions were willing to pay more for milk quality than other participants *(MALE and AGE).*

Table 5. Estimated Parameters for Model Examining the Impact of Demographic and Other Characteristics on WTP for Milk Quality in Moyale, Kenya.

Independent Variable	Parameter Estimate	Independent Variable	Parameter Estimate
Intercept	-0.064	*NOTEDUC*	-0.143
	(0.177)		(0.091)
MILK 1	-0.024	*BUYER*	-0.001
	(0.083)		(0.112)
MILK 2	0.249**	*INCOME*	-0.070
	(0.083)		(0.114)
MILK 3	0.219**	*NEWS*	0.132**
	(0.083)		(0.044)
MALE	-0.535**	*OPENMKT*	0.125
	(0.086)		(0.073)*
AGE	0.008*	*ASSURE*	0.196**
	(0.004)		(0.098)
CHILDREN	0.006	Adjusted R^2	0.363
	(0.020)	N=123	

[a] Standard errors are in parentheses.
* Denotes statistically different than zero at the 10% level of confidence.
** Denotes statistically different than zero at the 5% level of confidence.

There was also weak statistical evidence[20] that participants with no formal education were not willing to pay as much for milk quality as were participants with some formal education *(NOTEDUC).* This result suggests that literacy may be important in becoming informed about milk quality and is supported by the positive and statistically significant parameter estimate for *NEWS. INCOME* had an unexpected negative, though statistically insignificant sign as did *CHILDREN and BUYER.* Statistical evidence was exhibited suggesting that persons that thought the baseline milk was similar to what could be bought at the open-air markets

[20] *NOTEDUC* parameter estimate's p-value was 0.118.

(OPENMKT) were willing to pay more to exchange their baseline milk than those participants who thought the baseline milk was not similar to milk that could be purchased in the open-air markets. This would imply that participants in the open-air markets would respond positively to higher quality milk by paying higher prices for it than the milk that is currently sold there.

Even though participants were poor, they indicated they have strong WTP for additional assurances about food safety (ASSURE). Food safety has been shown consistently to be an important characteristic related to WTP in other similar studies (e.g., Dickinson and Bailey (2002, and 2005)). It is especially important here because poor participants indicate they are willing to pay more than a 19% premium for assurances about milk safety.

While this experiment was a proxy for actual conditions in the market[21] the results imply that WTP exists in this market for milk that can demonstrate quality characteristics. [22] There appears to be a clear preference for processed milk that has not been heated to ultra-high temperatures, but there are demographic characteristics of milk buyers that may also provide opportunities for selling unprocessed milk. For example, different types of certification schemes might be devised by pastoralists to ensure that milk has not been adulterated and this milk could have a target market of older females who have had some formal education. The affect of age appears to be linear because a test of age squared did not yield a significant parameter estimate. One illustration of WTP suggested by these results that should be considered with caution is that, on the average, a 40 year-old woman would be expected to be willing to pay about 20% more for quality milk than a 20 year-old woman ceteris paribus (0.010 * 20 years difference in age). The results support the notion that consumers in Moyale, Kenya would be willing to pay more for milk if they perceive it to be of higher quality than milk typically sold in the open-air market. This essentially indicates that pastoralists should be considering methods for providing higher quality milk to buyers in Moyale and that they can expect that buyers will be willing to pay more for milk if they are confident of the milk's quality.

Conclusions and Recommendations

Conditions for this study were much more difficult than for similar studies held in the United States and elsewhere (e.g., Dickinson and Bailey (2002 and 2005)) because of more difficulty in recruitment and issues of illiteracy in a significant number of the auction participants. However, with a few modifications, such as using key market informants in recruiting; reading the instructions to participants; and helping those who were unable to read and write to fill out the questionnaire, this study was able to demonstrate that experimental auctions can be conducted successfully in this part of Africa to determine WTP for food characteristics. The results suggest that incentives exist in the market to improve milk quality because relatively large portions of the market (e.g., older, informed females) are willing to pay for improved milk quality. The results also indicate that participants in this market are anxious to receive more information and assurances about the milk they consume. This may provide opportunities to pastoralists to

[21] Food safety issues would not allow for using milk actually purchased in the open-air market to be used in the experimental auctions.

[22] This seems to be an obvious, yet powerful, result because it indicates that economic incentives exist for marketing milk that is higher quality than that marketed in the open-air markets of Moyale and other cities and towns in northern Kenya.

devise methods for providing and certifying these types of assurances. Doing so may increase pastoralist incomes from milk sales while likely improving the overall quality of milk being sold in the Moyale market.

Many parts of Africa have market conditions similar to those in Moyale. The results suggest that economic incentives exist for improving the quality of milk sold in these markets. Some of this improvement may be marginal and slow because infrastructure issues create time and distance barriers to providing high quality fresh milk. However, even small improvements could potentially add value to the milk being sold in open-air markets. Pastoralists could also consider moving to town and perhaps purchasing feed for cows so that fresh milk could be provided in a timely manner to consumers. Participants in these markets appear hungry for more information about the milk they are buying. Pastoralists could provide this information and assurances as economic incentives appear to be present to do so.

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Appendix 1.

Table 3. Survey questions, frequencies, and mean responses to Moyale, Kenya survey

Question	Responses=Code	Frequencies[a]	Mean	Variable and Value
Are you Male or Female?	Male: 1 Female: 0	14 17		*MALE*=1 if male, 0 otherwise
What is your age?			36.87	*AGE* continuous
What is your marital status?	Married: 1 Divorced: 2 Widowed: 4	28 2 1		*MARRIED*=1 if married, 0 otherwise
How many children do you have?			3.97	*CHILDREN* continuous
What is the highest level of education you have completed?	Primary School: High School: Not Educated:	16 7 8		*NOTEDUC*=1 if Not Educated, 0 otherwise
Who typically makes most decisions about food purchases in your household?	You? Someone else?	28 3		*BUYER*=1 if "you", 0 otherwise
What is your current employment status?	Unemployed Employed Herding	18 12 1	671.41	*EMPLOYED*=1 if employed, 0 otherwise
Are you a student?	Yes No	0 31		*STUDENT*=1 if a student, 0 otherwise
What is your best estimate of your monthly *household* income?	<Ksh 5000 Ksh 5000-Ksh 10000 Ksh 10000-Ksh 15000 Ksh 15000-Ksh 20000 >Ksh 20000	21 6 4 0 0		*INCOME*=1 if monthly income exceeded 10000 Ksh, 0 otherwise
Have you or your family had food poisoning?	Yes: 1 No: 0	14 17		*POISON*=1 if yes, 0 otherwise
Have recent reports about food borne diseases (e.g., Milk adulteration) affected your milk purchases?	Great Affect: 1 2 Some Affect:3 4 No Affect:5	3 5 12 2 9		*REPORTS*=1 if <3, 0 otherwise
What is your best estimate of the number of news articles or reports that you have read or heard about on food-borne diseases in the last 6 months?			0.45	*NEWS* continuous

Table 3. *Continued*

Question	Responses=Code	Frequencies[a]	Mean	Variable and Value
How much confidence do you place in your government's current food inspection and safety program?	Complete confidence: 1 2 Some confidence: 3 4 No confidence: 5	3 3 8 5 12		*GOVTRUST*=1 if <3, 0 otherwise
Would you value having additional assurances, beyond what is currently provided by your government, about milk safety?	Highly value:1 2 Some value:3 4 No value: 5	26 0 3 0 2		*ASSURE*=1 if <3, 0 otherwise
Would you value knowing the exact manyatta that produced the animals for the milk you consume?	Highly value:1 2 Some value:3 4 No value: 5	19 0 4 5 3		*TRACE*=1 if <3, 0 otherwise
Would you value knowing the procedures and processes used by the farmer to produce the animal for the milk you consume?	Highly value:1 2 Some value:3 4 No value: 5	17 1 6 1 6		*PROCED*-1 if <3, 0 otherwise
If you value the information from question 17, why?	More confidence about safety/ quality of the milk you purchase: a You want to be able to identify the source of the problem, should one arise: b Both Other	18 4 4 5		
What would you normally pay for a milk similar to the one you were given at the start of the experiment?			15.65	
Where would you buy such milk from?	Open market Shop Regular customer brings to hotel	19 5 7		OPENMKT=1 if open market, 0 otherwise

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Linking Small Scale Farmers in China with the International Markets: A Case of Apple Export Chains

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Abstract

This study describes how governance mechanisms were formed that link small-scale apple farmers in China with export markets. These institutional innovations have improved the efficiency of price transmission and generated higher profit margins for various actors in the supply chain, in particular for small-scale farmers. Chinese apple exports are highly coordinated through ongoing long term loyal network relationships and vertical integration. Relevant policy implications and further challenges are discussed in the conclusion.

Keywords: supply chain, price transmission, institutions, market integration.

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Introduction

In just two decades, China has made a remarkable leap from being a small apple producer to becoming the world's largest apple producer and exporter. In the early 1980s, China produced under three million tons of apples per year. By 2007, more than 42 percent of all apples produced in the world originated in China (FAO, 2008). Due to its rapid expansion of apple orchards in the late 1980s, notably in Shandong and Shaanxi provinces, China is now the leading player with a 13.5 percent share of the global apple exports by volume; ahead of other apple exporters such as Italy (10.4 percent), Chile (10.3 percent), France (9.2 percent) and the US (8.8 percent)(UN COMTRADE, 2007). But the value of China's exports ranked fourth behind Italy, France and the US, since China's apples sell at lower prices in international markets.

China has been able to connect millions of small-scale apple producers at one end with modern sophisticated western consumers at the other. Policy makers and agribusiness managers in economies where there are many small-scale agricultural producers might benefit from China's experiences. They show that small scale farmers can be integrated into a modern supply chain. This helps address the ongoing debate about whether small scale farmers can ever be and how they might be part of a modern supply chain. Prior research by Elizabeth, et al. (2000) and Dolan and Humphrey (2001) suggested that small farmers tended to be excluded from the modern marking chains. Other studies showed that the emergence of modern supply chains produced increased interaction between buyers and small farmers in developing countries (Dries, et al, 2004; Maertens and Swinnen, 2006; Huang et al, 2008). To mitigate the possible negative impacts of modern market development on small farmers, several recent studies showed that farmer cooperatives, that government interventions restraining purchasing powers, and that increased farm contact were all ways of improving small farmers' market involvement and bargaining powers (Gibbon, 2003; Gulati et al., 2006; Devesh and Thorat., 2008). For instance, Roy and Thorat (2008) showed using a unique success story, that of the Mahagrapes, how farmer cooperative partnerships could successfully combine collective action and public private / partnerships. They found that smallholder Mahagrapes farmers included in the process were able to consistently meet market standards and benefitted from significantly higher incomes. This implies that the model may be scaled up.

The paper focuses on the development of the apple export chain in Shandong province in general and on the vicinity of Qixia city in particular. The Shandong region accounted for half of China's total fresh apple exports and the area around Qixia provided most of the apples exported from the Shandong region.

The paper is organized as follows. Section 2 introduces the methodology and data used. Section 3 positions the apple industry in the broader context of a changing institutional environment in China. This is followed by section 4 in which a set of issues relevant to the apple industry are presented. In section 5 the apple export chains and their related institutional arrangements are mapped out. Section 6 follows with a description of the mechanism for governing the chain. The paper concludes with a set of policy implications and a description of the challenges ahead.

Methodology

Two qualitative research techniques were applied in this study: focus group discussions, and individual in-depth interviews. In the focus group discussions groups, five to 12 selected individuals discussed a range of topics with the conversation moderated by a facilitator. The individual in-depth interviews were 'an unstructured personal interview[s] which use[d] extensive probing to get a single respondent to talk freely and to express detailed beliefs and feeling on a topic' (Webb, 1995). Advantages and disadvantages of group versus individual interviews have been discussed extensively (Crabtree and Miller, 1993; Stokes and Bergin, 2006). While focus groups are more applicable to wide-ranging exploratory research, individual interviews allow probing the respondent for underlying motivations and feelings (Malhotra, 1999; Hennink, 2007). Thus using both techniques helps achieve a broad overview and detailed understanding of the issues discussed (Stokes and Bergin, 2006; Gellynck and Kűhne, 2008).

The combination of two research methods in this research let us gain substantive insights into the pattern of the apple chain from the perspective of the participants themselves. The focus group discussions were applied to apple growers while in-depth interviews were applied to other actors at different stages of the apple chain. Table 1 provides the profiles of the two research techniques used for this study.

Table 1. Description of participants in focus group discussions and in-depth interviews along the apple chain

Methods	Regions	Numbers of respondents	Chain actors
Focus group 1	Qixia, Shandong	8	Producers
Focus group 2	Qixia, Shandong	6	Producers
Focus group 3	Rongcheng, Shandong	12	Producers
In-depth interview	Netherlands	2	Importers
In-depth interview	Netherlands	1	packing equipment supplier
In-depth interview	Qixia, Rongcheng and Shandong	4	Exporters
In-depth interview	Qixia, Shandong	2	Collectors
In-depth interview	Qixia, Shandong	1	e-auctioneer
In-depth interview	Qixia, Shandong	2	Producers
In-depth interview	Qixia, Shandong	3	policy makers

The guidelines for focus group discussions and in-depth interviews were developed based on literature reviews of global commodity chains and the authors' extensive field experience in

China. The central topic for producers' group discussions was understanding how producers were linked with export chains. These discussions also sought clarification on the reasons producers participated in certain ways, what the external influencing factors were in making their choices, and what the consequences were for the producers' choices. The focus group interviews were carried out in July, 2008. All sessions were audio-taped and the researchers recorded notes. After each session, the data were verified among the research team and transcribed.

The in-depth interviews for other chain actors covered sector characteristics, changes and development along the chain, chain governance, etc. The questions asked were formulated based on reviews of global commodity chains and the authors' extensive field experience in China. They were then fine tuned based on consultations with several horticultural chain experts in China and in the Netherlands. The questions were then translated into Chinese. The interviews in the Netherlands were conducted in February and March, 2008. The data collection in China was carried out during July 2008.

The Enabling Environment

The Chinese economic reform started with an institutional change called the 'Household Responsibility System (HRS).' This started in the early 1980s. It tore down the commune based production system and restored individual household units as the primary production framework (Lin, J, Y., 1987 and 1988). The first impact of this reform was felt by the apple industry of Shandong in 1984. That year, collective apple orchards were distributed to individual households and each became responsible for its own apple production. In the same year, the marketing of apples was also liberalized. The government no longer imposed price control, and private traders were allowed to enter or leave the apple market without restriction or outside control. At the time apples were a luxury product in China with high prices and limited supply. Consequently farmers planted additional apple trees during that period. Qixia, the most famous apple growing region in China, doubled the size of apple orchards in 1984. This expansion was encouraged by the Chinese Ministry of Agriculture (MoA) which defined Qixia as one of the Quality Apple Production Bases, and provided 2 million yuan in subsidies for the purchase of young apple trees and additional incentives.

China's entry into the World Trade Organization (WTO) in 2001 was another significant event for the apple industry. By this time the apple trees planted in the middle of 1980s and early 1990s were in full production. Chinese apple markets were no longer in short supply and new markets were required to keep the price of apples up. The potential for increased trade provided an incentive opportunity for seeking out these markets.

Another change in 2001 that had a major impact on the apple industry was the introduction of the pollution-free Food Action Plan by the Chinese government. This was instituted to address the demand for safe food and quality that were increasingly required by both domestic and international markets. The main objective of this plan was to establish a sound food quality and safety standard system in China within ten years. To promote the apple quality, and particularly to reduce the pollution due to pesticide use, apple production in Qixia was now required to shift towards producing safe food by adopting pest lighting, by promoting the use of organic fertilizers, and by minimizing the use of chemical pesticides. Under the plan, the Ministry of

Agriculture (MOA) certified most apple production regions in Shandong as 'Pollution-free Apple Demonstration Base' . Qixia's achievement in environmental protection was recognized in 2002 when the National Bureau of Environmental Protection classified Qixia as a National Ecological Demonstration Zone . As an Ecological Demonstration Zone, apple farmers in this area were required to reduce substantially their use of chemical fertilizer and pesticides, and to increase the use of organic fertilizer and biological methods to control disease and insects. Apple farmers now had an incentive to join this action because they were able to obtain higher apple prices by labeling their apples as being produced within the "National Ecological Demonstration Zone." In 2005 the first export company in Qixia achieved EurepGAP certification, enabling it to export to the EU. Since then, more companies were certified, in part because of encouragement from 2006 onwards by the provincial department of Finance in Shandong which provided subsidies equal to 40 percent of the cost of EurepGAP --the total cost of certification was 20,000 yuan of the 50,000 yuan. Some county governments provided additional subsides to companies. By 2008 most export-oriented companies in Qixia had obtained EurepGAP certificates.

Farm Structure

Qixia, the leading apple export region in Shandong, China, will be used as a case to illustrate how small in their production scale the Chinese apple farmers are in this section and how innovative Qixia farmers are in the next section.

Apples have been produced in Qixia for more than a century. It produces top quality apples on its hilly and mountainous landscape complemented by its suitable soil and weather conditions. Prior to the market liberalization in 1983, Qixia had 7,360 hectares of orchards producing 99,200 tons of apples. By 2007, Qixia's apple orchards covered 43,300 hectares and produced 8 million tons of apples.

According to our interviews with the local government and farmers, most apple orchards of individual household in Qixia ranged in size from 0.15 to 0.65 hectares. The large scale farmers with plots larger than 0.65 hectares accounted for 20 percent of the total production. These farmers had increased their production by renting additional hilly land from their village committees, or sub-renting land from other farmers. The middle-scale farmers had with plots averaging 0.4 hectares and accounted for 60 percent of the total production. The small-scale farmers with plots of 0.15-0.2 hectares produce the remaining 20 percent. Even the so-called large orchards in China were less than one hectare, which was very small in scale in comparison with orchards in other apple producing regions around the world.

Apple cultivation was more profitable than wheat and maize production in Shandong. For example, in 2006, the net profit for producing wheat, maize and apples per hectare of land in Shandong was 2010 yuan, 2460 yuan, and 23670 yuan, respectively (NDRC, 2007). Hence, apple farmers invested heavily in apple production, including investments in transportation machinery (tractors) and irrigation and spraying equipment. They also endeavored to improve the soil quality by applying more organic matter such as soya cakes , believing that good soil improved both the taste of and the productivity of the apple trees. The government's recent program, 'to adapt fertilizer application to soil conditions' also encouraged soil improvement efforts.

Technology Innovation

Technology innovation played an important role in the development of apply industry in Shandong. This can be seen by noting that Qixia farmers were innovative in the adoption new apple varieties. In 1984, there were more than 60 apple varieties in Qixia, of which the most popular were Xiao Guo Guang (46 percent) and Green Banana (11.3 percent). Since then, the Fuji apples from Japan were introduced along with other shorter branch varieties. in the 1990's R&D researchers in Yantai (the region to which Qixia belongs) successfully introduced a series of Fuji-based varieties, such as Fuji2001, YanFu No. 1 and No. 3. These varieties were produced by cross-breeding Japanese Fuji with local varieties. By the end of 2007, the leading variety was Fuji series (80 percent), followed by Gala (11 percent) and New Red Star (6 percent).

Cultivation innovation is another success factor for Qixia's apple industry. In 1990, a special pruning technique aimed at stimulating flowering was adopted. This was later adapted in the rest of China. In 1993, experiments with the bagging of apples started. The paper bags greatly improved the quality, color, and surface shine of the apples, and reduced pesticide pollution content in the fruit. This labor intensive technology was formally adopted in 1996 in Qixia and has since reached an acceptance rate of 95 percent in Qixia.

In addition, improvement in storage facilities contributed substantially to providing high quality apples year-round. In 1984, there were only three cold storage facilities with total capacity of less than 10,000 tons. By 2006, there were more that 200 cold storage facilities with a total capacity of 360,000 tons. Some of these facilities used highly advanced atmosphere control systems.

International and Domestic Market

The main international markets for Chinese apples were South East Asia (Indonesia, Philippine, Singapore, Thailand) and the EU (Spain, France, NL and UK), where the EurepGAP certificate was required (recently renamed as GlobalGAP). In the UK the quality requirement (hardness and sugar contents) was higher than on the European continent. Chinese apples did not have access to the Japanese and the US markets due to phytosanitary restrictions. Chinese exporters indicated that the strictest apple export market in terms of phytosanitary requirements was Canada.

Chinese apple markets were influencing international apple market prices because it was such a large producer. Fewer apples entered international trade when supply was closer to domestic demand and more apples entered foreign markets when supply was larger than domestic demand. Consequently, international traders watched the Chinese markets closely.

Typically Chinese apples were cheaper than those of other countries. However, this was not the case in the harvest year 2007-2008 for several reasons: the appreciation of the Chinese yuan against the US dollar by 15 percent within a year, an increase apple procurement price at farm gate by 20-30 percent, plus a ten percent increase in packing material costs (such as paper and plastics). These led to Chinese apple prices almost equaling US prices in the South East Asian markets in 2007. Some Chinese exporters retreated from the EU markets as they lost price competitiveness. Meanwhile, they found that India was becoming a promising market for top

quality Chinese Fuji apples and consumers there were willing to pay premium prices for high quality apples.

Export-oriented traders started selling apples in the Chinese domestic market in 2007 after retreating from international markets. To their surprise, they discovered that domestic markets were quite profitable, particularly for quality apples. It seems that the domestic prices are more responsive to the product's quality than the EU markets. The main destinations in domestic markets are supermarket chains and wholesale markets in Guangdong, Fujian, Shanghai and Beijing.

Domestic markets for apples function similarly to other horticultural commodity markets in China. In the 1980s and 1990s, many small-scale vendors collected apples in villages. More recently, the collectors increased their scale and used larger transport trucks. Farmers started to choose collectors with good reputation, in particular those who paid on time. Most farmers were still engaged in spot markets.

Non-Tariff Measurements

The EU applied an eight percent tariff from August through May and no tariff from April through July. The EU also had numerous other requirements. All exporters had to register their companies and their production bases (the location of the apple orchard is one example). In addition there were specific package requirements. All wooden pallets had to be steamed for more than 45 minutes at a temperature higher than 60 degrees Celsius. Thus the local China Entry-Exit Inspection and Quarantine Services (CIQ) required all facilities packaging apples for export be registered and had have video cameras installed so that the local CIQ could monitor and check the steam process via the internet. And paper boxes had to be glued; not stapled. Apples that varied more that 10 percent from the apple shape were rejected.

Some Chinese exporters described customs problems entering markets in North and South America. One incident occurred in 2006 when Mexican customs did not allow three containers from Shandong to pass through because of alleged quality controls deviations. Shipping these apples back to China was economically unviable, so they were destroyed near the harbor. The Chinese exporter claimed to have received only a vague explanation about the quality problem.

In 2008 Chinese apples could not enter the US or Japan. China had been negotiating the entry of fresh apples into the US since 1998. The Animal and Plant Health Inspection Service of the US Department of Agriculture had sent a list of over 300 concerns to the quarantine inspection agency of the Chinese government in 2003 and the Chinese government responded the next year. In 2008, the negotiations were still taking place.

Price Formulation and Transmission

Price Formulation

In normal production years, the early harvest which began in October saw a peak price peak of around 6 RMB per kg. This was due to apple traders and storage owners purchasing the best

apples. The prices dropped to around 5.4 RMB per kg during the following few months until the second peak around the Chinese new year (end of January or beginning of February) when the price level increased to about 6.4 RMB per kg (apple demand increases substantially at this period). In the spring, the prices would fall slightly and then peak again in June/July at the level of 7 RMB per kg. The last price peak occurs when the apples stored in cold storages begin to diminish in supply (for physical reasons, apple in those facilities can not be stored any longer), and thus apples stored at high cost in air controlled system enter the market. Apple prices in China fluctuated considerably in recent years, however. Every farmer and trader in China remembered the "dark" year of 2005 when the procurement prices at farm gate reached its lowest point –1.20 RMB (US$ 0.15) per kg, as opposed to a good year like 2007 when the prices reached 5.6 RMB (US$ 0.74) per kg.

The cost composition of the prices at different stages of the apple chains are as follow. Table 2 shows the price and costs of apples at the farm level. Table 3 shows the price and costs of apples at collectors' level. And Table 4 and 5 shows the price and costs of apples at exporters' level.

Table 2. Apple prices and costs at the farmers' level in RMB per hectare in 2007

Items	Costs and Values *	Note
a. Fertilizer:	12,000 RMB	
b. Pesticides	9,000 RMB	
c. Bags:	15,000 RMB	
d. Irrigation:	3,000 RMB	
e. Labor cost:	42,000 RMB	of which 15,000 for hired labor
f. Total cost (a + b + c + d + e)	81,000 RMB	
g. Harvest:	3,000 kg, average 2.6 RMB per kg	
h. Total revenue: (g * 2.6)	117,000 RMB	
i. Profit per hectare (h – f)	36,000 RMB	

* I Euro equaled around 10 RMB in 2007.
Source: field interviews, July 2008.

Table 3. Apple prices and costs at the collectors' level in RMB per kilogram in 2007

Items	Costs and Values	Notes
a. Procurement price at farm gate	4.00 RMB	grade 2 and grade3 mixed
b. Costs of web netting, grading and uploading	0.40 RMB	if using paper carton, adding another 0.30 RMB
c. Costs of transportation to storage facilities	0.06 RMB	within 50 km
d. Storage cost	0.40 RMB	Until end of may next year
e. Total added costs (a +b + c + d)	4.86 RMB	
f. Sale Prices	5.4 RMB	
g. Profit margin (f – e)	0.54 RMB	

Source: Field interviews, July 2008.

Table 4. Apple costs at the exporter' level in percent in 2007

Items	Percentage
Apple procurement	75 %
Labor	4 %
Customs/inland transportation	3 %
Pack material	10 %
Overhead	8 %
Total	100 %

Source: Field Interviews, July 2008.

Table 5. Apple price formulation along the supply chain: Grade 2 Fuji apples from China to EU in 2007 (unit: kg)

Stages of the Chain	Added Value (RMB)	Market Functions	Price Formulation	Price Accumulation %
Farm	4	Production	4	20
Local collection	0,42	Sorting, grading, web netting, transportation	4,42	4
Storage	0,80	Cold storage, out sorting, loss	5,22	5,2
Export, leaving from Qingdao harbor	1,03	Inland transport, inspection, customs fee	6,25 (FOB price)	2
Arriving at Rotterdam harbor	0,45	Sea fare, insurance	6,7 (CIF price)	8,9
Import	1,77	Customs cleaning, tariff	9,47	4,9
Wholesale	0,98	Storage cost, profit margin	10,45 (wholesale price in EU)	47,75
Retailing	9,55	Transport, loss, profit margin	20	Total: 100

Source: Field interviews, July 2008.

The precise values for these items vary considerably across the growing seasons and regions. However, the data in the tables indicate the value distribution along the chain in addition to input-output analysis at the firm level. While China's apple market chain is very competitive, farmers have received much larger price margins (20 percent over what consumers pay at the supermarkets) compared with small farmers in other countries. For example, Doland, et al, (1999 and 2001) presented a detailed cost structure for African FFV export to the UK. Their results indicated that producer costs only account for 12 percent and 14 percent of the final prices for

Zimbabwe and Kenya, respectively. In keeping with their study, this research also found that the greatest margins in the final stages of the chain, or supermarkets.

Price Transmission

Compared to prices in five years ago, apple prices were transmitted incredibly quickly in Shandong. According to interviews, during the 2007 harvest season, Shandong farmers followed price changes at wholesale markets within their cities instantly using mobile phone and telephone. Price change information in the markets outside of their province, such as in Guangdong's wholesale markets nearly two thousand kilometers away from Qixia, were transmitted to apple farmers in Qixia within two days. Based on this price information and their own storage capacities, traders adjusted their procurement prices and quality requirements and informed local collectors of their prices (lower or higher) a day earlier. Local collectors also formulated their own judgments on price changes based on the degree of urgency from traders' buying orders.

Traders indicated that international price changes were transmitted immediately between China and international markets since most Chinese exporters had daily contact with their foreign importers. Even small traders in China knew of price changes in the international market within one week. This meant that Chinese exports were subject to volatility as exporters altered prices in order to stay competitive.

One's understanding of the volatility in prices is conditioned by one's exposure to the markets. Most apple farmers usually sell apples to traders/collectors within 40 days of harvest because they do not have storage facilities. This means they have a limited period in which they can respond to price signals. Only a small proportion of farmers rent storage facilities and so can market their apples throughout the year. In most cases, traders bear the market risks after the harvest season is over.

Their different perspectives meant that they had different understanding of events and hence what prices would be. In the 2006-2007 production year there was bad weather (frost) in some apple production regions in China, and traders were speculating that Chinese apple production would decrease in 2007. Hence, during the harvest season, traders and collectors were in competition to procure and store as many apples as possible. The prices traders paid farmers in 2007 were very high and farmers made large profits. Consequently in 2008 farmers expected good prices so attempted to improve both apple quality and quantity. However, traders had a different story. Their profits in 2008 were smaller because of the high prices they paid for apples in 2007 and the appreciation of RMB. Consequently they were looking at paying less for apples.

All farmers at the focus group discussions agreed that prices were not transmitted to them systematically. When the apple prices at the urban markets were higher, their farmgate prices were higher, but to a lesser extent. When the urban prices were lower, farmgate prices were much lower than the changes in the urban market. Farmers based this view of price on 40 days of price fluctuation following the harvest. After that period it was the traders who experienced the market price volatility. So, it was the exporters rather than the farmers who bore most of the price risks on the apple markets.

Consumer Preferences

Fuji apples had a sweet taste, but more importantly their charming red color was highly valued, particularly in Asian countries. In 2007 the Chinese consumed 80 percent of Grade 1 Fuji apples while most exported apples were grade 2 and grade 3. Although premium apples were more expensive, the increasing middle class in provinces such as Guangdong and Fujian were willing to pay for these apples.

Generally speaking, in northern China, consumers prefer big apples while in the southern part of China they like smaller apples, and Shanghai consumers often choose middle sized ones.

India is becoming one of the most important markets for Chinese apples as Indian consumers willing paid for top quality, heavy red Fuji apples even though the Indian tariff on imports was raised from 40 percent to 80 percent in 2006.

In the EU markets, Spanish and French consumers also relished Fuji apples. Chinese traders reported, however, that EU consumers chose grade 2 apples since they have the same taste as grade 1 though they were less appealing color-wise.

Mapping Supply Chains and Institutions

Mapping Supply Chains

Here again, we use Qixia as a case to illustrate the apple trade flow in Shandong. Qixia had 43,000 hectares of apple orchards in 2007 and produced 8 million tons of fresh apples (SBSP, 2008). Around 10 percent was exported to Southeast Asia, the EU and Russia, while the rest was earmarked for domestic consumption. The top quality apples went to big provincial cities, such as Guangzhou and Xiamen, while apples of lower quality went to cities in the counties. The Qixia apple flow chart and the percentages of the products marketed through different channels are shown in Fig. 1. It shows that the greatest tonnage of the apples (60 percent) is produced from the medium scale farms. A very small part of Qixia ‘s tonnage went to the processing industry. Although Qixia is the main apple exporting region in China, the largest portion of the tonnage of (90 percent) supplied the domestic markets.

There are various apple supply chains in Shandong. A supply chain picture of one Export Company actively involved in the EU market is illustrated in Fig. 2. The apple production in this chain was mainly carried out by its long term loyal farmers as well as by farmers connected through local collectors. These farmers were part of a cohesive area entity – their smallholdings were individually owned yet geographically connected to one another.

The marketing function of the packing station was sorting and grading. Packaging materials, such as boxes and pallets, were produced in its own packaging factory. Exporters extended their control over various stages of the chain by owning a nucleus farm, a packing station and a

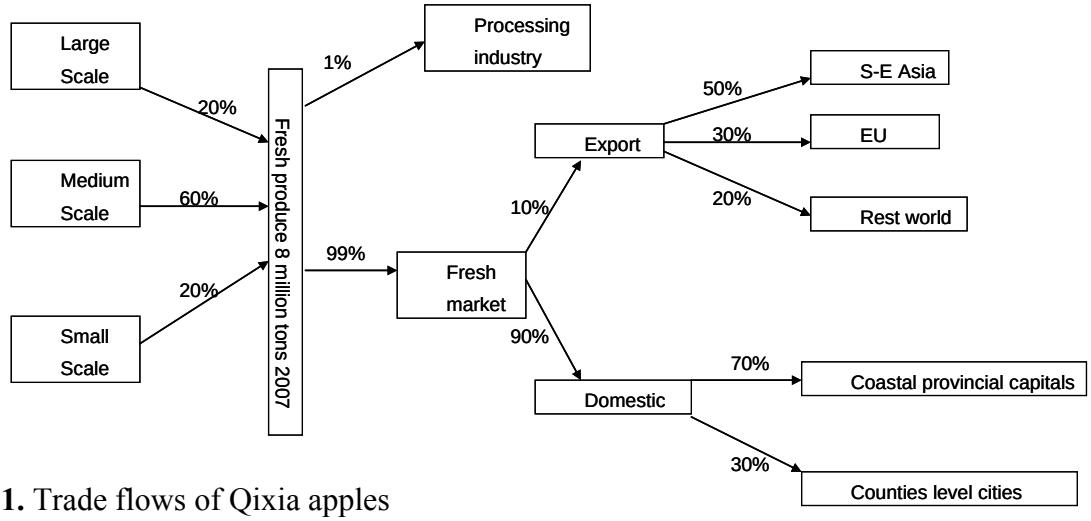

Figure1. Trade flows of Qixia apples

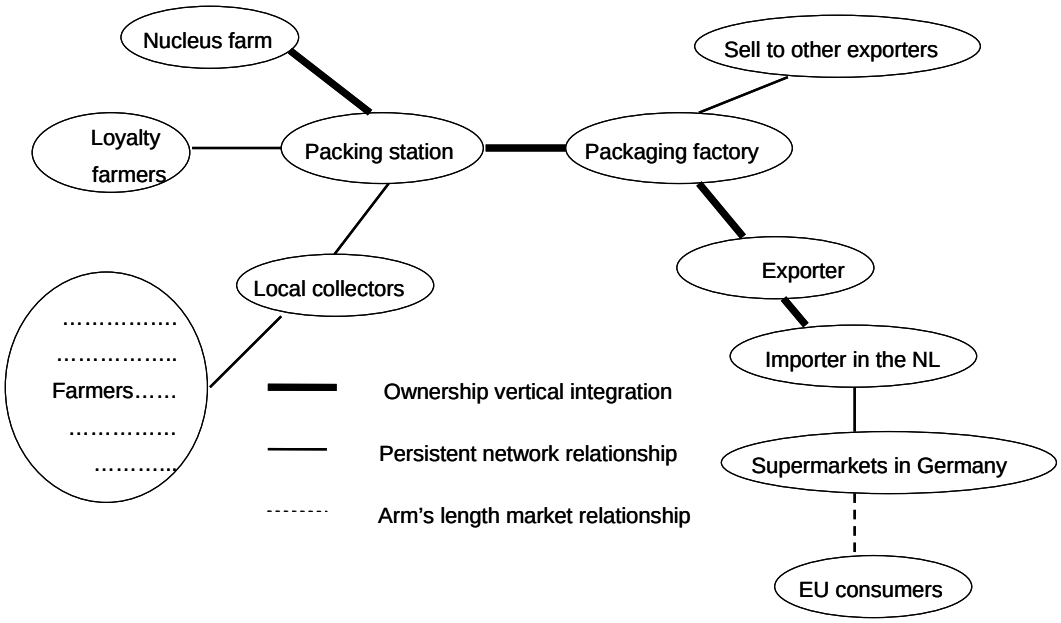

Figure 2. A case of Qixia apple Chain to EU markets

packing material factory. Since both Chinese government and EU regulations required that apple exporters register their orchards and packaging factories, it was efficient to centralize all of these processes. In addition to upward integration by the exporter, it also coordinated downward along the chain by setting up a joint venture with its long-term EU trading partner. This was a highly coordinated apple supply chain where all chain players were either vertically integrated or shared persistent network relationships, with the exception of consumers at the end of the chain, where a simple market relationship applied.

Mapping Institutions

A wide range of public and private institutions affected apple chains. Institutions which were critical to each phase of the apple export chains are identified in Table 6.

At the production stage, land tenure was the central issue. When collective land was equally distributed among villagers in the 1980's, land tenure was guaranteed for 30 years. Due to decent income from apple production and the exemption of governmental land taxes since 2003, capable farmers were requesting more land.

- Farmer cooperatives were allowed to be involved in apple production under the newly adopted Cooperative Laws
- The China Entry-Exit Inspection and Quarantine Services (CIQ) at local level frequently inspected fields and orchards.
- In some cases importing markets required that private institutions be involved in apple production, such as EurepGAP when apples were to enter the EU markets.
- Packaging materials was produced in factories certificated by the CIQ to guarantee food safety and meet phytosanitory requirements.
- Workers at the factories enjoyed certain welfare and working conditions according to new Labor Law requirements in China.
- Some traders were considering applying for certificates in corporate social responsibility as encouraged by importers.
- Quality control schemes, such as HACCP, were also prevalent.
- All export companies and their orchards were registered and checked by the local CIQ in China, except for those exporting to Canada. The companies were registered at provincial CIQ level, an indication of a more demanding requirement. When apples are ready for export, CIQ tested a sample of every shipment. Customs checked the consistence between the customs paperwork and the products.
- Both the EU and China had clear standards set for apple grades to ensure quality. Most traders had their own private standards which were stricter than compulsory standards.
- Food safety laws protected consumers' health.
- Preferences of consumers around the world varied and these differences were often difficult to address.

Table 6. Mapping institutions along the apple export chains

	Production	**Packaging**	**Trade**	**Consumption**
Public Institutions	Cooperative Law	Labor Law	Customs	Food Safety Laws
	Land Tenure	CIQ	CIQ	
	CIQ		WTO/ Bilateral agreement	
			Compulsory standards	
Private Institutions	EurepGAP/ GlobalGAP	Social Corporate Responsibility	Private standards	Cultural preference
		HACCP		

Chain Governance Mechanism

We use the term "chain governance" to denote the ways in which activities along the chain are coordinated, such as how the process is specified and how standards are enforced and monitored. Since the linkage between small-scale farmers and modern traders was the bottleneck for the apple chains, we were particularly interested in how small scale farmers were integrated in the apple export chain so we will describe this in greater detail than governance relationships in the rest of the chain.

Export companies were the leading firms in the apple export chain and used their power structure the apple chains. Five modes of relationships with farmers were identified using the interview data. Each is now described separately.

Mode 1: Multi Party Networks

Exporters signed agreements with village committees to support apple production in the village and purchase quality apples from village farmers. There were no prescribed agreements on apple prices and quantities. In order to help improve the apple quality exporters hired technical consultants from township extension stations to advise villagers with pesticide and chemical uses. About 5 to 10 times a year these consultants offered apple farmers field management courses. Exporters procured top quality apples by offering higher prices than the prices offered by other collectors. Exporters selected the villages based on the scale of the village orchards, purity of varieties, taste and quality of apple, and open transparent communication relationships with the village committees.

Mode 2: Preferred Farmers

Exporters developed long term relationships with preferred farmers by continual cooperation over time. Exporters could have hundreds of preferred farmers. These farmers were selected based on mutual trust as well as geographic location: higher altitude regions with tasty apples were preferred. Exporters required that these farmers use particular fertilizer and chemicals. In the end, exporters paid preferred farmers a higher price than the market price.

Mode 3: Nucleus Farm

Exporters often owned nucleus farms where they could demonstrate agronomic practices and provide training. A nucleus farm could be formed in several ways: (1) Export companies could lease collective orchard land from village committees where suitable soil and irrigation ensured quality apples; (2) The companies could acquire land from individual farmers by signing land tenure agreements with village committees. Exporters then employed village farmers to work on orchards (paid by salaries) and paid the village land rents annually (the village will then pay farmers); or (3) Exporters could lease land directly from farmers to establish their own orchards.

Mode 4: Cooperatives

Exporters would jointly register with farmers that they trusted as cooperatives. This was a step further than simply working with preferred farmers. The exporters joined the co-ops based on

the value of their cold storages and marketing capacity while the farmers join the co-ops based on their apple production. The farmers chosen had good reputations (that is, they were cooperative in terms of applying fertilizer and pesticide) and operated adjacent orchards. The farmers delivered their graded apples to exporters' cold storage without determining prices. The sale committees in consultation with farmers sold these apples in the markets. The exporters' storage and marketing costs were deducted from the apple revenues and the remaining funds were then distributed among farmers. The cooperatives also hired technicians to provide technological support to its farmers and help procure inputs so that the apple quality was constant.

Mode 5: Contracting for Special Markets

Written contracts were rarely used though informal contacts started when the exporter began advising farmers that they follow certain production practices. The survey only identified one case when a written contract was used. That time an importer had a special requirement for yellow-green Fuji apples rather than the normal red apples. The exporter signed detailed contracts with farmers one month before the harvest in which the quality, quantity, color and prices of apples was specified.

The governance relationships between apple farmers and their exporters under five modes are compared in Table 7. The comparison is in terms of their objectives, the co-ordination mechanism and the institutional environments. The first mode, the co-ordination of the multi party mode, was based on a wide network of exporters, village committees, farmers and extension staff. Through this network, exporters treated farmers' land as their 'orchards' and influenced farmers' production process in order to obtain a higher volume of top grade apples. The second mode, the preferred farmers scheme, was the result of mutual trust based relationships between farmers and exporters. The third mode, the exporters' owned nucleus farm served two purposes: to demonstrate practices to other farmers; and to satisfy export regulations which require orchard registration. The fourth mode, the formation of a cooperative by an exporter and farmers was done to maximize chain performance in both profitability and product quality. And the fifth mode, written contracts, was only used when the exporter desired a specific product. In the apple sourcing sector relational network based on trust and reputation was far more important than formal contracting.

Table 7. Comparison of Governance Mechanism between Farmers and Exporters

Modes	Objectives	Chain Co-ordinations	Institutional Environments
1. Multi party network	Getting more top grade product	network based	Land tenure
2. Preferred farmers	Stable quality suppliers	Persistent Relationship	Trust
3. Nucleus farm	Demonstration	Integration	Corporate law
4. Cooperatives	Efficient chain performance	Equity-based	Cooperative Law
5. Contracting	Specific demand	Specification contracts	Contracting Law

The dominant way in which exporters sourced their apples was through local collectors or agents. These delivered more than half of the exporters' apples. Some big exporters used up to 400 collectors. These collectors were entrepreneurial farmers as well as private businessmen. The relationships between collectors and farmers changed overtime. Five years ago farmers had to ask collectors to accept their apples. More recently, collectors encouraged farmers to deliver apples to them by providing more help and support to farmers as well as high prices. Farmers felt that it was getting easier to sell apples than few years ago. The main reason was a strong demand for quality apples.

Farmers were very conscious about collectors' reputation. They did not do business with collectors who have a poor reputation ('no heart' in the farmers' words). The main measures of reputations were quality requirements, fair pricing, honest weighting, and timely payment. Most farmers believed contracts were useless without trust because enforcing contracts through lawsuits was too costly. In addition, collectors and traders also thought that contracts without mutual trusts were useless because it was hard to sue collective, small farmers.

Conclusions and Policy Implications

This paper has analyzed the Chinese apple chain from a global supply chain perspective. Over the last 20 years, Chinese apple industry has made great progress in terms of both quantity and quality. China has emerged as one of the leading players in the global apple market over the last two decades. As described in this study, the Chinese apple export chains had become highly integrated within the international market. The efficient price transmissions between China and the world markets indicated a high degree of market integration. In addition, farmers were well integrated into apple chains and received a much higher profit margin compared with apple farmers in most other countries.

The success of the Chinese apple chain was attributed to factors, such as technology innovation and market liberalization. However, we would like to focus on two policy observations from our Chinese experiences. These observations may provide other transitional countries struggling with their global chain structure with ideas they may like to consider during the process of economic global integration,

The first observation is that globalization is beneficial to improving food safety and quality in China. When we review the development of apple industries in China over the last three decades, the process of domestic market liberalization and integration into world markets has had a substantial impact. In the 1980's, apple production started to take off as a result of domestic market liberalization. Towards the end of the 1990's apple markets were turned from supply driven to demand focused when food safety and quality became priorities due to well-off domestic consumers and pressures from trade partners. After China joined the WTO in 2001, Chinese apples quickly became significant in world markets because of their good quality and low prices. Meanwhile, domestic consumption increased as a result of the increasingly affluent middle class in China.

The development China of China's apple industry showed a clear path that began with increasing production then pursuing quality and safety, followed by entering international markets, and then

returning to domestic markets. During this process globalization was not the goal but was used as an instrument to improve the product's quality and safety. As the domestic markets mature, traders may alternate between domestic and international markets, dependent on profitability at the time. The question posed is 'Will this kind of development cycle be representative for other sectors in China as well?' Will the Chinese food industry need to first face up to the global markets to advance its interests before they head back to the domestic markets? "In fact, one should not be surprised to observe such shifting process between domestication and globalization given the great potential in China's domestic market. Affluent domestic consumers are the final beneficiaries in the apple case since they are ready to pay the premium prices for top quality products. If this development cycle holds for other agribusiness sectors in China, it likely has similar implications for other transitional countries such as India, which also enjoys a dynamic domestic market with increasing affluent middle class consumers.

The second observation is that China has a very reactive institutional mechanism that responds to the international demand for food safety in efficient ways. In the Chinese apple sector we did not see the public and private sectors join forces and act together to simply serve domestic interests. Rather, the international markets set the standard requirements while Chinese authorities adjusted their measures to help the apple industry's meet these requirements. It is irrelevant whether these requirements came from public institutions, such as EU's packaging treatment condition, or from private sectors, such as GlobalGAP. As long as it was necessary to export apples, the Chinese government saw these requirements in their responsibilities and met them, sometimes in creative ways such as video-camera monitoring of packaging treatment and through financial subsidies for GlobalGAP. Yet we recognize that in China there are separate procedures for food safety control for domestic and export markets. Having two separate systems where those for export are more rigorous may provide other transitional countries facing sector resource constraints with export markets while retaining smallholders in the modern chain.

Although China's apple industry has made great progress in the last 20 years, it still faces many challenges. The major problem lies in small-scale production. Small-scale production makes it difficult to produce homogeneous products. Imperfect land markets hamper the transfer of land use rights to other families. Small scale production is not attractive enough to keep young generations at the field. Lack of public investment in R & D is another weak point. Before 1995, the government financed horticultural extension stations in each town to carry out technology extension work. Since then horticultural stations were leased to private persons and became profit-oriented, rarely providing farmers with technology supervision. Alongside public extension, R & D investment in variety breeding is also urgently required. Fuji apples are currently the dominant variety. Although the markets welcome this variety, relying on a single variety is still precarious in volatile markets.

The chain analysis allows us to do more than just understanding the process. We must try to anticipate changes in the future (Vermeulen, et al. 2008). In order to facilitate policy discussion we identify two key factors which may influence the Chinese apple markets in the future and envisage four possible scenarios (Fig. 3). One factor is the future development of farmers' organization, and the other factor is the development of international and domestic apple markets. Will Chinese farmers remain as small scale and fragmented as they are now or will they be organized as cooperatives in order to enhance their market positions? Should the Chinese apple markets seek export business or domestic growth?

Although it is difficult to choose which scenario may be seen as the most favorable, Figure 3 shows clearly that the fragmented structure of growers is the major institutional obstacle for apple quality improvement as well as for long-term development in the apple sector. When compared to technical challenges, institutional obstacles may be seen as a more fundamental threat. Both farmers and traders have felt the urgent need to work together in order to succeed in the export market. They remain involved in the process of discovering an efficient cooperation and profit distribution mechanism.

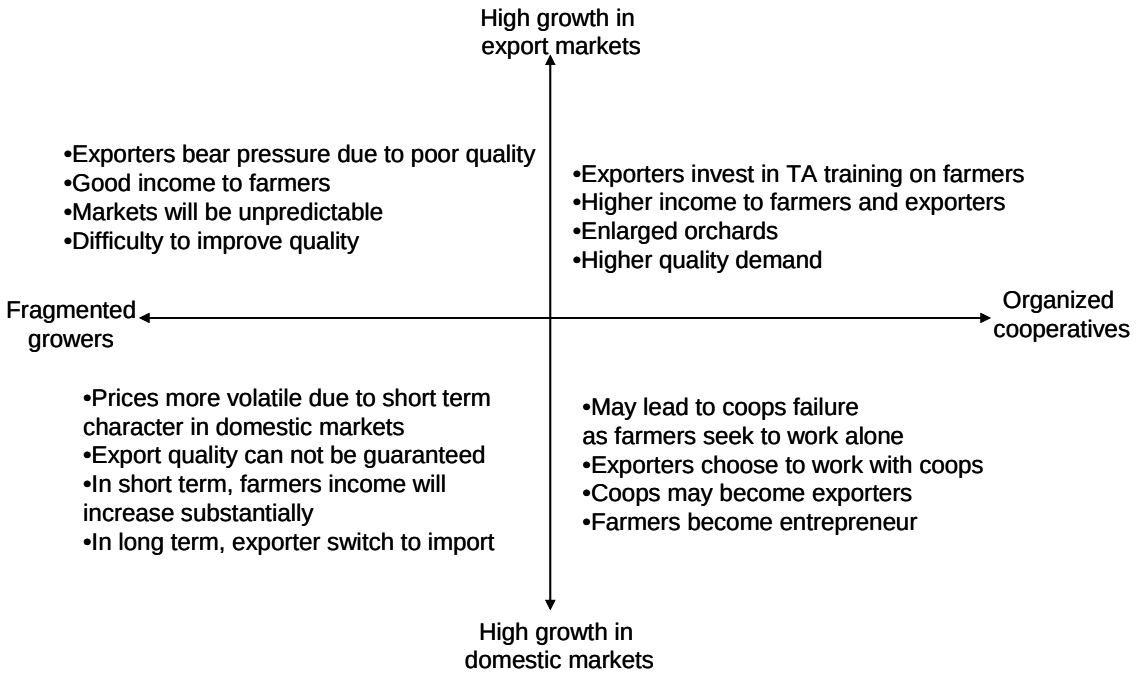

Figure 3. Scenarios for apple industry in China

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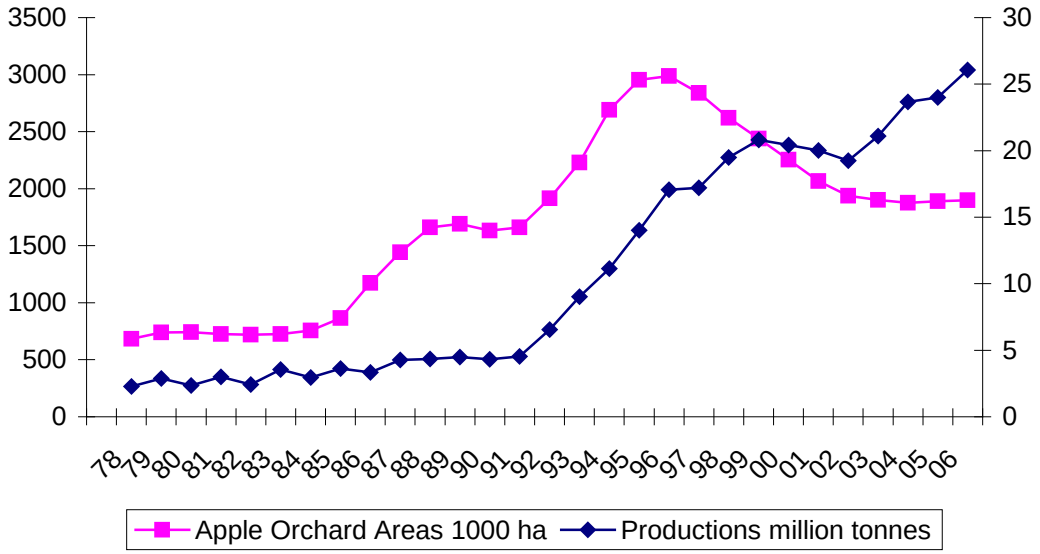
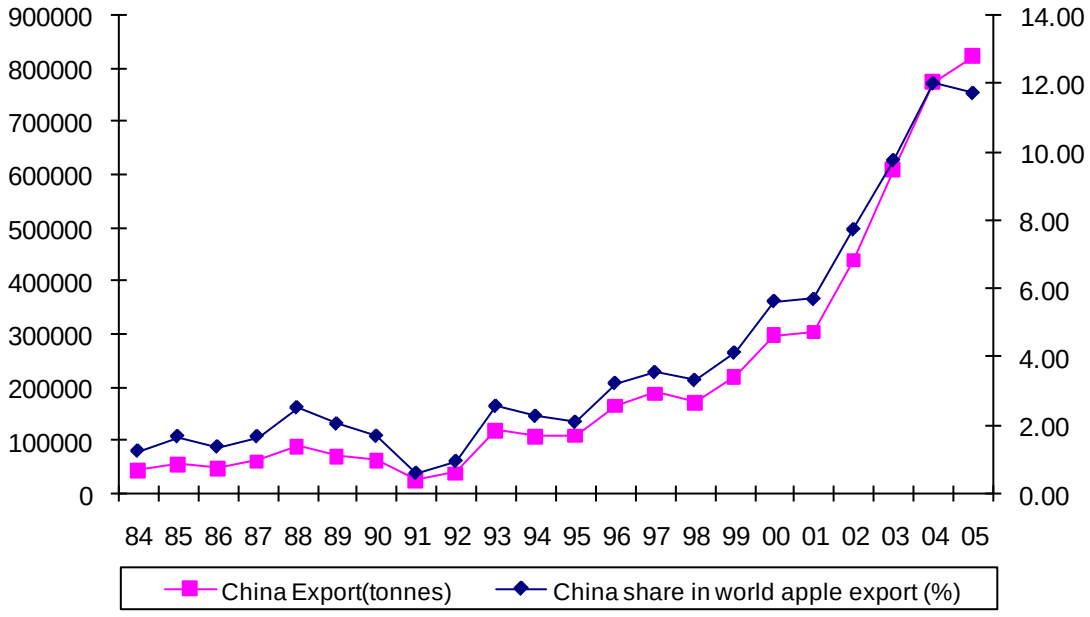
Appendix 1. Areas of apple orchards and apple production in China from 1978 to 2006.



Source: China Agricultural Statistics Yearbook, various years

Appendix 2. Quantity of Chinese apple export and its global export share from 1984 to 2005.



Source: FAO's Agricultural and Trade Data

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Of Junk Food and Junk Science

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Abstract

The popular press has triumphantly announced that the cause of the obesity epidemic is "junk food." After a moment's reflection, however, it seems likely that the true causal structure of the obesity epidemic can be neither single-equation nor univariate. Therefore, while the hypothesis that "junk food" is the cause of obesity has little a priori plausibility, these articles in the popular press present a testable hypothesis that, in spite of some measurement impossibilities, is tested here. While one can always argue about p values etc., it is safe to say that the results show no evidence to indicate support for a causal link. The second section of the paper explains this result and suggests a rudimentary structural model of obesity that begins to address the issues of specification error, simultaneity, etc., that plague much of the obesity research. This model shows that because of the dynamic nature of weight status, there is no necessary reason to expect to find a statistical relation between a person's observed weight and the amount he or she is currently eating or exercising. Therefore, studies which regress weight, obesity, or the probability of obesity on eating and exercise patterns have serious specification error. Further development of structural econometric models of obesity may lead to consistent estimates of the partial effects of exogenous variables on obesity levels. We conclude with a discussion of the implications for policy development and industry.

Keywords: obesity, junk food, Granger-causality

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Introduction

Initially, the idea of a Granger causality study of junk food and obesity arose as an attempt to inject a little humor into a professional meeting. There is some precedent for such econometric humor. Thurman and Fisher published a Granger causality study of eggs and chickens in the AJAE about 20 years ago. Since it is 100% certain that all chickens are caused entirely by eggs and all (chicken) eggs are entirely caused by chickens, this was more of a humorous test of the methodology than a potential resolution of the age-old philosophical question. Fortunately, the results showed a reasonable likelihood of a connection between eggs and chickens, so Granger's Nobel prize is probably safe. However, after some thought, we realized that a Granger causality study of junk food and obesity was not in the same league as one for chickens and eggs, and had the potential to make a contribution to the obesity literature. In this paper, we explore the relationship between junk food consumption and obesity, discuss the elements of a structural model of obesity, and discuss the implications for policy makers and management.

In recent years, the popular press has announced that the American obesity epidemic is being caused by the food industry, specifically companies selling "junk food." This claim may be found in articles such as, "Junk Food, TV Driving Kids to Obesity (Gordon in the Washington Post), "Junk Food Is Fooling People into Overeating" (Henderson in the Times London), "TV Ads Entice Kids to Overeat, Study Finds" (Mayer in the Washington Post), "Junk Food Giants Spend Billions Brainwashing Consumers & Buying Politicians" (Organic Consumers), and many others. Other articles warn of the potential danger of junk food, with titles such as "Don't Even Think of Touching that Cupcake" (Kershaw in the New York Times), and "Fighting Obesity, but Fronting for Junk Food" (Melz in the Boston Globe). Even reading past the headlines, the articles typically present a simple picture of cause and effect, i.e. increases in junk food consumption have led to increases in obesity rates. Most articles contained little or no discussion of the complexity of factors that may be related to the rise in obesity. While these articles generally present little or no evidence to support their strident claims, they may not be totally devoid of legitimate content. They may contribute to scholarly inquiry by presenting a clear, testable hypothesis. If the popular press is correct that junk food is the cause of obesity, then one would think that a statistical relationship between per capita consumption of junk food and aggregate rates of obesity in the United States could be observed.

It is not clear that the actual line of causality between junk food and obesity is as obvious as these articles suggest. It is clear that companies specializing in donuts, candy, fried chicken, etc. sell foods that are high in calories and/or sugar or fat. This is not disputed. It is also clear that there is a fairly predictable relationship between calories consumed and the common measure of obesity, the body mass index (BMI), but the exact nature of this connection is not so obvious. While it is certain that consumption of large quantities of these junk foods can certainly cause obesity, it is not at all certain that this is the underlying causative factor. Indeed, the line of causality could run the other way. The obesity epidemic may be arising as a result of other causative factors that create an increased demand for junk foods. As people become obese, their maintenance calorie level increases substantially. Therefore, obese people become hungry unless they eat large quantities of calories. These junk foods are a readily-available source of cheap, tasty calories which can provide the function of preventing hunger for the obese. Therefore, if junk food consumption and obesity were both increasing, it is a logical possibility

that the increase in obesity rates is the cause of the increasing the demand for high calorie foods rather than the result of it.

However, since obesity is one of the factors determining caloric consumption, and caloric consumption is one of the factors determining obesity, it is obvious that obesity and food consumption are both endogenous variables in a system of structural equations. While a significant amount of responsible analysis of the obesity problem is underway, it is fair to say that the true casual structure of obesity is not well-understood. At this point, it seems likely that in addition to the underlying basic thermodynamics, other factors including, physiological, psychological, social, cultural, and economic components are involved in what may be a very complex set of relationships.

Therefore, even though it is highly unlikely that the causal structure of obesity can be adequately represented by any univariate, single equation structure, an econometric analysis of such a model is justified as a test of the hypothesis currently being trumpeted in the popular press that junk foods are the cause of the obesity epidemic. It is equally reasonable to examine the possibility that the obesity epidemic is causing a rise in junk food consumption. If the linkages were really this simple, it should be possible to present empirical evidence to support one or the other of them with a Granger causality test.

Methodology

Every sophomore is aware of the *post hoc, ergo proper hoc* fallacy. It is clearly too simple to suggest that correlated events have a causal relationship. However, Granger's suggestion is more sophisticated than that. He suggested a clever test statistic to see if patterns in preceding values of a variable add a statistically significant amount to the ability to forecast subsequent values. While this is a form of "after this, therefore because of this," it is a more sophisticated form. While there are many possible ways of calculating a Granger causality test, the most straightforward simply compares the residual sum of squares from a vector autoregression that contains lagged values of the proposed "casual" variable with residual sum of squares from one that does not. For example, to test if Y Granger-causes X, first estimate two vector autoregressions:

$$x_t = \alpha_1 + \sum_{i=1}^{\rho} \beta_i x_{t-i} + \gamma_i y_{t-i} + \varepsilon_t$$

$$x_t = \alpha_2 + \sum_{i=1}^{\rho} \phi_i x_{t-i} + e_t$$

Then, denoting the residual sums of squares from these two regressions as SS1 and SS2, the test statistic for the null hypothesis that y does not Granger-cause x is:

$$\frac{(SS_2 - SS_1)/\rho}{SS_1/(T - 2\rho - 1)},$$

which is distributed F with ρ and T - 2ρ -1 degrees of freedom as long as the residuals are normally distributed, or the sample sizes are large enough to rely on the central limit theorem. This amounts to a test of whether adding lagged values of Y add a statistically significant amount of reduction in the error sum of squares of the regression.

Data

As with many empirical studies in social science, acquiring the data needed to test these hypotheses is not a trivial task. Even defining the concepts of obesity and junk food is not straightforward. Therefore we generated some proxies. While it would be fairly easy to find disagreement on the definition of obesity, some objective measures are available. Defining and measuring "junk food" is considerably more difficult. The Body Mass Index (BMI) is a commonly-used measure of obesity. It is calculated as the weight (in kilograms) divided by the square of height (in meters).[1] The World Health Organization and the U.S. Centers for Disease Control and Prevention considers adults with a BMI between 25.0 and 29.9 to be overweight, and those with a BMI of 30.0 and above as obese. (World Health Organization; Centers for Disease Control and Prevention). Therefore, we measure the rate of obesity in the U.S. by the proportion of the population with a BMI of 30 or above.

To attempt to measure the rate of national per capita "junk food" consumption, we developed an *ad hoc* "junk food index" (JFI). First we collected the annual sales data for a group of companies who sell mostly foods with high sugar or fat content and/or are generally believed to be mostly devoid of other healthful nutrients. Sales data were collected for the period 1990 through 2006 for the following companies (with some of their signature products and brands in parentheses): Interstate Bakeries (Twinkies, HoHos), McDonalds (Big Mac), Hershey Foods (Hershey's Chocolate Bar, Reese's, Almond Joy), Coca Cola (Coca Cola, Sprite), Pepsico (Pepsi, Mountain Dew) and YUM Brands (Pizza Hut, Taco Bell, KFC), and Kelloggs (Frosted Flakes, Pop-Tarts). Sales data were obtained from the Compustat North America database. Because of the spin-off of Yum Brands from Pepsico, we combined the sales for these two companies in the years after the spin-off. Second, the aggregate annual sales of this group of companies was deflated to real dollars by the food component of the consumer price index and divided by population. This gives an *ad hoc* measure of real, per capita "junk food" consumption in the United States. These data are shown in Table 1 and plotted in Figure 1. A brief glance at the data casts doubt on the hypotheses that obesity rates are caused by "junk food" consumption. Real per capital consumption of "junk food" from these companies is essentially the same in 2005 as it was in 1996, but the incidence of obesity has grown from 16.8% of the U.S. population in 1996 to 24.4% in 2005, a 45% increase.

Data Validity

While it might at first appear that our *ad hoc* "junk food" index is a somewhat arbitrary measurement device, this criticism raises several other issues. The problem is not just a measurement problem; it is more serious than that. The concept of "junk food" itself has little

[1] To calculate BMI using pounds and inches, the formula is the product of weight (in pounds) and 703, divided by height (in inches) squared.

Table 1. U.S. Real per capita "junk food" consumption and obesity rates

Year	% Obese*	"Junk Food" Index
1990	11.6	$135.24
1991	12.6	$141.33
1992	12.6	$152.17
1993	13.7	$159.44
1994	14.4	$172.39
1995	15.8	$186.36
1996	16.8	$188.13
1997	16.6	$182.88
1998	18.3	$180.42
1999	19.7	$172.83
2000	20.1	$171.79
2001	21.0	$180.73
2002	22.1	$171.82
2003	22.8	$178.31
2004	23.2	$182.98
2005	24.4	$188.62
2006	25.1	$191.63

***Sources:** 1990-2002: Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System, Trends Data, http://apps.nccd.cdc.gov/brfss/Trends/TrendData.asp; 2003-2006: Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System, Prevalence Data, http://apps.nccd.cdc.gov/brfss/index.asp.

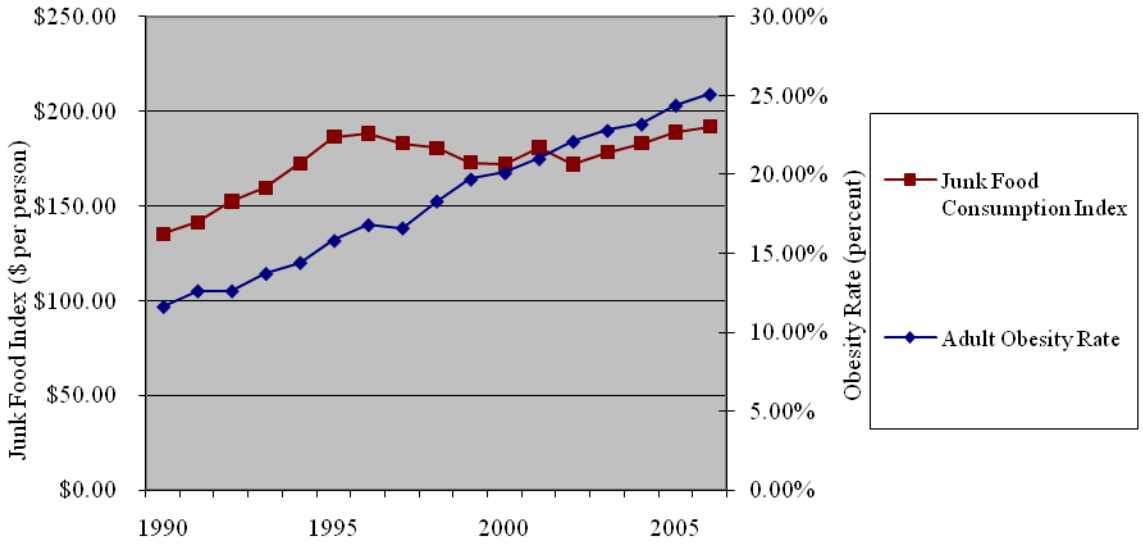

Figure 1. Real, per capita "junk food" Index and Obesity Rates, 1996-2006

scientific validity and is not really subject to measurement. There are several reasons for this. First, all foods fall on a multivariate continuum of nutritional merit. Assuming one could actually measure "aggregate nutritional merit" of a food item in some reasonable way, as one goes toward zero on that continuum, what threshold level should cause a food to be categorized as junk? Clearly it is not reasonable to pick an arbitrary cut-off level and simply classify all foods as "junk" or "non junk". Nutrition is much more complex than that. Second, the nutritional merit of a food has many dimensions; one for each important nutrient that potentially promotes health and one for each potentially harmful ingredient.[2] Moreover, some compounds may be beneficial at low levels and harmful at high levels. Even if one could find agreement on which compounds should be included in which category, there is the problem of determining how increasing amounts of favorable ingredients could compensate for lack of other favorable ingredients or the inclusion of harmful ingredients. This mind-boggling task makes it clear that a threshold concept of "junk food " is not a concept that has much potential scientific validity and is certainly not a concept that lends itself to precise measurement.

Despite the problems described in the preceding paragraph, the term "junk food" is one that is widely used in both the popular press and the vernacular. While it may defy easy definition, to paraphrase Justice Potter Stewart's comment on obscenity, most people "know it when they see it." Therefore, while our "junk food" index is admittedly imprecise, it does measure something related to the claims found in the media. It seems clear that the aggregate sales of these firms we include measures something about what the popular press, which commonly targets foods such as Big Macs and Twinkies, considers to be "junk food" consumed in the United States. The lack of precision of the measurement is certainly not as much of a problem as the lack of validity of the concept being measured. Furthermore, any possible potential lack of validity of the "junk food" index will be rendered irrelevant by the arguments made in the second part of this paper. There we show that regressing obesity levels on eating and exercise patterns is a severely flawed econometric structure. Because of the dynamics of obesity, not only is there no reason to expect to find any statistical relationship between aggregate junk food consumption and overall obesity levels, but there is no reason to expect to find a statistical relationship between aggregate total food consumption and overall obesity levels. These issues are explored after the econometric results are examined.

Econometric Results

Given the nature of the problem, it seems likely that only short lags are relevant. This assertion is verified by the econometric results. Lags longer that two periods were highly insignificant. The Granger causality hypotheses and results are shown below.

H_0: "Junk food" consumption does not Granger-cause obesity.

The two necessary regression equations are:

[2] A good example is the debate about whether the beneficial fats in fish more than compensate for possible damage from toxic metallic compounds.

$$\%\,Obese_t = \alpha_1 + \beta_1\,\%\,Obese_{t-1} + \beta_2\,\%\,Obese_{t-2} + \gamma_1\,JF_{t-1} + \gamma_2\,JF_{t-2} + \varepsilon_t$$

$$\%\,Obese_t = \alpha_2 + \phi_1\,\%\,Obese_{t-1} + \phi_2\,\%\,Obese_{t-2} + e_t$$

The first regression had an $R^2 = 0.9869$ and the second had an $R^2 = 0.9850$. This gives a hint about how the results will come out. The parameter estimates, t and p values for regression one and two are shown in Table 2.

Table 2. Parameter estimates for H_0: Junk food consumption does not Granger-cause obesity

Parameter	Estimate	t value	p value
α_1	-1.18	-0.60	0.56
β_1	0.58	2.04	0.07
β_2	0.39	1.41	0.19
γ_1	0.02	0.75	0.47
γ_2	-0.002	-0.09	0.93
α_2	1.02	1.50	0.16
φ_1	0.64	2.38	0.03
φ_2	0.36	1.35	0.20

The calculated value of the $F_{2,10}$ test statistic is 0.719. The critical value of the F statistic for alpha = 0.05 is 4.1028. Therefore, do not reject the null hypothesis that junk food consumption does not Granger-cause obesity. While failure to reject the null hypothesis does not constitute evidence for accepting the null, one has to note the nearly total absence of evidence for rejecting the null in this case. Even if one were willing to accept an alpha level of 0.2, the critical value of the F statistic would be 1.899, and the calculated F value of 0.719 still is not even close.
The alternative logical possibility is that obesity is causing the demand for junk food. The formal hypothesis statement is:

H_0: Obesity does not Granger-cause junk food consumption.

The two necessary regression equations are:

$$JF_t = \alpha_1 + \beta_1\,JF_{t-1} + \beta_2\,JF_{t-2} + \gamma_1\,\%\,Obese_{t-1} + \gamma_2\,\%\,Obese_{t-2} + \varepsilon_t$$

$$JF_t = \alpha_2 + \phi_1\,JF_{t-1} + \phi_2\,JF_{t-2} + e_t$$

The third regression had an R2 = 0.767 and the fourth had an R2 = 0.746. The parameter estimates, t and p values are shown in Table 3. The calculated value of the $F_{2,10}$ test statistic is 0.45 which is again a very long ways from the critical value for alpha = 0.05 of 4.1028 or the critical level for alpha level of 0.2 of 1.899. Therefore, do not reject the null hypothesis obesity does not Granger-cause junk food consumption. Again, the lack of support for rejection of the null hypothesis is nearly total.

Table 3. Parameter estimates for H_0: Obesity does not Granger-cause junk food consumption

Parameter	Estimate	t value	p value
α_1	59.37	2.63	0.025
β_1	0.92	3.32	0.008
β_2	-0.29	-1.15	0.28
γ_1	-1.54	-0.48	0.64
γ_2	1.97	0.61	0.55
α_2	54.96	2.66	0.02
φ_1	0.93	3.50	0.004
φ_2	-0.23	-1.03	0.32

Sample Size, Power and Distribution of Residuals

Given the relatively small number of observations compared to the number of parameters being estimated, one can legitimately wonder if the test statistics have adequate power. When one fails to reject a null hypothesis for alpha = 0.05 or even 0.2, it is certainly a logical possibility that a larger sample would cause rejection of the null hypothesis. However, in this case, the calculated values of the F statistic are so tiny that no amount of data would cause rejection of the null. For example, consider the largest F statistic which is for the main hypothesis that "junk food" consumption does not Granger-cause obesity. The calculated $F_{2,10}$ value is 0.719. In order to reject the null hypothesis at the 5% level, the calculated $F_{2,10}$ value would have to exceed 4.1. Clearly, more data would affect the threshold rejection level. If there were 65 data points, the test statistic would have 2 and 60 degrees of freedom and the critical value would fall to 3.15. With infinite data, the test statistic is $F_{2,\infty}$ and the critical value would be 3.0, still far above the calculated value of 0.719. Therefore, even though the length of the obesity epidemic does not provide us with many annual data points, the extremely small values of the test statistics suggest

that failure to reject the null hypotheses is not simply due to lack of data.
Additionally, the relatively small sample size raises legitimate questions about the distribution of the test statistic. In order for the test statistic to have an F distribution with a small sample, the residuals must be normally distributed. The normal probability plots for the residuals for the four regressions all appear reasonably normal, but if non-normality were suspected, it would be a suggestion of slightly "fat tails" i.e. "chubby tails." This would imply that the test statistic might also have "chubby tails" meaning that the test might have a tendency to reject the null too often. Therefore, if the null had been rejected, one could argue that it was a spurious result due to a violation of the assumptions. However, this departure from normality cannot be blamed for a failure to reject, and one is forced to conclude that the evidence is adequate to reject the single equation univariate model structure that "junk food" is *the* cause of obesity.

A formal test of the assertion commonly found in the popular press shows that the lack of evidence in support of Granger causality is nearly total. Moreover, given the complex multivariate continuum of foods characteristics that exist, the concept bifurcating food into "junk food" and "non-junk food" has very little validity.

Toward a Structural Model of Obesity

The true causal structure of obesity is likely much more complex than the simplistic relationships proposed in the popular literature and tested above. Almost certainly, the actual causal structure of obesity is multi-equation, multivariate, and dynamic. It is not necessary to point out to most scholars the dangers of specification error, the difference between a reduced form and a structural model, or the folly of estimating a dynamic structure with a static form. But in the interest of promoting discussion of an adequate econometric structure for the obesity problem, a simple structural form is suggested below.

Without making any claims of physiological expertise, basic thermodynamics requires that people gain weight[3] when the calories they consume exceed the calories they burn. Since it is important to separate the effects of biology from individual choices, calories burned may be divided into the maintenance requirement (M) and the amount consumed by exercise and factors other than maintenance. Net caloric intake (NC) may be defined as calories eaten minus calories burned by work, exercise, etc. Then, we can conceptualize excess calories per unit of time as the difference between net caloric intake and the maintenance requirement (M). This conceptualization separates the issues of biology and individual choice. The maintenance requirement is primarily determined by who we are and net caloric intake is primarily determined by the eating and exercise that we choose. The maintenance requirement is a function of many predetermined variables that would have to be accounted for, but ignoring those temporarily, it is also a function of the endogenous variable weight (W). The simplest possible form for a maintenance caloric requirement function would be a linear function of weight, $M = \alpha_0 + \alpha_1 W$. While the coefficients would be affected by the characteristics of the individual, example coefficients would be $\alpha_0 = 800$ and $\alpha_1 = 8$ giving a maintenance level of 2000 calories per day for a 150 pound person. While the Forbes equation (Forbes) suggests that

[3] We switch from BMI to weight because height will be one of the predetermined variables in a more complete model.

the relationship between excess calories and weight gain may not be quite linear, for the sake of simplicity we will assume that each 3500 excess calories causes one pound of weight gain. Given this simplifying assumption, weight gain is given by a simple first-order, first-degree differential equation:

$$\frac{dW}{dt} = \left[NC - \alpha_0 - \alpha_1 W\right]\phi$$

where phi is 1/3500.

Therefore, basic thermodynamics says that overeating and lack of exercise do not cause obesity, they cause weight gain. While everyone knows this, it is a crucial distinction that has not been adequately incorporated in much obesity research. If a person is obese, it is not because of their current eating and exercise habits. Indeed, one might expect the obese to have a motivation to exercise and diet more. While the existence of obesity reflects a history of excessive caloric consumption relative to exercise, it says nothing in particular about their current eating and exercise habits. As a result, the common practice of regressing obesity levels (or the probability of obesity) on a vector of eating and exercise habits is severely mis-specified. While there is no necessary connection between a person's obesity status and their current eating habits, one might argue that if one has constant eating and exercise habits, then it would be valid to look for relationships between eating, exercise and obesity. However this assertion is also flawed because of the dynamics of obesity.

The dynamics of obesity cause there to be no necessary relationship between current eating and exercise habits and weight even if eating and exercise habits are constant over time. This may be explained by the simple differential equation for weight gain shown above. For a net caloric intake which is greater than maintenance, the change in weight is positive. If the net caloric intake is constant at this level, weight increases over time. The increase in weight causes the maintenance requirement to rise and the rate of weight gain to fall until an *equilibrium* weight is reached where the net caloric intake equals the maintenance requirement. Therefore, while a constant set of eating and exercise habits totally determine a person's equilibrium weight, they have no relationship to this person's weight at a point in time. For example, consider a person weighing 150 pounds who consumes a net caloric intake of 2400 calories every day. Since the maintenance level for a 150 pound person is 2000 calories, initially there will be an excess intake of 400 calories per day. But with a constant intake of 2400 calories there will be a weight gain each day, and the weight gain increases the maintenance requirement thereby reducing the excess intake until eventually the person's weight reaches 200 pounds. At this point, the maintenance requirement will have risen from the 2000 calories/day required for a weight of 150 pounds to 2400 calories, and weight will equilibrate at 200 pounds. Therefore, while a 150 pound person who has a net caloric intake of 2400 calories has an equilibrium weight of 200 pounds, since his current weight is not in equilibrium, it will be misleading to associate their eating and exercise habits with a weight of 150 pounds. Conversely, a 300 pound person who consistently eats 2400 calories per day will also eventually arrive at a weight of 200 pounds because at 300 pounds her maintenance requirement exceeds 2400 calories. In fact with this model, anyone who has a constant net caloric intake of 2400 calories will eventually weigh 200 pounds, regardless of his or her current weight.

This means that in a cross-sectional sample of individual observations, there is no reason to expect to find a connection between weight and net caloric consumption when a significant part of the sample is not at their equilibrium weight. This is especially significant in a country like the U.S. where a large portion of the population has been gaining weight over the last several decades. Unless the sample is restricted to individuals whose weight is stable, the common econometric structure regressing obesity on eating, exercise, TV watching, etc. is severely flawed. By integrating the differential equation for weight gain, solving for W(t) and using La Hopital's rule to take the limit of W(t) as t gets large, we see that the *equilibrium weight* is [NC-α0]/α1 . Therefore, given the parameters of the model, a person's equilibrium weight is totally determined by net rate of caloric intake. However, for those whose weight is not in equilibrium (possibly a large percentage of the population), there is no necessary relationship of any kind between a person's weight at a point in time and the net rate at which they are consuming calories. For example, one could find 100, 200, 300 and 400 pound people all who have a net caloric intake of 2400 calories. The weight of the first person would be increasing, while the third and fourth persons' weights would be decreasing. Only the second person would have a stable weight at 200 pounds. A sample of these four people would have a beta of zero if weight were regressed on net caloric consumption.

In general, if some people in the sample are not at their equilibrium weight, the partial effects of exogenous variables on weight can be estimated accurately only when the rate of change in weight is also accounted for. This may be seen by re-arranging the differential equation for weight by putting the rate of change of weight on the right hand side:

$$W(t) = -\frac{\alpha_0}{\alpha_1} + \frac{1}{\alpha_1} NC(t) - \frac{1}{\alpha_1 \phi} \frac{dW}{dt}.$$

Therefore, when obesity (W) is regressed on net caloric consumption (NC), we are really estimating a reduced form with an omitted variable, if the rate of change of weight is omitted. Since we know that the rate of change of weight is not orthogonal to net caloric consumption, the estimates of the reduced form coefficients will be biased. This is especially important in the context of a country, like the U.S. where a substantial proportion of the population is gaining weight.

Suggestions for Model Specification

Obesity is an important social problem which unfortunately has been the victim of a fair amount of junk science in the popular press. Creation of a multivariate multi-equation dynamic structural econometric model of individual obesity with correct functional forms suggested by nutritional scientists (rather than linear approximations) could make a significant contribution to public policy decisions.

The basic overview might be as follows. Let **X** be a vector of predetermined variables measuring individual physiologic characteristics such as age, height, thyroid function, etc. Let **Y** be a vector of choice variables such as diet and exercise choices. Since maintenance calories might be affected by choices as well as individual characteristics and body weight (W), let M = m(**X,Y,**W). Total caloric intake may also be of the form C = c(**X,Y,**W). Since the amount of

calories consumed by a 300 pound person running a mile might be more than what a 100 pound person would use, the function describing calories burned by activity choices may also be of the form B = b(**X,Y,**W). Hopefully, the physiology literature can give some guidance for the proper functional forms for these functions, which probably will involve some non-linearities. Then, the basic differential equation would probably be:

$$\frac{dW}{dt} = f\left(C - B - M\right)$$

where f, again, has the proper functional form. Even using linear approximations for these equations may be a significant improvement over single-equation models with obesity or the probability of obesity as the dependent variable. The dynamic problems may be avoided by using the rate of weight gain (loss) as a dependent variable rather than weight or obesity.

Discussion and Implications

An accurate and full understanding of the interaction of food choices (including what is commonly referred to as "junk food" and other quantity and quality factors), lifestyle choices (including work and leisure choices), and weight status is critical to the development of sensible policy choices. The news is full of blanket condemnations of the current evil, be it "fast food," "junk food," "too much TV," "too little exercise," or "inadequate physical education in the schools." A better understanding of the causes of obesity will help us get the policies right so that they have the intended effects. Individuals will then be able to make choices based on sound science.

One of the principal implications of our findings is that they argue against a simplistic explanation of the obesity problem. Similarly, our findings argue against a simple solution, i.e. eliminating the simple cause. It is tempting to fall prey to the fallacy that coincident events must somehow be related and to search for a cause and effect relationship. Over the last few decades obesity rates have increased along with the consumption of junk food, sales of video games, and a decline in physical education in the schools. It is tempting to blame some or all of these factors for the rise in obesity and it is easy to construct a convincing rationale for the case. Of course, the last few decades have also seen the introduction of cell phones, widespread adoption of the Internet, and rapid social change. Which of *these* factors, if any, is responsible for the rise in obesity? The search for a single cause and a single solution grossly oversimplifies a problem that is almost certainly extremely complex.

The attention surrounding the publication of findings implicating a single cause of a health problem is often substantial. We are frequently told that a single factor is associated with an increased or decreased risk of a disease. The natural reaction is to avoid the poison and seek the cure. However, after numerous food scares and warnings, what are we to believe? First caffeine is bad for you, then it's good for you. Alcohol is bad for you ..... well maybe alcohol in moderation is actually beneficial. What are Joe and Jane consumer to believe? The outcome is a confused public that has tried many of the quick fixes that have failed to solve its problems and eventually becomes inured to health and nutrition news of any kind. Furthermore, the sound-bite

nature of most news reporting makes it difficult to sort out "good" science from "junk" science and encourages the proclamation of simple prescriptions that do not accurately reflect the complexity of the problems.

Despite the widespread nature and increasing severity of the problem, little progress has been made in addressing the obesity epidemic that is sweeping the U.S. and much of the developed world. The problem is severe. It manifests itself in poor health, time away from work, higher public and private health costs, and increased mortality rates. We don't have a good understanding of the causes and potential solutions and we certainly don't know what public policies might be most effective. What is needed is research that incorporates the best medical and social science to develop an understanding of the complex causes of obesity both at both the individual and societal levels. This knowledge could serve as a basis for sound public policy that could help consumers make informed choices and encourage the pursuit of healthy lifestyles. There are a host of public policy issues associated with the obesity epidemic that could be informed by a better understanding of how the various factors interact to influence weight gain and weight status. For example, we expect that much public policy would be targeted at schools where the audience is impressionable and lifelong diet and exercise patterns are in the formative stages. Notable programs include school lunch programs, policies on what types of food and beverages may be served on campus, physical education and after school sports programs, and curriculum addressing nutrition and exercise. Restaurants have also been the subject of significant debate regarding the impact of "fast food" on weight status. Recently, Los Angeles banned new fast food restaurants in the low income area of south Los Angeles. Policies encouraging or discouraging certain types of restaurants and the availability and placement of nutritional information could benefit from a better understanding of the causes of obesity. Finally, given the importance that diet and exercise play in the nation's health, government has an interest in educating citizens to lead healthful lives. From an economic perspective, policies that encourage healthy eating and exercise may translate into more productive workers, less time off due to sickness, and lower health care costs for companies and governments.

The food industry also has a large stake in the public policy debate over the causes of obesity. Policies and regulations concerning where and when their products may be sold, how they are taxed, and what information must be made available to consumers will be influenced by our collective understanding of how food consumption affects weight status. There are many opportunities for food companies to exploit the obesity epidemic. Over the years, many companies have tried to market the diet food of the day to Americans hungry for the latest slimming fad-food. More recently, Kraft has marketed "100 Calorie Packs" of items including Oreos, Chips Ahoy, and Wheat Thins. Disney has recently partnered with Imagination Farms to sell Disney-branded fruits and vegetables to children. A more complete understanding of the causes of obesity should enable companies to profitably design, package, and market products that will enable consumers to make wise, healthful choices.

Concluding Comments

Even though it is preposterous to suppose that the cause of the obesity epidemic is either single-equation or univariate, a formal test of this type of causal relationship between per capita "junk food" consumption and the rate of obesity shows that the lack of evidence in support of Granger

causality in either direction is nearly total. We also showed that there is no relationship between a person's weight and how much he or she eats and exercises. Rather, these factors determine whether a person is gaining or losing weight (not actual weight). The implication of this result is that studies in which current weight (or the proportion of the population that is overweight) is regressed on factors related to current eating and exercises habits are seriously flawed. We should be very cautious in interpreting the results of these studies, which have serious specification error. Of course, our research neither suggests that food choices are not an important causative factor in the obesity epidemic, nor that obesity is not an important factor in food choices. Almost certainly, the actual causal structure of obesity is multi-equation, multi-variate, and dynamic. A more promising approach for econometric models is to use the rate of weight change as a dependent variable rather than weight when trying to determine the partial effects of things like "junk food" consumption, TV watching, etc. In general, more attention needs to be paid to the underlying thermodynamics in econometric research of obesity, and over-simplified explanations must be avoided. The popular press is rife with this articles that gloss over the complexities and then do not pass the test when confronted with the evidence. Perhaps the media should stick to their time-honored "man bites dog" stories rather than pretending to contribute to the discourse on public policy.

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Do Market Oriented Firms Demonstrate Clarity on Their Value Discipline? Evidence from Illinois Beef Producers

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Abstract

A market orientation has been shown to lead to improved firm performance in a variety of industries (Narver and Slater, 1990; Deshpande et al., 1993). In previous research, it has been argued that performance benefits are a result of a greater awareness of the sources of value the product provides to the consumer, without specifically describing how value was created. Treacy and Wiersema (1993) developed the concept of value disciplines, which are three distinctive means of value provision, namely operational excellence, customer intimacy and product leadership. More recently, Narver et al. (1998) argued that market oriented firms have a clear understanding of how they provide value to customers, but this assertion has yet to be empirically tested. A new scale was developed and tested to measure the choice and clarity of value discipline. Using a sample of 343 Illinois beef producers, results show that organizational learning, innovativeness, and extreme levels of market orientation contribute to value discipline clarity while moderate levels of market orientation have the opposite effect.

Keywords: innovation, market orientation, organizational learning, value disciplines

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Introduction

Over the past two decades the concept of a market orientation has been extensively developed and tested (Narver and Slater, 1990; Kohli and Jaworski, 1990; Day, 1994a). Findings suggest market oriented firms achieve superior performance driven by their superior ability to market products and services that more accurately match the expressed and latent needs of consumers (Narver and Slater, 1990). The degree of success in matching product to consumer is based on the distinct capability of the market oriented firm in transforming information into knowledge. Firm knowledge is leveraged to tailor the product in a manner which provides superior value relative to available alternatives. Extending this principle, Treacy and Wiersema (1993) argue that the choice of product and customer is not separable. Product choice, and the method of providing value, effectively limits the customer base to a specific group of customers with a harmonious value proposition. To be able to successfully market one's products and services, awareness of the target audience and their specific value proposition is vital.

A market orientation has been defined as a business culture which focuses on continuous value creation for the customer (Narver et al., 1998). In the search for opportunities to create value, it is extremely important to understand how the product in question fits into the buyer's value chain. Superior awareness allows the market oriented firm to focus on the specific attributes of the product the purchaser actually values (Anderson et al., 2006). Greater awareness has been argued to help market orientated firms express "clarity on their value discipline and its value proposition" (Narver et al., 1998; pg 243). Value discipline clarity enables the market oriented firm to more accurately determine specific attributes they can provide based on their own core competencies. This avoids the pitfall of trying to become all things to all customers. If the firm does not have clarity of focus on a specific value discipline, it could become "stuck in the middle," where the firm strives to compete on all possible sources of value rather than focusing on one specific area of value (Porter, 1985). Unfortunately, this often leads to the firm being mediocre in all sources of value rather than excellent in any.

Value is defined as "… the worth in monetary terms of the technical, economic, service, and social benefits a customer company receives in exchange for the price it pays for a market offering" (Anderson and Narus, 1998; pg. 54). Based on this definition, a firm could provide value to consumers in myriad of ways. Treacy and Wiersema (1993) clarified this discussion by developing the idea of separate value disciplines, which focus on the specific means of providing value. These disciplines include *Customer Intimacy, Product Leadership, and Operational Excellence,* and each value discipline can be thought of as relating to a singular component of the definition of value.

The choice of value discipline to follow is therefore vitally important as it will define both the market as well as the search for resources to build core competencies needed to succeed within the chosen discipline. This choice does not occur within a vacuum, however. While many firms within agriculture have focused on becoming the low-cost leader, strategy heterogeneity has important implications in terms of firm and industry performance. Traditionally, cattlemen as a whole have focused on improving performance through efficiency, and a possible consequence of this lack of diversity has been mediocre performance (see Jones, 2000). This is consistent with the theory that strategy imitation leads to weakened performance for the entire industry (Porter, 1991).

Outside of agriculture, strategy and marketing scholars have long argued knowing what customers value is an important resource. Leveraging this knowledge, a firm can build the specific core competencies needed to provide value, and speed of transforming information into knowledge may ultimately be a source of competitive advantage. Unfortunately, a dearth of research has been conducted examining the market orientation-clarity link put forth by Narver et al. (1998). To test this relationship, a scale has been developed to measure value discipline clarity. Using a sample of Illinois beef producers, we test our value discipline scale based on four components of the value proposition, specifically product quality, channel relationships, pricing and production.

The relationship between market orientation and value discipline clarity is important as the location of a firm on the value triangle (relative to competition) has serious implications concerning the ability of the firm to defend their strategy choice (i.e. how they provide value to the customer) long-term. Furthermore, awareness of value disciplines allows for investment in the specific resources needed to build core competencies required to sustain a strategic position within a specific value discipline. The objective of this paper, therefore, is to determine if market oriented firms are more focused on the means of providing value to their customers.

Foundations and Implications of a Market Orientation

In order to continuously provide value the firm must be aware of the buyer's value chain and how the product actually provides value to the customer. Market oriented firms may be better equipped to discover and capitalize on this awareness. A market orientation has been defined as a corporate culture which stresses the continuous creation of customer value (Narver et al., 1998). Kohli and Jaworski (1990) go further in defining a market orientation as the managerial actions manifested in the search for market information, the spread of this information within the firm, and the managerial response to the market information. Upon closer examination, it would seem managerial actions are consequences of a market orientation culture within the firm. Firms which have in place a culture that stresses the need to consistently create superior value for the customer – through differentiated products, efficient production, or other means – will actively seek out information as to how to best meet the needs of the market.

Focusing on the search for customer value, Narver and Slater (1990) empirically measured market orientation as three singular, but equally important behavioral components, namely a customer orientation, a competitor orientation, and inter-functional coordination. A customer orientation enables the firm to determine what specifically is valued by the customer. While a customer focus allows market oriented firms to determine which products and services are currently valued by the market, a market orientation, however, is more than simply being customer-led (Slater and Narver, 1998). A competitor orientation allows the firm to analyze whether desired attributes are being adequately met by competitors. Taken together, this is akin to a traditional SWOT analysis. A decision on whether to compete directly for this market segment is based on market characteristics and the current capabilities of the firm.

Inter-functional coordination refers to the transfer of market knowledge between managerial groups within the firm. The interaction of the three behavioral components of a market orientation is integral to the firm's strategy formulation and implementation process (Homburg et al., 2004). Internalizing this valuable information leads highly market oriented firms to a clear

understanding of various means to provide value for customers, potentially in a less highly competitive market.

Market orientated firms have been found to have superior performance across a wide range of industries and cultures (Narver and Slater, 1990; Deshpande et al., 1993; Pelham, 1997). By offering products which uniquely meet the specific needs of customers, firms have been able to see increased returns as well as improved success rates of new products. While Pelham (1997) questioned the performance implications of a market orientation in commodity industries, Narver and Slater (1990) found a U-shaped relationship between market orientation and performance. That is, firms with low and high levels of market orientation outperformed business units with average levels of market orientation. While this dichotomous relationship may provide short-term performance benefits to both extremes of market orientation; the benefits to highly market oriented firms may be more sustainable as their focus is not solely on the product, but rather on the specific needs of the market (Day, 1999).

More recently, Menguc and Auh (2006) found the dynamic capability of identifying opportunities to create value increased with both market orientation and innovation. The development of similar dynamic capabilities could be the reason underlying the results of Langerak (2003), who found the positional advantage (cost or differentiation advantage) of the firm increased with the level of market orientation. By the adoption of a customer and competitor orientation, market oriented firms were found to outperform less market oriented rivals. Dynamic capabilities developed through a market orientation have also been shown to improve new product advantage and launch success (Langerak et al., 2004). This success, however, may be limited to those firms with a proactive form of market orientation (see Narver et al., 2004 and Atuahene-Gima et al., 2005).

The divergent forms of market orientation and the consequences of each have important ramifications in terms of value discipline clarity. As shown in the results of Atuahene-Gima et al. (2005) firms with a responsive market orientation need to be extremely market oriented to successfully develop and launch new products. Conversely, proactive market oriented firms may see performance and new product launch success at lower levels of market orientation. Further, proactive market oriented firms may be able to determine opportunities for discontinuous leaps in the customer's value proposition, thereby transforming the firm from one who is driven by the market to one that is driving the market (Jaworski et. al, 2000; Kumar et al.., 2000; Tuominen et al., 2004).

While much research has been done on the subject of market orientation, unanswered questions remain. Many of these studies examine the market orientation-performance link and attribute success to providing superior value relative to that of rival firms. The question is how do market oriented firms provide superior value? Is their method of value provision clearly defined relative to rival firms? Secondly, are firms with a proactive market orientation more apt to be on the vanguard of value provision in a specific industry? This study hopes to enlighten the discussion regarding the clarity of value provision, while also examining if extreme levels of market orientation are necessary in order to perform the clarification task adequately.

Theoretical Foundations of Value Disciplines

Treacy and Wiersema (1993) developed three distinct value disciplines firms can implement. Each value discipline is based on the specific value proposition for the product in question. This development is an extension of Porter's (1985) work on competitive advantage where firm strategies are grouped into two generic categories (low-cost and differentiation) in conjunction with two types of market focus (broad and narrow). Porter argues value creation must first begin with an assessment of how the product fits into the buyer's value-chain. Depending on several factors, buyers may prefer a product with standardized attributes at a lower cost or a product with augmented attributes which garner a premium price. Superior value is created when the difference between perceived value and the cost of acquisition is greater than the value created by alternative products.

Treacy and Wiersema (1997, pg xiii) point out that the choice of value discipline "...defines what a company does and therefore what it is." The question remains, what is value discipline clarity and why is it important? Value discipline clarity refers to a singular focus on a specific discipline the firm uses to provide value to the customer. Treacy and Wiersema (1993) argue firms should focus on one source of value provision for the customer while maintaining industry standards in the remaining components. With a clear focus on the means of providing value, the firm can begin to build the resources and competencies needed to meet this objective. Unfocused firms do not have a clear understanding of the 'how' underlying the concept of value creation. As such, they are not able to develop and strengthen important competencies and their disjointed efforts dilute the company's offering.

Amassing the core competencies needed to meet the minimum requirements of each customer through a singular product is either impossible or prohibitively expensive. Therefore, Treacy and Wiersema (1997) argue, firms should choose one value discipline and build core competencies around achieving that goal. They go on to develop four 'Rules of Competition' (1997, Ch 2).

Rule 1: Provide the best offering in the marketplace by excelling in a specific dimension of value.

Rule 2: Maintain threshold standards in other dimensions of value.

Rule 3: Dominate your market by improving value year after year.

Rule 4: Build a well-tuned operating model dedicated to delivering unmatched value.

The Development of a Valid Measure of Value Disciplines

In order to measure value discipline clarity, a scale was developed as no existing scale could be found following a thorough search of the literature. Each value discipline is hypothesized to be a one-dimensional construct measuring the means in which a product's value proposition fits within the buyer's value chain. Four components of the value proposition were used, including pricing, product quality, production practices, and relationship building within the channel. This resulted in a multi-item scale measuring each value discipline.

Uni-dimensionality of each specific value discipline measure is necessary in order to properly ensure that the scale is clearly measuring a specific value discipline. Uni-dimensionality is further important as it is hypothesized value discipline clarity is analogous to closeness to the border of the value triangle developed by Treacy and Wiersema (1993). It is important to note, however, that the firm's choice of value discipline is not binding as it can differ across product lines or regions. As firms can employ strategies for long-term profit within each individual value discipline, we present *Operational Excellence, Customer Intimacy, and Product Leadership* as an equilateral value triangle (Figure 1) similar to Treacy and Wiersema (1997, pg 45).

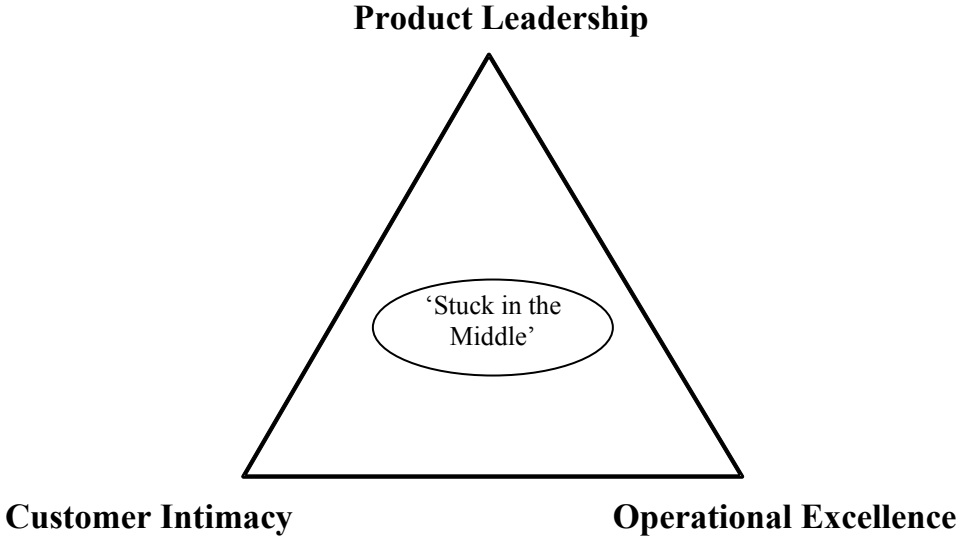

Figure 1. The Value Triangle

Choice of value discipline was measured using a framework similar to Miles and Snow (1987) in their development of strategy typologies. Specifically, producers were shown three statements relating to a particular value discipline. Each statement was framed in a manner that removed any ambiguities about which value discipline it was referring to, stopping short of identifying the value discipline by name (See Appendix 2). Within each component of value, producers were asked to assign a total of 100 points among the three statements depending on which statement fit their operation best.

The livestock industry was chosen as a setting for this study as there is growing evidence, anecdotally at least, that all three value disciplines are employed by U.S. cattlemen. Historically, commodity beef producers operated with a strategy focused increasing production efficiency. This was driven by firms not possessing much, if any, control over prices received. Success within this value discipline may be driven by economies of size or scope while providing a standardized product for downstream channel partners. In search of improved financial performance, a growing number of cattlemen are moving towards more aligned production channels (Mulroney and Chaddad, 2005). This growth of production and marketing alliances, along with direct marketing via farmer's markets points to a shift away from an operational

excellence (OE) value discipline to one with an increasing focus on customer intimacy (CI). Producers operating within the CI value discipline focus on discovering unmet customer needs and delivering tailored solutions leveraging close relationships built through repeated transactions. Channel relationships can be valuable sources of information and could allow producers to rapidly meet the specific requirements of consumers and potentially earn premium prices[1] for doing so. The value of relationships can also be seen at the aggregate level as various production alliances endeavor to market products using in-store promotions where actual producers interact with consumers or through the provision of producer profiles on alliance websites.

A product leadership (PL) value discipline is demonstrated through the rapid development or adoption of new technologies (i.e. genetics, tenderness EPDs[2], traceability) that aid in the successful implementation of new and innovative production strategies. Some alliances may operate within a product leadership value discipline as they continually search for new products to market containing various attributes ranging from grass-fed to natural, to sustainable. [3] Even with the increasing segmentation of the beef market, there are still a considerable amount of producers who operate anonymously through the commodity market and an operational excellence value discipline.

Sampling Frame and Data Collection

The sampling frame for this study consists of producing members of the Illinois Beef Association in 2007. The membership list was examined and obvious commercial businesses not directly involved in beef production were removed from the population. A total of 1,570 informants received a mailing which included a letter from the researchers outlining the study and a questionnaire. A reminder card followed two weeks after the initial mailing. A second questionnaire was mailed to non-respondents after a subsequent two weeks. A total of 343 usable responses were received after two waves of mailings, yielding a response rate of 21.8%. Respondents were active in both the cow-calf and feedlot segments of the production channel with an average of 77 calves raised and 495 head of cattle fed out in each respective group. Survey respondents had, on average, 32 years of experience in the cattle business. Nearly 25% of respondents (80 out of 343) indicated that they participate in some form of alliance production.

Construct Validity and Reliability

Following the development of the value discipline scale, it was tested for both validity and reliability. Content validity is a qualitative measure used to assess the clearness of the scale as well as the ability of the scale to measure the concept in question. This was assessed using both academics and practitioners who read and commented on the clearness of the scales. Construct validity was measured through a Confirmatory Factor Analysis (EFA) approach. In this method, the goal is to explain the correlation between the observed variables and the underlying latent

[1] A price differential that reflects the value of the business relationship or the information transferred in the transaction.
[2] Expected Progeny Differences (EPDs) are utilized by producers to predict probable differences in specific characteristics of future offspring from a specific animal.
[3] For example, see the case of Country Natural Beef described in Campbell, D. (2006).

structures (Bollen, 1989). In this case, the underlying latent variables are the specific value disciplines.

$$1) \qquad x = \Lambda_x \xi + \delta$$

The structural equation depicted in (1) can further be described in matrix form as:

$$2) \qquad \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \\ x_9 \\ x_{10} \\ x_{11} \\ x_{12} \end{bmatrix} = \begin{bmatrix} \lambda_{11} & 0 & 0 \\ \lambda_{21} & 0 & 0 \\ \lambda_{31} & 0 & 0 \\ \lambda_{41} & 0 & 0 \\ 0 & \lambda_{52} & 0 \\ 0 & \lambda_{62} & 0 \\ 0 & \lambda_{72} & 0 \\ 0 & \lambda_{82} & 0 \\ 0 & 0 & \lambda_{93} \\ 0 & 0 & \lambda_{103} \\ 0 & 0 & \lambda_{113} \\ 0 & 0 & \lambda_{123} \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \\ \delta_8 \\ \delta_9 \\ \delta_{10} \\ \delta_{11} \\ \delta_{12} \end{bmatrix}$$

The reason underlying these measures is that if a survey item (x_i) measures a specific construct (ξ_i) it is reasonable to assume a change in the latent construct would lead to a change in the measurement item. Factor loadings which represent these relationships (λ) are shown to be greater than 0.618 which would signify that the items are measuring the scale intended (Table 1).

Variance extracted for all value disciplines is greater than 50% indicating that the variance explained by the scale is greater than the variance that is attributed to measurement error (Fornell and Larcker, 1981).

Internal consistency for the value discipline scale was tested using a split-sample method suggested by Churchill (1979). Reliability analysis was conducted on the first sample and was repeated on the second sample. Following initial purification of the scales, construct reliability was tested on the full sample. The items measuring production practices did not have item-to-total correlations exceeding the threshold recommended by Streiner and Norman (1995) and were removed from the scales. From the remaining items, coefficient alphas for each value discipline exceed 0.60, the threshold suggested by Nunnally (1978) for exploratory research (Table 2).

The Effect of Market Orientation on Value Discipline Clarity

Drivers of Value Discipline Clarity

It is hypothesized that a market orientation could lead the firm to a specific means of providing value to the market. A customer orientation generates market intelligence as it relates to buyers and the value proposition of the product in question. Armed with this knowledge, firms can

begin to improve the value the product provides. A competitor orientation focuses resources to assess the value proposition being provided by rival firms, and whether the firm should compete directly with a similar product offering based on market conditions, core competencies, and other factors. As firms become more market oriented, or as the culture of market orientation becomes more ingrained in the day-to-day activities of the firm, we would expect increased clarity on how the product offering provides value to the customer. As such, the following hypotheses are presented:

H1a: *Market Oriented firms express clarity on their value discipline.*

Hb: *As market orientation increases exponentially, value discipline clarity increases.*

Innovation can be seen through a variety of prisms. It is often thought that innovative firms continuously develop new products and services, but this is only one method to create superior value for the customer. Combined with a market orientation, firms can utilize innovation to create products and services that are currently not being offered by rival firms (Han et al, 1996). Less technological, Nelson and Winter (1982) characterize innovations simply as a change in routines. Within this characterization, any number of innovations can be used to create value for buyers. Increased communication between segments in the beef industry was an issue that was singled out in the 2005 National Beef Quality Audit (NCBA, 2005). Increased communication could lead to increased value for downstream partners if the communication leads to superior value relative to the traditional, anonymous transactions between segments. A move to direct marketing could also be seen as an innovation as there was a shift from arms length transactions to one based more on relationship development between the parties of the transaction.

Therefore, we present the following hypotheses:

H2: *Innovative firms express clarity on their value discipline.*

Entrepreneurial firms have long been in search of opportunities to create value where others see none. To create profit opportunities, entrepreneurial firms recombine resources to capture unrealized value. Alvarez and Businetz (2001), in describing entrepreneurship within the framework of the resource based view, indicate that "…entrepreneurship is about cognition, discovery, pursuing market opportunities, and coordinating knowledge that lead to heterogeneous outputs" (pg 757). This definition is strikingly similar to the behavioral definition of market orientation developed by Jaworski and Kohli (1993) who state that a market orientation is comprised of intelligence generation, intelligence dissemination, and the firm's response to the market intelligence.

Entrepreneurship within agriculture has focused on the ability for agropreneurs to recognize and react to profit opportunities. Using a simulation model, Ross and Westgren (2006) were able to find positive and significant returns to entrepreneurs in the pork industry. These excess rents were based on the firm's ability to recombine resources in such a manner to create a product which was valued by the market. Firms that are able to determine where opportunities for value creation lie will be better able to focus their attention on the means for providing continuous value for the market in the future. As such, we hypothesize the following:

H3: *Entrepreneurial firms express clarity on their value discipline.*

Slater and Narver (1995) argued that the firm's ability to learn faster than their competition may be their only source of competitive advantage. This may be especially true in agriculture where the majority of innovations put into practice by producers are either easily imitated or substituted. The lack of ex post limits to competition eliminates the ability of the firm to extract rents from the implementation of new technologies. Furthermore, organizational learning has been found to be an antecedent to the development of a market orientation (Day, 1994). A culture which values learning and questions the status quo of the firm will be one that continually searches for the creation of superior value. This culture is likely related to the level of education the manager has attained. The search for superior value and the firm's commitment to learning lead us to our next hypotheses, namely:

H4a: *Firms with a learning orientation express clarity on their value discipline.*

H4b: *As the education level of management increases, so does value discipline clarity.*

Traditionally, agricultural firms focused on increasing production efficiency as a means of increasing profits. As producers of standardized products subject to homogeneous grades and standards, the only way to improve profits and increase buyer value is to produce the undifferentiated product at the lowest possible price. This is a natural fit for an OE value discipline. Furthermore, producers can increase the perceived value by augmenting the standardized product to decrease the cost of ownership. Preconditioning cattle for the feedlot is one method cattlemen can use to increase downstream buyer value within an OE value discipline. However, these opportunities are generally dependent on the speed of imitation by rivals. If the pricing mechanism shifts from price premiums for the provision of the attribute to a price discount for non-provision, then value will again be measured solely on acquisition costs. Hence, we hypothesize:

H5: *Managers with a cost focus experience clarity on their value discipline.*

Along with the behavioral and cultural components, the length of time a firm has been present in the market may also contribute to value discipline clarity. As firms grow and mature, how the product offering fits into the buyer's value chain may become clearer. This clarity can be useful in developing new products or services which can continue to provide superior value for consumers. Firms in their infancy may chase the latest trends in the hopes of earning premium prices without fully understanding the reason for the price premium. While experience may overcome this pitfall, it could also be a hindrance if it leads to a single-minded focus on the current needs of the market as opposed to identifying latent needs. A tunnel vision approach to current customers may provide short-term benefits, while hamstringing the firm's future opportunities as limited attention has been paid to develop the capabilities needed to meet future needs of the market (Hamel and Prahalad, 1991; Leonard-Barton, 1992). These shortcomings, while severe, may not necessarily cause the firm to be unclear on how its current product provides value for the customer. What social embeddedness may cause, however, is the potential of a product in the future to no longer meet the threshold standards of the market.

Therefore, we present the following hypothesis:

H6: *Managers with more experience express clarity on their value discipline.*

Independent Variable Measure Development

Measurement scales from previously published research in the marketing literature were identified and used to construct the independent variables used in this study. These measurement scales were previously intended for management teams of large corporations so the wording of items was modified to fit an agricultural audience. Following modification, the measurement scales were pre-tested by two distinct groups. First, University of Illinois Extension personnel were asked to read through the questionnaire and identify any potentially difficult items and provide comments for their improvement. Following the initial pre-test, a group of beef producers participating in the Illinois Farm Business Farm Management association were sent a questionnaire and asked to read through the survey and comment on any remaining ambiguities. Following this informative feedback, items that were most problematic were revised or removed from the questionnaire.

All independent variables were constructed using multiple-item scales on a six-point Likert scale. The scale used to measure market orientation included items used in the original MKTOR scale first developed by Narver and Slater (1990) as well as the scale used in Narver, Slater and MacLachlan (2004). In this 19-item scale, a firm's market orientation is comprised of their customer and competitor focus as well as the coordination of market knowledge within the firm. The market orientation scale is a hybrid scale as it measures both the reactive and proactive forms of market orientation. To measure organizational learning, 11 items from Farrell and Oczkowski (2002) were used. These items sought to measure the 'learning culture' of the farm business. The entrepreneurial tendency was measured with a 5-item scale used in Matsuno, Mentzer and Oszomer (2002). The indicators measured the inclination of managers to use innovative marketing strategies to improve performance or whether they chose to 'play it safe' when it comes to forming solutions to management problems. Innovation was measured using a 5-item scale tested by Hurley and Hult (1998). Similar to the entrepreneurship scale, the innovation scale measured the penchant for managers to utilize innovative strategies to solve problems on the farm. The final independent variable measures the cost focus of the firm. A cost focus was measured using a combination of scales developed by Homburg, Workman and Krohmer (1999) and Kotha and Valdamani (1995) and consisted of 5 items. The scale measured the manager's focus on production efficiency and cost reduction as a means of improving performance.

Internal consistency of the independent variables was tested using factor analysis with varimax rotation in SPSS to ensure the scales were measuring a distinct construct within the sampling frame of this study. Factor loadings and item-to-total correlations were used to purify the scales. Worthington and Whittaker (2006) suggest to only retain those items where factor loadings are greater than 0.32. Factor loadings can be thought of as regression coefficients. That is, the amount by which the indicator variable will change for a one unit change in the underlying latent variable. Indicators below the threshold were removed from further study. Item-to-total correlations less than 0.2 were also removed in accordance to Streiner and Norman (1995) as they are likely to be measuring a different construct from the other items in the scale.

The lowest factor loading reported is 0.547 for the fourth question in the cost focus scale is shown in Table 3 (see Appendix 1). Further, all item-to-total correlations and factor loadings are well above established thresholds. Cronbach alphas are all shown to be above 0.70, the cutoff for confirmatory research (Nunnally, 1978). Variance extracted for each scale is also shown to be above 50% for all latent constructs. As the extracted variances are above 50%, this demonstrates the variance accounted for by the scale is larger than the variance due to measurement error (Fornell and Larcker, 1981).

Discriminant Validity

Discriminant validity was checked to ensure items were measuring only one distinct construct. Discriminant validity was examined using a method outlined by Fornell and Larcker (1981). They argue discriminant validity is present when the variance extracted of the scale is greater than the square of the correlation between constructs (Table 1).

Together, the results offered in Tables 1-4 (See Appendix 1.) demonstrate that each construct is measuring only one concept as it relates to value disciplines and the factors which may contribute to how clearly a firm expresses their value discipline.

Results

Empirical Model

Following validity checks, a ternary plot (Figure 2) was created using an Excel program (Graham and Midgley, 2000) to show the strategy choice of Illinois producers. Ternary plots are commonly used when analyzing the components of a 3-item mixture when the sum of the components must equal 1. To obtain the coordinates for the ternary plot, the averages across value disciplines were used (e.g., the average customer intimacy score for quality, pricing, and relationship building was used to obtain the customer intimacy coordinate). Value discipline clarity was calculated as the minimum distance from the coordinate to a boundary of the value triangle employing a half-taxi metric (Miller, 2002).

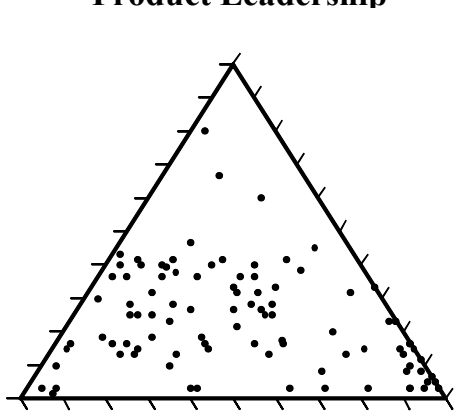

Figure 2. The Value Disciplines of Illinois Beef Producers

The sum of retained items for each measurement scale was used to comprise the independent variables. Scales were centered by subtracting the mean from each item. This was done to prevent multicollinearity when both the individual scale and the square of the scale were used. It was hypothesized that the firm's clarity on their chosen value discipline would be a function of their market orientation (MKTOR), the square of their level of market orientation (SQRMKTOR), their innovativeness (INNOV), their focus on learning (LEARN), their level of entrepreneurship (ENTRE), as well as their cost focus (COST). Experience as measured by years involved in producing beef and a dummy variable where 0 = no college degree and 1 = college degree were also included as control variables.

Empirical Results

An ordinary least squares (OLS) regression analysis was applied to test the stated hypotheses. Similar to the sample for reliability analysis, the OLS regression utilized a sample of 344 Illinois beef producers. While the sample includes producers within the cow-calf and feedlot segments, as well as alliance and non-alliance production practices, a pooled sample was initially tested. The results are presented in Table 5.

Six of the eight independent variables have significant coefficients, with four of the six significant at the 0.05 level. Neither education nor the level of entrepreneurship had any discernable effect on value discipline clarity, or lack thereof, as shown by the insignificance of the coefficient. The insignificance of these variables could be caused by many factors. As this sample covers only one year firms could be in various stages of an entrepreneurial shift in value discipline, clouding the ability to ascertain the effect of entrepreneurship on clarity.

Table 5. The Effect of Market Orientation on Value Discipline Clarity

	MKTOR	SQRMKTOR	LEARN	ENTRE	INNOV	COST	Experience	College	Constant
Expected Sign	-	-	-	-	-	-	-	-	
Unstandardized Coefficients	0.190*** (.044)	-0.006** (.002)	-0.378* (.201)	0.219 (.197)	-0.363** (.173)	0.361** (.172)	0.055* (.030)	-1.007 (1.036)	15.05*** (1.661)
Standardized Coefficents	.241	-.142	-.119	.062	-.140	.137	.097	-.052	
t-statistic	4.305	-2.704	-1.882	1.111	-2.102	2.098	1.851	-.972	9.060
Significance	.000	.007	.061	.267	.036	.037	.065	.332	.000
N = 343, r-squared = .129, adjusted r-squared = .108									

The effect of a market orientation on value discipline clarity is opposite of the proposed hypothesis. The positive sign indicates that as firms' increase their market orientation, their focus on a single value discipline lessens. Again, this could be caused by having only one year of data. A plausible explanation could be that firms who have just begun to develop their market orientation have shifted their focus, possibly to an entirely different value discipline. The square of market orientation, however, has a negative coefficient, as hypothesized. Here, highly market oriented firms are able to increase their focus on a specific value discipline.

Firms with a learning orientation were also shown to express clarity on their value discipline as shown by the negative coefficient. This fits with the statement by Slater and Narver (1995) who challenged that a firm's only true source of competitive advantage is their ability to learn faster than their competitors. Conversely, experience seemed to make unclear the specific value discipline of the firm. This is contrary to the stated hypothesis but may provide preliminary evidence to demonstrate the adverse effects of social embeddedness within changing markets.

The negative coefficient on firm innovation confirms hypothesis 2. The results indicate innovative firms are able to modify routines and practices in order provide products which more closely fit into the buyer's value chain. Innovation does not have to be technological, however, as can be seen through the positive coefficient on the cost focus variable. Similar to the experience results, a cost focus has long been the dominant strategy in agriculture. Firms who are focused solely on cost efficiency may, as Day (1999) argues become oblivious to the market and lose sight of their product's ability to maintain industry standards, thereby decreasing the value the buyer places on this product.

Discussion

The objectives of this study were to develop a value discipline scale and to determine if market oriented firms were more explicit in how they provided value to customers. Findings were mixed, leading to a need for careful discussion as to the importance of a market orientation in determining value discipline clarity. Results indicate moderately market oriented firms are not explicit in their self assessment of how they provided value to downstream partners or customers. In fact value discipline clarity decreased, as interpreted by the positive coefficient, as market orientation increased. This result contradicts our hypothesis as well as that of Narver et al (1998). An important consideration is that our measure of market orientation measures only the quantity, *not the quality,* of the market oriented behaviors of the firm (Day 1994b). Furthermore, as this is the first attempt to measure the market orientation-value discipline relationship, additional research is warranted.

The square of market orientation was found to influence value discipline clarity. As market orientation was measured using a centered scale, careful interpretation is needed. High squared market orientation values are associated with firms with extreme levels of market orientation. In this case, producers with both extremely high and extremely low levels of market orientation were shown to clearly express their choice of value discipline. A possible explanation may be that firms with extremely low levels of market orientation may operate within the operational excellence value discipline, and through social embeddedness, focus solely on producing a low-cost product. Almost by default, they express clarity on their value discipline as they feel controlling costs is their only means of increasing profit.

In combination, these results seem to be consistent with the U-shaped relationship between market orientation and performance found by Narver and Slater (1990) as well as the market orientation-new product success results from Atuahene-Gima et al (2005). In these studies, researchers observed initially that an increased market orientation led to decreasing performance up to some point. Only after a firm achieved a high level of market orientation did increased

performance or launch success result. The relationship between market orientation and value discipline clarity may be explained similarly (Figure 3).

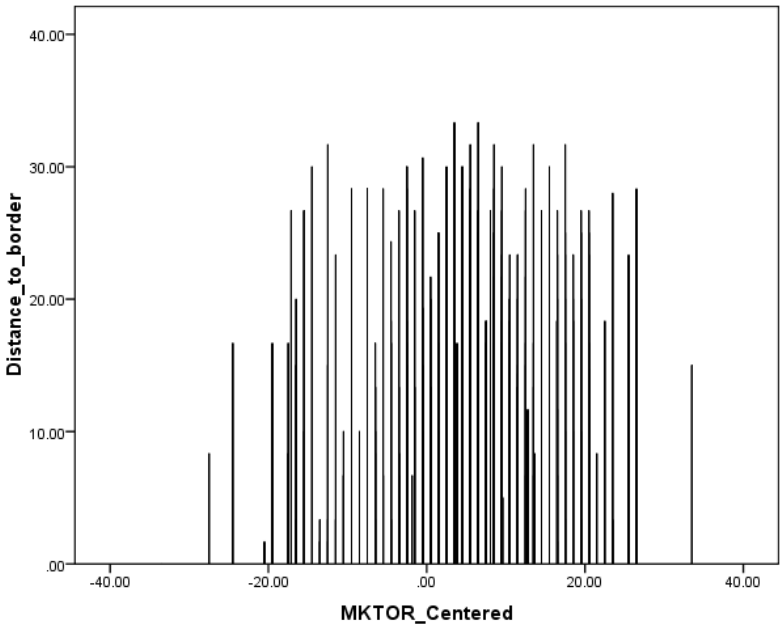

Figure 3. Market Orientation and Value Discipline Clarity

Narver and Slater (1990) argue highly market oriented firms should focus on determining customer needs, and the most efficient method to meet these needs. Beef producers with extremely high levels of market orientation may be displaying the characteristics presented by Narver et al (1998) such as value discipline clarity, market leading as opposed to following, and seeing themselves as service providers. By focusing on current and future customer needs, highly market oriented firms may be able to effectively remove themselves from the 'commodity' market even while participating in it. Through a market orientation, they are able to alter their specific product offering to provide attributes which are a source of value for downstream partners as well as final customers.

Managerial Implications

Slater (1997) said "…superior performance accrues to firms that have a customer value-based organizational culture (i.e., a market orientation), complemented by being skilled at learning about customers and their changing needs and at managing the innovation process, and that organize themselves around customer value delivery processes" (pg. 164). Firm profit is therefore a function of market knowledge, customer awareness, and the innovation needed to capitalize on this knowledge, which has been shown in empirical studies (see Narver and Slater, 1990; Baker and Sinkula, 1999; Farrell and Oczkowski, 2002). Firms with improved information sources may find opportunities to leverage superior information into improved market knowledge which eventually may become a source of sustainable competitive advantage.

Earlier research examining the market orientation-performance link focused on the broad definition of 'value' without specifically answering 'how' the firm created value for the customer. This paper presents opportunities to begin answering the question of 'how' a firm might provide superior value and thus achieve superior performance. Without awareness of the 'how' of value creation, the strategy of creating value is at risk of becoming a generic strategy similar to Porter's (1985) differentiation and low-cost strategies. Specifically, the firm needs to focus on how value is created, not an abstract concept of value. Through improved awareness of the specific of value discipline vis-à-vis rival firms, highly market oriented and innovative firms will be able to determine the appropriate strategic response.

Results point to opportunities for highly market oriented and innovative firms. Given superior knowledge of how value is provided vis-à-vis rival firms, highly market oriented firms may be able to focus on improving the means of value provision by increasing core competencies. Further, highly market oriented firms may be able to not only map how they fit into the value triangle, but how their close competitors fit as well. Competitor mapping may be invaluable if the firm is considering an investment in resources which could be leveraged in the creation of further value.

These results also provide opportunities for underperforming firms which find themselves in the middle of the value triangle. With improved information, underperforming firms can determine the proper method for competing in the chosen market based on their current capabilities. This may entail further investment in, or refinement of, their core competencies and the degree that these match the chosen strategy. Strategy refinement may allow the firm to remain on (or move toward) the vanguard of value provision within a specific value discipline. Conversely, increased awareness may signal an opportunity for improved performance through a shift to a less competitive landscape (Kim and Mauborgne, 2005).

Within the beef industry specifically, and agriculture in general, awareness of one's own value discipline as well as the value discipline of close competitors may be important as more and more alliances are formed in search of improved performance. For independent producers, awareness of their value provision may allow them to select the appropriate value chain based on shared values. Value discipline awareness may also have strategic benefits for new entrants. Depending on the characteristics of the market, new entrants may choose to compete by providing products which are not in direct competition (in a value discipline sense) with those of already established firms. Rather than competing directly on innovation capability, for instance, new entrants may see better opportunities through the provision of more direct relationships via a customer intimacy framework.

Theoretical Implications

Value discipline clarity, therefore, may be a moderating factor in the ability to transform a market orientation into firm performance. Firms with increased clarity may be better able to generate information relating to new sources of value for consumers. This information may lead to the more rapid development of new offerings which deliver attributes which more closely meet the latent and expressed needs of the market. Furthermore, a high market orientation combined with elevated levels of entrepreneurship and innovation may enable the firm to

migrate from a highly competitive position (i.e. commodity beef) to a niche where market size and customer relationships, once established, provide significant barriers to entry.

While the performance benefits of becoming more market oriented are well established even in commodity markets (see Micheels and Gow, 2008), there may be other benefits as well. If market oriented firms are able to move to a less competitive market, or closer to the border of the value triangle in highly competitive markets, they may benefit from occupying a more 'defendable' position relative to rival firms. Firms along the border of the value triangle may be what Kohli et al (2000) describe as market-driving, whereas market oriented firms not on the border of the value may be market-driven. Market driving firms are characterized by their ability to anticipate changes in the market ahead of their competitors or simply creating market changes themselves. Market driven firms, however, are more reactive in nature and are thus not able to achieve any first-mover advantages which may accrue to their market driving counterparts. This perceived disadvantage may be potentially offset by second-mover advantages such as lower search and implementation costs.

Limitations and Future Research

This study, while being the first to test the relationship between market orientation and value discipline clarity, has some limitations. First, the sample includes only one year of data on market orientation and value disciplines for Illinois beef producers. As the creation of a market orientation and the choice of value discipline is a dynamic process, a longitudinal study may elucidate the relationship between market orientation and the choice of value discipline. Internal consistency and reliability of the value discipline scale exceeded the thresholds for exploratory research, but further refinement of the scale is warranted. Purification of the value discipline scales, as well as the inclusion of other components of the producer value proposition would be worthwhile endeavors for future research.

This preliminary research contributed to the market orientation literature as well as the agricultural economics literature by developing a scale to quantify a firm's choice of value discipline. Future research may examine differences in relative importance of innovation, entrepreneurship and market orientation across value disciplines, as well as determining whether there are differences in performance across value disciplines. These potential research agendas have broad policy and managerial implications as agriculture moves forward in an ever-changing customer-driven marketplace.

Conclusions

The objectives of this study were 1) to develop a measure to quantify value discipline choice and clarity, and 2) to determine if a market orientation increased value discipline clarity. A scale to measure a firm's choice of value discipline was developed and tested using a sample of 343 Illinois beef producers. Results indicate highly market oriented firms are clearer in their means of value provision. Firms which can clearly define how they provide value may be more precise in their development of the specific capabilities needed to provide continuous superior value for customers.

Results show that highly market oriented beef producers express clarity on their value discipline, partially confirming the hypothesis of Narver et al (1998). In doing so, a new scale was developed to measure the firm's choice of value discipline. This scale was constructed in a manner similar to Miles and Snow's (1987) strategy typologies. Following the development of their scale, much research was done on the differences between *analyzers, prospectors, reactors, and defenders.* Research examining the cultural differences and performance outcomes of firms within the different value disciplines could provide fruitful opportunities for other scholars. As a growing number of firms eschew the commodity market in favor of a more differentiated approach, it will become increasingly important to know exactly how to provide the most value relative to the competition. The search for value within these highly competitive markets may lead to dramatically different methods of sustaining superior value creation. The choice of appropriate methods and the requisite core competencies will depend on the specific value discipline of the firm. As channels of communication evolve within once adversarial value-chains, market oriented firms will be better positioned to create a valuable product based on specific relationships, product innovations, or low cost of acquisition and ownership.

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Appendix 1.

Table 1. Value Discipline Construct Validity

		Factor Loadings		
Item	Variance Extracted	Customer Intimacy	Product Leadership	Operational Excellence
Customer Intimacy	68.98%			
We are able to set or negotiate above market prices due to our close relationships		0.803		
We try to develop individual business relationships		0.872		
Through our close relationships with customers, we adopt practices to ensure our product meets customer specs		0.814		
Product Leadership	55.65 %			
We are continuously developing new technology that provides us a price advantage			0.618	
We are recognized as a leader in innovation of new beef production technologies and are able to establish product differentiation			0.801	
Innovative technologies allow for the screening and selection of animals through the production process to ensure quality			0.803	
Operational Excellence	73.52%			
We are unable to influence prices we received so we rely on increasing efficiency				0.800
We are generally not aware of exactly who our customers are and do not establish relationships with them				0906
We only invest in minimum process control systems				0.863

Table 2. Value Discipline Reliability Analysis

	Sample 1 N1= 195		**Sample 2** N= 148	**Combined Sample** N = 343	
Item	Cronbach Alpha %	Item-to-total Correlation	Cronbach Alpha	Cronbach Alpha	Item-to-total Correlation
Customer Intimacy	0.729		0.794	0.761	
We are able to set or negotiate above market prices due to our close relationships		0.498			0.558
We try to develop individual business relationships		0.599			0.657
Through our close relationships with customers, we adopt practices to ensure our product meets customer specs		0.563			0.572
Product Leadership	0.573		0.650	0.604	
We are continuously developing new technology that provides us a price advantage		0.276			0.313
We are recognized as a leader in innovation of new beef production technologies and are able to establish product differentiation		0.422			0.474
Innovative technologies allow for the screening and selection of animals through the production process to ensure quality		0.451			0.472
Operational Excellence	0.792		0.822	0.805	
We are unable to influence prices we received so we rely on increasing efficiency		0.525			0.576
We are generally not aware of exactly who our customers are and do not establish relationships with them		0.718			0.738
We only invest in minimum process control systems		0.677			0.656

Table 3. Independent Variable Reliability Analysis

Scale	Items	Alpha	Variance Extracted	Mean	Std Dev	Corrected Item-to-Total Correlation	Factor Loadings
Customer Focus		0.756	0.5872				
	Cust1			3.94	1.202	0.650	0.849
	Cust2			3.78	1.103	0.614	0.820
	Cust4			3.92	1.252	0.360	0.556
	Cust5			3.74	1.268	0.600	0.803
Coordination		0.756	0.5847				
	Coord1			3.38	1.486	0.523	0.731
	Coord2			3.94	1.312	0.523	0.732
	Coord3			3.85	1.227	0.619	0.810
	Coord4			4.16	1.117	0.576	0.782
Competitor Focus		0.857	0.5422				
	Comp1			3.74	1.391	0.548	0.664
	Comp3			3.78	1.267	0.581	0.693
	Comp4			4.13	1.279	0.522	0.639
	Comp5			3.14	1.359	0.664	0.772
	Comp6			2.99	1.289	0.707	0.805
	Comp8			3.96	1.234	0.628	0.748
	Comp9			3.80	1.270	0.709	0.814
Learning		0.782	0.6169				
	Learn2			4.83	0.906	0.617	0.807
	Learn3			4.92	0.965	0.692	0.867
	Learn4			4.91	0.965	0.673	0.851
	Learn5			4.31	1.058	0.403	0.593
Entrepreneurship		0.704	0.6304				
	Ent2R			3.29	1.106	0.513	0.791
	Ent4R			3.27	1.164	0.596	0.846
	Ent5R			3.74	1.192	0.462	0.742
Innovation		0.740	0.7183				
	Innov1			4.55	1.020	0.502	0.865
	Innov2R			4.69	1.180	0.567	0.721
	Innov3			4.58	0.925	0.552	0.817
	Innov4R			5.23	1.049	0.350	0.898
	Innov5R			4.86	1.129	0.560	0.786
Cost Focus		0.728	0.5106				
	Cost1			5.01	0.896	0.649	0.845
	Cost2			4.98	0.938	0.580	0.806
	Cost3R			4.88	1.128	0.377	0.598
	Cost4			4.01	1.288	0.358	0.547
	Cost5			4.59	0.990	0.575	0.730

Appendix 2. The Value Discipline Scale

These questions relate to different components of your beef operation. Each item contains three descriptions of marketing strategies. Please distribute 100 points among the three descriptions depending on how similar the description is to your beef operation. There is no one right answer and please use all 100 points. Most beef producers will be a mixture of those described.

For example…	*Marketing*	*Strategy 1*	*15*
		Strategy 2	*60*
		Strategy 3	*25*
			100

15 **Pricing**

S1 We are able to set or negotiate above market prices for our cattle as we have established close relationships with our customers and fully understand their specific requirements. _____

S2 We are continuously developing or adopting new technology that provides us a short term competitive market and price advantage. _____

S3 Due to being unable to influence current market prices, we strive to continually become more efficient in an effort to reduce costs. _____

100

16 **Production**

S1 We are continuously developing new and innovative technologies that provide our farm with product, production or marketing advantages. _____

S2 We willingly modify production practices to meet our customers specific product requirements, even if it increases our costs. _____

S3 We are seen as a leader in production efficiency by our neighbors and peers due to our continuous efforts to produce efficiency gains. _____

100

17 **Relationship building**

S1 We try to develop individual business relationships with each of our customers and attempt to produce products that meet each of their specific requirements. _____

S2 As producers and marketers of commodity beef through independent auctions, we are generally unaware of exactly who our customers and buyers are and see little value in establishing relationships with them. _____

S3 As we are recognized as a leader in innovation and early adoption of new beef production technologies, we are able to gain access to valuable customer markets and establish product differentiation. _____

100

18 **Quality**

S1 Through our close relationships with lead customers, we willingly adopt production practices, processes and certification systems to ensure our product meets customer specifications and supports their marketing brand. _____

S2 We only invest in meeting the minimum required level of certification and process control systems that are signalled through the pricing mechanism or mandated by regulatory agencies. _____

S3 Through the adoption and use of innovative technologies, we are able to screen and select animals while tracking them through the production process to ensure optimal final product quality in the market. _____

100

Symposium Special Edition

Best Paper and Student Case Competition Winners

Best Paper Award Winners

1st Place

Commodity-based Trade and Market Access for Developing Country Livestock Products: The Case of Beef Exports from Ethiopia

Karl Rich, American University in Cairo, International Livestock Research Institute, *Egypt*
Brian Perry, Department of Veterinary Tropical Diseases, University of Pretoria, *Kenya*
Simeon Kaitibie, International Center for Agricultural Research in the Dry Areas, *Syria*

Innovation Award

Export Implicit Financial Performance: The Case of French Wine Companies

Jean-Laurent Viviani, ISEM, Université de Montpellier, *France*

Conference Theme Award: Best Local Solution to a Global Challenge

Entrepreneurial Supply Chains and Strategic Collaboration: The Case of Bagoss Cheese in Bagolino, Italy

Vincent Amanor-Boadu, *Kansas State University, U.S.A.*
Piercarlo Marletta, *Kansas State University, U.S.A.*
Arlo Biere, *Kansas State University, U.S.A.*

Communication Award

Willingness to Pay for Improved Milk Sensory Characteristics and Assurances in Northern Kenya Using Experimental Auctions

Francis O. Wayuaa, Agricultural Research Institute (KARI), *Kenya*
Mohamed G. Shibiab, Agricultural Research Institute (KARI), *Kenya*
Moses S. Mamoc, Agricultural Research Institute (KARI), *Kenya*
DeeVon Bailey, *Utah State University, U.S.A.*
D. Layne Coppocke, *Utah State University, U.S.A.*

2009 Student Case Competition Winners

Tied 1st Place Winning Teams

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Advisor: Dr. Elliot Currie
Ms. Emily Bogaert
Mr. Blair Cameron
Mr. Matthew Ball
Ms. Nicole Beechey

Santa Clara University
Advisor: Dr. Andrew Starbird
Ms. Lisa Stapleton
Mr. Abhihit Joshi
Mr. Meher Shah

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