International Food and Agribusiness Management Review

Supporters and Partners

Santa Clara University — Leavey School of Business

Food & Agribusiness Institute — STRONG ROOTS - BRIGHT FUTURE

ILLINOIS — Food and Agribusiness Management

TEXAS A&M UNIVERSITY

International Food and Agribusiness Management Review

Editorial Staff

Executive Editor

Peter Goldsmith
University of Illinois, USA

Regional Managing Editors

Africa and Middle East
Herman Van Schalkwyk, University of the Free State, South Africa

Asia, Australia, and New Zealand
Murray McGregor, Curtin University of Technology, Australia
Nicola M. Shadbolt, Massey University, New Zealand

Europe
Jacques Trienekens, Wageningen University, The Netherlands

North America
Corinne Alexander, Purdue University, U.S.A.
Vincent R. Amanor-Boadu, Kansas State University, U.S.A.
Mark Hansen, Brigham Young University, U.S.A.
David Sparling, The University of Western Ontario, Canada

South America
Joao Martines-Filho, Universidade de São Paulo, Brazil

Case Editor
John Siebert, Texas A&M University, U.S.A.

Editorial Board

Table of Contents

RESEARCH

CASE STUDIES

EXECUTIVE INTERVIEW

Trade Liberalizing Impacts of NAFTA in Sugar: Global Implications

Ronald D. Knutson,[⊕a] Patrick Westhoff,[b] and Pablo Sherwell[c]

[a]*Professor Emeritus, Agricultural and Food Policy Center, Department of Agricultural Economics, Texas A&M University, 450 Blocker Building, College Station, Texas, 77843-2124, U.S.A.*

[b]*Co-Director, Food and Agricultural Policy Research Institute, Department of Agricultural Economics, University of Missouri, 101 Park DeVille Drive, Suite E., Columbia, Missouri, 65203, U.S.A.*

[c]*Mexico Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentacion, Av. Municipio Libre 377, piso 4 A: Col. Santa Cruz Atoyac, Del. Benito Juárez: México, DF 03310*

Abstract

In 2008, the NAFTA provisions opened the U.S. market for sugar imports from Mexico. The FAPRI U.S. agriculture sector model and the Mexican agriculture sector model were utilized simultaneously to analyze the implications for agribusiness interests of free trade with Mexico in sugar. It was found that the dire predictions of U.S. producer interests would not materialize. The economic impacts were much less than had been predicted. It was found that even with free trade, U.S. and Mexican sugar prices do not move in lockstep.

Keywords: policy, NAFTA, sugar

[⊕]Corresponding author: Tel: + 1 979.845.5913
                         Email: rknutson@tamu.edu

Other contact information: P. Westhoff: westhoffp@missouri.edu
                            P. Sherwell: psherwell@gmail.com

1

Problem

While U.S. consumers traditionally have had a sweet tooth, some chinks may be developing in the armor. Consumption of sugar and high fructose corn syrup (HFCS) peaked at 132 pounds per capita in fiscal year (FY[1]) 1999 but then declined progressively to 117 pounds in FY 2009—an average of 1% per year over the decade (Figure 1). HFCS accounted for most of the decline, with per-capita consumption falling from 65 pounds in FY 1999 to less than 53 pounds in FY 2009.

The changes occurring on the demand side could be dwarfed by those on the supply side. Traditionally, the U.S. sugar industry has been highly protected by policies that restrict imports. Over the last decade, these policies have resulted in an average price of sugar in the U.S. market that was approximately double the world market price (Figure 2). Because of the North American Free Trade Agreement (NAFTA), there are no longer any restrictions on the amount of sugar the United States can import from Mexico. If this results in a sharp increase in U.S. sugar imports, it could transform U.S. sweetener markets.
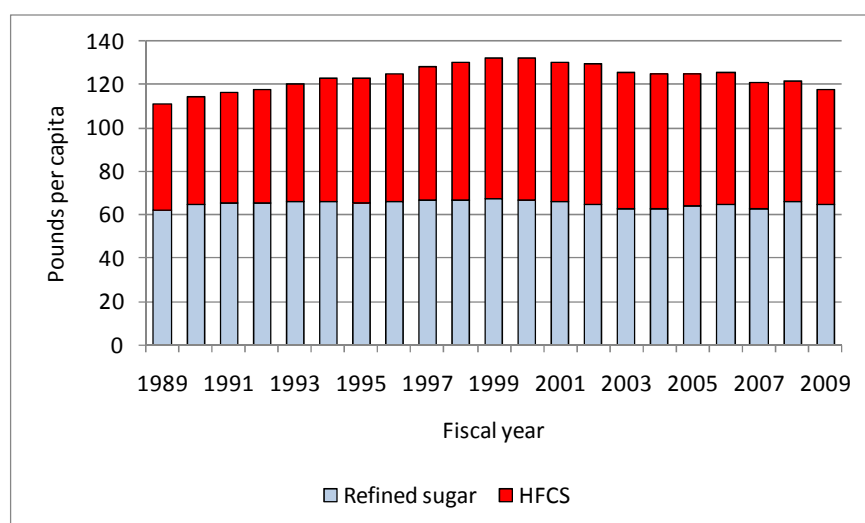
Figure 1. U.S. per-capita consumption of refined sugar and high-fructose corn syrup (HFCS).
Source: Author calculations based on USDA Economic Research Service data from "Sugar and Sweetener Yearbook Tables," available at http://www.ers.usda.gov/Briefing/Sugar/data.htm#yearbook .

Many expected the NAFTA liberalization of North American sugar markets to result in a surge of exports of Mexican sugar into the United States. Early indications appeared to confirm this view: in the first full year after the final barriers to U.S.-Mexican sugar trade were removed in 2008, Mexican exports of sugar to the United States exploded, more than doubling from the previous record set just one year earlier.[2]

---

[1] Sugar data are reported here on a fiscal year (FY) basis, where the fiscal year begins on October 1 of the previous calendar year. FY 2009, for example, extended from October 2008 until September 2009.
[2] USDA's January 2010 *World Agricultural Supply and Demand Estimates* reports U.S. imports of Mexican sugar reached 1.4 million short tons in FY 2009, up from 0.7 million tons in FY 2008.
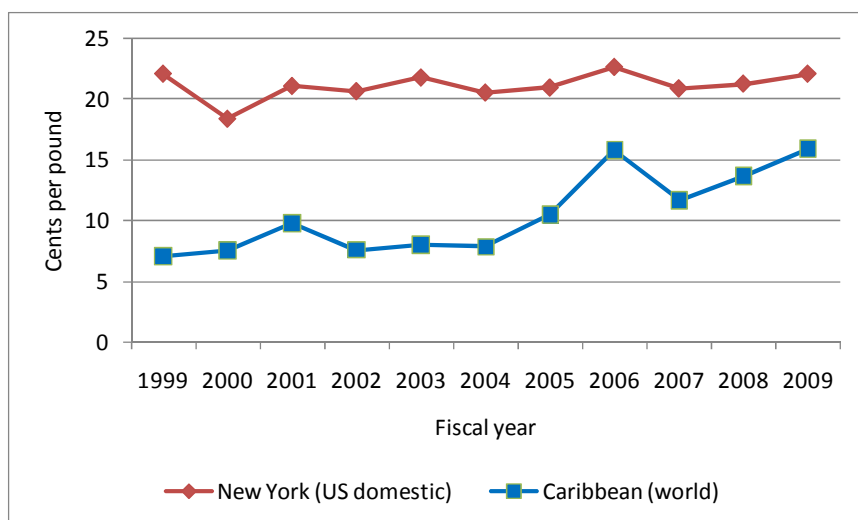
Figure 2. U.S. and world raw sugar prices.
Source: USDA Economic Research Service, "Sugar and Sweetener Yearbook Tables," Tables 3 and 4, available at
http://www.ers.usda.gov/Briefing/Sugar/data.htm#yearbook.

The story, however, is not so simple. Mexico also has a Tariff Rate Quota (TRQ) designed to keep the price of sugar in Mexico above the level that prevails in world markets. In fact, domestic sugar prices in Mexico are sometimes above those in the United States (Figure 3). However, in FY 2009 there were strong incentives for Mexico to export to the United States as the Mexican refined sugar price fell 7.1 cents per pound below the U.S. price. Mexico increased its exports to the United States in FY 2009 by sharply drawing down sugar stocks built up in previous years. When weather problems reduced the size of the FY 2010 sugar crop in Mexico, tight supplies in the Mexican sugar market caused a dramatic price spike that at least temporarily drove Mexican sugar prices above those in U.S. markets. What will happen next in North American sugar and sweetener markets remains uncertain, and different plausible scenarios have very different implications.
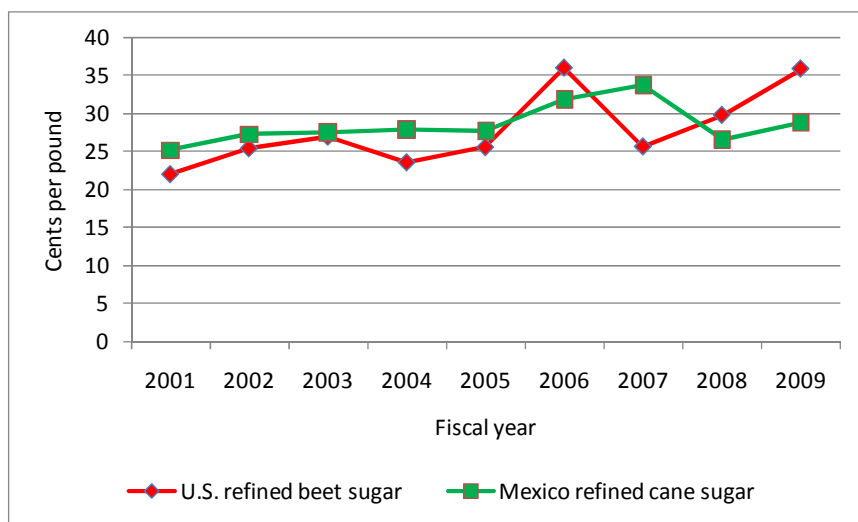
Figure 3. U.S. and Mexican refined sugar prices.
Source: USDA Economic Research Service, "Sugar and Sweetener Yearbook Tables," Tables 5 and 55, available http://www.ers.usda.gov/Briefing/Sugar/data.htm#yearbook.

Sugar markets also have a number of other features that deviate from free trade ideals. Price supports, TRQs, and state traders are prevalent globally. As a result, the residual world market for sugar has been thin, with relatively small volumes being freely traded outside preferential arrangements. Both the residual market and the TRQ international markets have been dominated by developing countries, often as state refiners and as state traders.

An additional factor influencing the U.S. caloric sweetener supply and demand situation is competition from biofuels. Brazil is the world's largest exporter of sugar, but the country uses most of its sugarcane to produce ethanol, not sugar. While Brazil led the world in the development of ethanol, U.S. ethanol production has surpassed that of Brazil (AFDC). Increased corn demand for ethanol was one of the factors that resulted in a rise in the price of HFCS, a primary U.S. soft drink sweetener.[3] Brazil and the United States also produce biodiesel from soybean oil. Land utilized for sugar production in both Brazil and the United States has had to compete with that utilized to produce corn and soybeans, creating yet another linkage between sweetener and biofuel markets.

Objectives

This paper identifies and weighs the factors affecting the contemporary and future Mexican and U.S. sugar industry. The analysis takes place in a NAFTA open-market environment where sugar competes with HFCS produced from corn and where ethanol production has important direct and indirect effects. The specific objectives of the paper include:

1. To evaluate how the changed configuration of demand for sugar and HFCS impacts the U.S. and Mexican agriculture and agribusiness sectors.

2. To evaluate the impacts of NAFTA sugar provisions on the Mexican and U.S. sugar supplies.

3. To explore the implications of this change in sugar policy for the market for sweeteners, for consumer demand, and for agribusiness firms that utilize sweeteners.

Literature Review

While there have been a number of previous studies of sugar and sweetener policy issues, the interactive impacts of freer trade policies and consumer demand changes have received little empirical analysis. In 1987, Lieu, Schmitz, and Knutson completed an economic welfare analysis of the gainers and losers for the U.S. sugar prices support and production control program with a finding that while the U.S. producers experienced large welfare gains, U.S. consumers were much bigger losers as were producers in other countries. Subsequently, Kennedy and Schmitz used a welfare approach to analyze the U.S. production response options to increased imports of sugar. While the NAFTA opening of the U.S. sugar market and the anticipated drop in U.S.

---

[3] Corn prices also rose from 2005-2008 because of higher energy prices, which increased the cost of fertilizer and fuel, strong global food demand growth, and the weather-induced reductions in grain supplies in major exporting countries, and a range of other factors. Corn prices have since retreated but remain above pre-2007 levels (Westhoff). HFCS prices rose with corn prices but have remained high even as corn prices have declined from their peak levels.

sugar prices is mentioned as a justification for the study, most of the attention in this research is given to the impacts of U.S. production control policy options.

Of greater interest to this analysis is a 2008 study by Castillo, Bucaram, and Schmitz, which studied price relationships in the U.S. sugar market. They concluded that the consequence of increases in U.S. corn prices could be to put sugar at a price advantage over HFCS, thus increasing the demand for sugar and reducing the price depressing effects of increased imports from Mexico. Neither of these studies gave attention to limitations on the sugarcane production potential of Mexico, the impacts of open market policies on Mexico, or the policy options available to Mexico, which are a central focus of this analysis.

Procedures

Over the past two years, a Mexican baseline and policy analysis model has been developed as a counterpart to the U.S. model maintained by the Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri (Meyers et al.). Both models are being utilized to evaluate for U.S. and Mexican policymakers, the impacts of policy changes. Utilizing models simultaneously makes it possible to evaluate effects of free trade in sugar on the U.S. and Mexican producer, agribusiness, and consumer sectors.

The U.S. and Mexican models are directly linked to ensure a consistent set of estimate results for North American markets. This linkage makes it possible to analyze the impacts of economic and policy changes on the agriculture and agribusiness sectors in both countries. Utilizing these models, the impacts of liberalization of sugar trade under NAFTA are analyzed over the next decade, 2010-2019. This analysis simultaneously considers the effects of NAFTA, ethanol, HFCS, and farm policies on the agriculture subsectors related to sweeteners, corn, and ethanol for both countries.

Demand and Supply Conditions for Sweeteners

Changes in U.S. Demand for Sweeteners

U.S. demand for sugar and HFCS has been influenced primarily by the combination of changes in consumer tastes and preferences and changing price relationships. In the past two decades, U.S. sugar consumption has been relatively stable (Haley and Dohlman, Haley, and Jerardo). The big change in U.S. caloric sweetener use is attributable to the 19% drop in per-capita HFCS consumption from FY 1999 to FY 2009. The major user of HFCS is the beverage industry (ERS, Sugar and Sweetener Background). Table 1 suggests that there has been a marked shift in demand from caloric soft drinks, primarily sweetened with HFCS, to bottled water. Part of this shift may represent a change in consumer preferences (Farah and Busby). HFCS has encountered adverse publicity from studies linking HFCS consumption with obesity and other health concerns, as reported widely (e.g., Science Daily) and even dramatized on a recent television sit-com.[4]

---

[4] Corn prices also rose from 2005-2008 because of higher energy prices, which increased the cost of fertilizer and fuel, strong global food demand growth, and the weather-induced reductions in grain supplies in major exporting countries, and a range of other factors. Corn prices have since retreated but remain above pre-2007 levels (Westhoff). HFCS prices rose with corn prices but have remained high even as corn prices have declined from their peak levels.

Table 1. U.S. carbonated soft drink and bottled water consumption per capita by calendar year, 1989-2007.

Calendar year	Bottled water	Carbonated soft drinks		
		Diet soft drinks	Other soft drinks	Total soft drinks
		Gallons		
1989	8.1	13.4	33.0	46.4
1990	8.8	14.0	33.1	47.1
1991	8.9	14.1	33.1	47.3
1992	9.2	13.9	33.4	47.3
1993	9.9	13.6	34.3	47.9
1994	10.8	13.8	35.6	49.4
1995	11.6	13.8	36.8	50.6
1996	12.4	13.8	37.8	51.6
1997	13.4	13.6	39.1	52.7
1998	14.4	13.9	39.9	53.8
1999	15.8	13.8	39.7	53.5
2000	16.7	13.8	39.4	53.2
2001	18.2	13.9	39.0	52.9
2002	20.1	14.4	38.5	52.8
2003	21.6	15.1	37.5	52.6
2004	23.2	15.4	37.0	52.5
2005	25.5	15.3	36.3	51.7
2006	27.7	15.2	35.4	50.6
2007	29.1	14.9	33.9	48.8

Source: ERS/USDA, Beverage Consumption per capita data set, beverage.xls/.
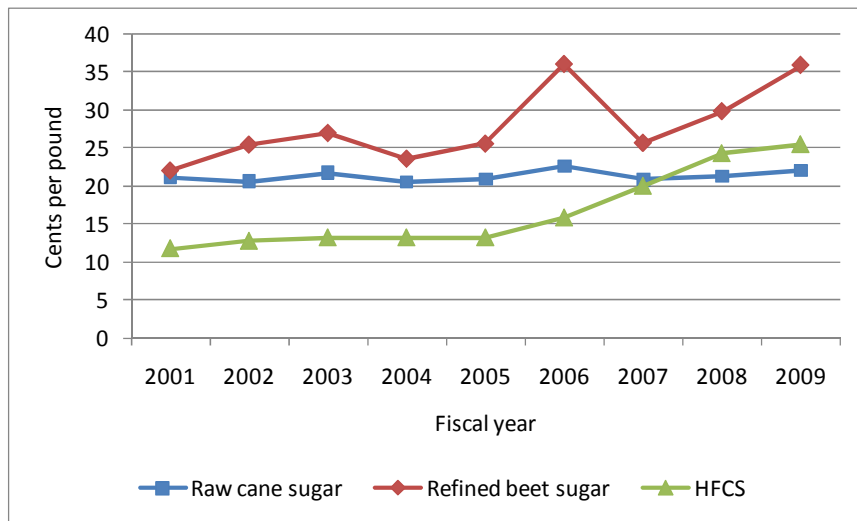
Figure 4. U.S. Sweetener Prices.
Source: ERS, "Sugar and Sweetener Yearbook Tables," Tables 4, 5, and 9. The HFCS price reported is the spot price for HFCS-42 in Midwest markets.

Relative prices of sugar and HFCS may have also played an important role in the recent decline in HFCS consumption. For many years, HFCS sold at a large discount to sugar, providing a strong incentive for its use in soft drinks and other suitable products. That relationship changed

dramatically over the last few years. The HFCS price increased by 94% between FY 2005 and FY 2009 and actually exceeded the price for raw cane sugar in FY 2008 and FY 2009 (Figure 4).

Changes in Mexican Demand

The sugar and HFCS demand patterns in Mexico are quite different than in the United States. While over the period, 2001-2009, total Mexican and U.S. demand for sugar and HFCS were reasonably comparable, Mexican sugar use per capita[5] was two-thirds higher than that of the United States (Table 2). Prior to NAFTA's full implementation, domestic HFCS production in Mexico was hindered by high Mexican corn prices. HFCS imports were long restricted, and a tax was imposed on the use of HFCS in soft drinks.

Table 2. Mexico sugar and HFCS consumption per capita.

Fiscal year	Sugar	HFCS	Sugar and HFCS
	Pounds		
2001	99.5	13.1	108.6
2002	105.8	5.7	111.5
2003	105.7	2.8	108.5
2004	112.0	2.8	114.9
2005	108.6	7.4	116.0
2006	112.6	13.7	126.3
2007	107.5	14.2	121.7
2008	106.3	15.7	122.0
2009	102.3	13.0	115.3

Source: Sherwell, Knutson, and Westoff.

In spite of these factors inhibiting the industry, Mexican HFCS consumption increased from 2.8 pounds per capita in FY 2003 to 14.2 pounds in FY 2007. Most of the growth, however, was for uses other than carbonated soft drinks, which continued to be sweetened with sugar. With full NAFTA implementation, Mexican HFCS producers now have free access to U.S. corn, and the tax on the use of HFCS in soft drinks was repealed. With the playing field leveled, an important question is whether the Mexican soft drink industry will evolve to rely as heavily on HFCS as its U.S. counterpart.

At least two factors will play a role in determining future use of HFCS by the soft drink industry. First, it is often asserted that Mexican consumers have a strong taste preference for sugar rather than HFCS, so soft drink producers may be reluctant to take a step that could alienate consumers. Second, as noted by Castillo, Bucaram, and Schmitz, the relative prices of sugar and HFCS in the Mexican market will also clearly play an important role.

Another important dimension of demand for Mexican sugar is the export market. Prior to 2008, Mexican exports of sugar to the United States were limited by a TRQ. In 2008, NAFTA provisions removed all restrictions on Mexican sugar exports to the United States. Due to high

---

[5] In contrast with the United States where most consumption is refined sugar, most sugar consumed in Mexico is "standard" sugar, with about 96 degrees of polarization, while refined sugar has 99 degrees. Mexico exports both standard and refined sugar.

stocks and low sugar prices relative to U.S. prices, Mexican sugar refiners took advantage of this policy change by sharply increasing exports (Table 3). Mexico's exports to the United States increased from 118,000 tons in FY 2007 to 694,000 tons in FY 2008 and 1.402 million tons in FY 2009. This increase in export demand drew down stocks and caused Mexican sugar prices to rise sharply in 2009. Coupled with a weather-reduced sugar crop in 2009, Mexico was forced to increase its TRQ and import more sugar to address the serious shortage in the domestic market.

Table 3. U.S. and Mexican sugar production, exports, and imports.

Fiscal year	United States			Mexico		
	Sugar production	*Sugar imports*	*Sugar exports*	*Sugar production*	*Sugar imports*	*Sugar exports*
	1000 Short tons					
2005	7,877	2,100	259	5,813	132	276
2006	7,399	3,443	203	5,813	629	247
2007	8,446	2,080	422	5,846	130	487
2008	8,152	2,620	203	6,081	694	237
2009	7,484	3,082	137	5,470	1,402	607

Changes in U.S. Sugar Supplies

U.S. sugar production fell in FY 2006, partially because of the damage caused by Hurricane Katrina, which occurred in August 2005. Recovery of the Louisiana sugar cane industry and record sugar beet yields in the Plains resulted in a sharp recovery in production in FY 2007. U.S. cane sugar production was fairly steady from FY 2007 to FY 2009, at about 3.4 million short tons each year, and preliminary estimates suggest the FY 2010 crop will be about the same.

In contrast, beet sugar production has been quite variable in recent years. Strong returns to competing crops, rising sugar beet production costs, and other factors led to a 23% reduction in the area planted to sugar beets between FY 2007 and FY 2009. This contributed to a significant reduction in U.S. sugar production in FY 2009, but domestic market prices were somewhat restrained by the surge in imports from Mexico.

In FY 2010, there has been some recovery in U.S. beet sugar production, but reduced sugar imports from Mexico have led to a very tight market and a sharp increase in U.S. sugar prices. World sugar prices have set record highs this year, not so much because of developments in North America, but because of a very poor crop in India and a Brazilian crop that also fell short of expectations. For the first time in decades, world sugar prices have actually risen above the levels at which the U.S. government supports the domestic market price, making it difficult to relieve the pressure on the domestic market by opening the U.S. market to third-country imports.

Changes in Mexican Sugar Supplies

The Mexican sugarcane crop was adversely affected by poor weather conditions in both FY 2009 and FY 2010. Large carry-in stocks from FY 2008, however, meant that total sugar supplies in Mexico in FY 2009 were adequate to allow the country to export record amounts of sugar to the United States. Without the buffer provided by large stocks, the poor FY 2010 crop led to

incredibly sharp increases in domestic sugar prices in Mexico. For example, the price of standard sugar in Mexico rose from 17 cents per pound in February 2009 to almost 45 cents per pound in September 2009 (ERS Sugar and Sweetener Yearbook, Table 54). As a result, Mexican sugar was no longer very attractive to U.S. buyers, although sugar that was under contract continued to be delivered.

U.S. and Mexican Baseline

The U.S. and Mexican baselines were developed using FAPRI's U.S. baseline model (FAPRI), which has a 25-year history of development and enhancement. Following its development, FAPRI's 2010 baseline was peer reviewed by USDA, Congressional Budget Office, and industry analysts with adjustments considered to be justified. The Mexican baseline model (Sherwell, Westhoff, and Knutson), was first developed and utilized in 2008. The Mexican model was substantially modified in 2009 to better reflect domestic and trade policies. Special attention was given to improving and updating the sugar model. It was peer reviewed by SAGARPA and industry analysts.

U.S. Baseline

The 2010 baseline reflects a substantially different agricultural economic situation than has existed over much of the period since World War II. In short, higher grain prices than pre-2007 levels increase HFCS prices and competition for land. While it is easy to oversimplify, higher grain prices reflect both increased costs of production due mainly to higher energy prices and increased use of corn for ethanol production. Both economic and political conditions foretell little likelihood of a relaxation of these pressures on grain prices.

The 2010 sugar baseline reflects the fact that production expenses have increased dramatically with 40-60% increases in expenses for seed, pesticides, and fertilizer. Although the figures are uncertain (USDA only publishes sugar beet expenses), the 2010-2019 baseline shows lower average net returns per acre to both sugar beets and sugar cane than the 2005-2008 average. Sugar prices at historical norms (23 cents per pound) would result in even lower levels of U.S. sugar production, as some producers could not cover costs or would find other crops more attractive. Even at relatively high current prices, U.S. sugar beet acreage is far below pre-2007 levels. Likewise, HFCS prices are above pre-2007 levels, which are projected to continue. While the U.S. sugar market continues to be politically managed, in this environment there is no reason to anticipate that USDA sugar program managers would take action to run prices at below 23 cents per pound. The 2008 farm bill requires, except in time of shortage, that non-NAFTA imports are maintained at the WTO-required levels, which makes it more difficult for USDA to manage the price of sugar.

In FY 2010, tight U.S. sugar supplies have led to record high prices in the domestic market. While these high prices are viewed as an anomaly, they provide an incentive to cane and beet producers to increase the area they devote to sugar production this year, which should lead to a larger U.S. sugar crop in FY 2011 (Table 4). Baseline sugar acreage is projected to be fairly stable in later years, but yields increase in line with past trends to result in modest growth in U.S. sugar production.

Table 4. U.S. sweetener supply, utilization, and prices: baseline projections.

Fiscal year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Area harvested					*(Thousand acres)*					
Sugarcane	821	857	866	844	842	842	841	839	835	832
Sugar beets	1,145	1,315	1,205	1,183	1,190	1,195	1,201	1,197	1,196	1,197
Sugar supply and use					*(Thousand short tons, raw value)*					
Production	7,837	8,913	8,611	8,541	8,681	8,831	8,985	9,084	9,192	9,316
Imports	2,157	2,067	2,144	2,136	2,118	2,094	2,062	2,030	2,000	1,964
(from Mexico)	340	550	625	615	594	568	534	499	467	428
Domestic use	10,293	10,401	10,544	10,532	10,616	10,749	10,859	10,923	11,004	11,096
Exports	168	161	161	161	160	160	160	161	160	160
Ending stocks	984	1,403	1,453	1,437	1,459	1,475	1,503	1,534	1,562	1,585
HFCS supply and use					*(Thousand short tons)*					
Production	8,790	8,790	8,834	8,969	9,058	9,117	9,152	9,202	9,249	9,303
Domestic use	8,232	8,116	8,078	8,127	8,141	8,142	8,128	8,135	8,139	8,151
Net exports	558	675	756	842	917	975	1,025	1,067	1,110	1,153
Per-capita consumption					*(Pounds)*					
Refined sugar	61.9	62.0	62.2	61.6	61.4	61.6	61.7	61.4	61.3	61.2
HFCS	53.0	51.7	51.0	50.8	50.4	49.9	49.4	48.9	48.5	48.1
Sum	114.9	113.7	113.2	112.4	111.9	111.5	111.0	110.4	109.8	109.3
Prices					*(Cents per pound)*					
Raw cane sugar	31.1	26.5	25.7	26.3	26.5	26.8	26.9	26.9	27.0	27.1
Refined beet sugar	45.3	35.0	33.8	34.6	34.8	35.2	35.3	35.2	35.3	35.4
HFCS	26.3	25.2	25.5	25.9	26.2	26.7	27.1	27.1	27.3	27.4

Source: Author estimates using the FAPRI U.S. model and the Sherwell, Westhoff, and Knutson Mexico model.

Refined sugar consumption per capita projections remain around 61-62 pounds per capita over the next decade. Consistent with recent trends, HFCS consumption projections fall from 53 pounds per capita in FY 2010 to 48 pounds per capita in FY 2019.

U.S. sugar imports remain relatively stable at about 2 million tons per year. Imports from countries other than Mexico are largely determined by the TRQ and other special programs. The baseline assumes the TRQ is increased slightly in FY 2010 to slightly alleviate the current tight supply situation but then is set at the minimum level permitted under international trade agreements in subsequent years.

Baseline U.S. sugar prices retreat from the current peak in FY 2011 but remain slightly above the levels that prevailed prior to FY 2010. This result is contingent on competing crop prices that remain above the historic norm because of continued growth in biofuel production, the assumed recovery of the world economy, and oil prices that slowly increase over time. After having a price advantage relative to sugar in FY 2010, HFCS prices are projected to be generally near prices for raw cane sugar in FY 2011 and beyond.

10

Mexican Baseline

Poor weather reduced the Mexican sugar crop in both FY 2009 and FY 2010. If growing conditions return to normal, current high prices should provide an incentive for increased Mexican sugar production in FY 2011 (Table 5). The area devoted to sugar production in Mexico is projected to remain fairly steady in later years so production only increases with very modest growth in yields.

Mexican sugar consumption is constrained in FY 2010 by high prices, substitution of non-caloric sweeteners, and the weak economy. If greater supplies result in lower prices, Mexican sugar consumption could rebound in FY 2011. Total sweetener consumption per capita could increase from 118 pounds per capita in FY 2011 to 128 pounds in FY 2019, a rate of growth consistent with that observed in recent years. Most of the growth after FY 2011 would likely occur in HFCS consumption, which is assumed to modestly increase its share of the soft drink market.

Table 5. Mexico sweetener supply, utilization, and prices: baseline projections.

Fiscal year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Area harvested					*(Thousand hectares)*					
Sugarcane	667	696	699	700	701	702	702	702	702	702
Sugar supply and use					*(Thousand metric tons)*					
Production	4,974	5,349	5,274	5,302	5,326	5,352	5,373	5,389	5,407	5,425
Imports	511	442	438	439	440	442	443	445	446	448
Domestic use	4,819	5,014	5,072	5,123	5,174	5,222	5,273	5,325	5,374	5,423
Exports	309	500	567	558	539	516	485	454	424	390
(to the U.S.)	309	499	567	558	539	515	484	453	424	389
Ending stocks	889	1,111	1,129	1,133	1,131	1,131	1,135	1,135	1,135	1,140
Residual	55	55	55	55	55	55	55	55	55	55
HFCS supply and use										
Production	335	331	330	332	335	338	342	344	347	349
Domestic use	782	887	961	1,041	1,111	1,168	1,217	1,258	1,299	1,341
Net imports	447	556	631	709	777	830	875	914	953	992
Per-capita consumption					*(Pounds)*					
Refined sugar	98.0	101.2	101.6	101.9	102.2	102.5	102.8	103.2	103.5	103.9
HFCS	15.4	17.2	18.5	19.8	20.9	21.8	22.4	23.0	23.5	24.0
Sum	113.4	118.4	120.1	121.7	123.1	124.3	125.3	126.2	127.0	127.9
Prices					*(Cents per pound)*					
Standard sugar	38.6	29.4	29.6	29.9	30.5	30.8	31.0	31.2	31.6	31.6
Refined sugar	45.0	34.8	35.0	35.3	35.8	36.1	36.3	36.6	36.9	36.9

Source: Author estimates using the FAPRI-MU U.S. model and the SAGARPA Mexico model.

Tight supplies limit Mexican sugar exports in FY 2010, and exports remain far below the FY 2009 level over the 10-year baseline. Given the projected supply-demand balance, Mexico simply does not have adequate sugar supplies to capture a large share of the U.S. market. Note that projected Mexican refined sugar prices are very similar to those prevailing in the U.S.

market. The more integrated the North American sugar market is, the more closely those prices will tend to follow one another. However, seasonal price variation and a variety of other factors mean that Mexico may be able to export modest amounts of sugar to the United States even when the season-average price of sugar in Mexico is equal to or greater than the U.S. season-average price.

Scenario Analysis

In 2008, Mexico and the United States entered a new free trading era. The effects of this policy appeared to be less severe than many in the U.S. sugar industry had anticipated when the NAFTA provisions were negotiated. In the baseline just discussed, the liberalization of U.S.-Mexican sugar trade does not appear to have dramatic effects over the next decade. While sugar prices in the two countries come in closer alignment to one another, exports of Mexican sugar to the United States remain limited. In spite of common concerns that the NAFTA liberalization would make the U.S. sugar price support program unworkable, baseline sugar prices remain above the levels that would require the government to take actions to support prices (approximately 20 cents per pound for raw cane sugar).[6]

Of course, actual market outcomes will differ from these baseline projections. At least two plausible scenarios could result in significantly more Mexican sugar exports to the United States. These would have important implications for both countries. The scenarios selected relate to: (1) the impacts of increased substitution of HFCS for sugar in the production of Mexican soft drinks and (2) the impacts of increased Mexican sugar imports.

Increased Mexican Use of HFCS

The "more HFCS in Mexico" scenario increases Mexican HFCS consumption by 8.5 pounds per capita by FY 2019. This is sufficient to allow HFCS to dominate the soft drink market and would free up Mexican sugar supplies for export to the United States. It assumes that Mexican consumers would accept soft drinks sweetened with HFCS.

 Table 6 summarizes the major economic impacts of this scenario in terms of the percentage changes from the baseline. As soft drink manufacturers expand their use of HFCS, sugar use in Mexico falls relative to the baseline. This results in lower prices for sugar in the Mexican market; by FY 2019, Mexican prices for standard sugar fall by 19% relative to the baseline. This results in a modest reduction in Mexican sugar production, but it also makes Mexican sugar more competitive in the U.S. market. The result is a 178% increase in Mexican sugar exports to the United States.

Increased imports of Mexican sugar result in lower prices in the U.S. sugar market. These lower prices result in a modest reduction in U.S. sugar production. Meanwhile, HFCS prices actually increase, as the effect of increased HFCS exports to Mexico outweighs the effect of lower sugar prices in the domestic market. The combination of higher HFCS prices and lower sugar prices encourages some U.S. HFCS users to switch to sugar.

---

[6] The "loan rate" for raw cane sugar is currently 18.25 cents per pound, but seasonal price variability and other factors mean that the price support program generally begins to have an effect when raw sugar prices fall below about 20 cents per pound. Note that baseline raw cane sugar prices never dip below 25 cents per pound.

While this scenario does result in lower U.S. sugar prices, it does not result in prices low enough to trigger government price support activity. The effects on the U.S. market are less than some might expect. One reason is that an extra pound of HFCS used by the Mexican soft drink industry does not translate into a pound of additional exports of sugar to the United States. In FY 2019, for example, Mexican HFCS consumption exceeds baseline levels by 1.03 million metric tons, but Mexican sugar exports exceed baseline levels by just 0.69 million metric tons. The reduction in Mexican sugar prices results in some reduction in Mexican sugar production and encourages a slight increase in sugar consumption outside the soft drink industry.

Poor weather reduced the Mexican sugar crop in both FY 2009 and FY 2010. If growing conditions return to normal, current high prices should provide an incentive for increased Mexican sugar production in FY 2011 (Table 5). The area devoted to sugar production in Mexico is projected to remain fairly steady in later years so production only increases with very modest growth in yields.

Mexican sugar consumption is constrained in FY 2010 by high prices, substitution of non-caloric sweeteners, and the weak economy. If greater supplies result in lower prices, Mexican sugar consumption could rebound in FY 2011. Total sweetener consumption per capita increases from 118 pounds per capita in FY 2011 to 128 pounds in FY 2019, a rate of growth consistent with that observed in recent years. Most of the growth after FY 2011 occurs in HFCS consumption, which is assumed to modestly increase its share of the soft drink market.

Table 6. Economic Impacts of Mexican substitution of HFCS for sugar in caloric sweetened soft drinks.

Fiscal year	United States				Mexico		
	Sugar imports	*Raw sugar price*	*Sugar production*	*HFCS price*	*Sugar exports*	*Standard sugar price*	*Sugar production*
	(percent change from baseline)						
2011	3.8	-1.2	-0.3	1.4	14.4	-3.3	0.0
2012	7.7	-1.1	-0.7	1.4	25.7	-5.7	-0.4
2013	11.2	-1.5	-0.9	2.2	39.1	-8.1	-0.8
2014	15.2	-2.0	-1.2	2.8	54.1	-10.3	-1.3
2015	19.3	-2.4	-1.5	3.5	71.0	-12.4	-1.7
2016	23.6	-2.8	-1.8	4.1	91.2	-14.5	-2.1
2017	28.3	-3.2	-2.1	4.8	114.9	-16.4	-2.6
2018	33.1	-3.5	-2.4	5.6	141.5	-18.4	-3.0
2019	38.8	-4.0	-2.7	6.2	177.5	-19.3	-3.4

Source: Author estimated changes relative to the baseline.

Increased Mexican Imports of Sugar

The "more Mexican sugar imports" scenario adjusts the Mexican TRQ to allow 1.5 million tons of additional sugar to be imported at the world price by FY 2018. Because the world price is typically far below the sugar price in Mexico, imports would be expected to increase by the full

amount of any increase in the TRQ. The assumed increase in imports would add more than 20% to the Mexican sugar supply.

Table 7 summarizes the major economic impacts of the scenario. The increase in supplies on the Mexican market would significantly reduce Mexican sugar prices. Lower prices, in turn, would result in a reduction in Mexican sugar production and an increase in Mexican sugar consumption, partially at the expense of reduced consumption of HFCS. Lower Mexican sugar prices also make Mexican sugar more competitive in the U.S. market, and Mexican sugar exports in FY 2019 exceed baseline levels by 270%. The resulting increase in U.S. sugar imports results in lower U.S. sugar prices, reduced U.S. sugar production, increased domestic consumption of sugar, and reduced domestic consumption and prices for HFCS.

The interesting story here again is that the increase in exports to the United States is noticeably less than the increase in third-country imports by Mexico. In FY 2019, Mexican sugar imports would increase by 1.50 million metric tons, but sugar exports would increase by 1.05 million metric tons because of the reduction in production and the increase in domestic use that result from lower prices. Therefore, increased sugar imports by Mexico impact Mexican sugar producers more adversely than they affect U.S. sugar producers.

Table 7. Economic impacts of 1.5 million tons of additional Mexican sugar imports from the world market.

Fiscal year	United States				Mexico		
	Sugar imports	Raw sugar price	Sugar production	HFCS price	Sugar exports	Standard sugar price	Sugar production
	(percent change from baseline)						
2011	7.4	-2.7	-0.7	-0.5	27.7	-8.0	-0.1
2012	14.4	-3.7	-1.9	-1.5	49.2	-13.0	-1.0
2013	21.4	-4.8	-2.8	-1.6	74.3	-17.8	-1.9
2014	28.6	-6.0	-3.6	-2.0	102.0	-22.0	-2.8
2015	36.0	-7.0	-4.5	-2.3	132.8	-26.2	-3.7
2016	44.3	-8.2	-5.4	-2.6	171.1	-29.4	-4.6
2017	53.6	-9.2	-6.6	-3.0	217.9	-31.0	-5.3
2018	58.6	-9.2	-7.2	-2.8	250.6	-31.2	-5.8
2019	58.9	-8.5	-7.0	-2.5	269.5	-31.1	-6.0

Source. Author estimated changes relative to the baseline.

Conclusions and Implications

There were many dire predictions by U.S. sugar producer interests that opening the U.S. market for sugar under NAFTA would ruin the U.S. sugar industry. This did not happen, and the results of this study indicate that it is unlikely to happen in the near future under reasonable assumptions. Clearly, NAFTA's effects on the U.S. sugar industry have been less than anticipated for several reasons related to the Mexican market. At least so far, Mexico has not demonstrated an ability to significantly increase domestic production at the level of prices that prevail in U.S. markets. Soft drink manufacturers have not made a wholesale replacement of

sugar with HFCS, and Mexico has not greatly increased sugar imports to arbitrage low world sugar prices and high prices in the U.S. market.

NAFTA's effects on the U.S. sugar market have also been less than anticipated because of unexpected developments in U.S. and Mexican markets. From a U.S. perspective, increased biofuel production, rising production expenses, and a range of other factors have resulted in less domestic sugar production than many expected. Further, domestic sugar consumption has held fairly steady as HFCS has absorbed most of the reduction in domestic sweetener consumption. From a Mexican perspective, there appear to be greater limitations on Mexico's sugar production capacity than might have been anticipated. Under current market conditions, there are less incentives for Mexican sugar users to substitute sugar for HFCS than has been the case for U.S. agribusiness firms. Rising HFCS prices meant there was less incentive for users to switch from sugar to HFCS in 2008 and 2009. The current high price of sugar in North American and world markets is not expected to persist, and it is likely that high corn prices will help keep HFCS prices above historical norms. In reaction to the current situation, Mexico could increase sugar imports. However, this would depress prices in the Mexican market, with important negative implications for the Mexican sugar industry, even if it did result in increased sugar exports to the United States.

An important question for the future is just how integrated the North American sugar market will prove to be. While U.S. and Mexican sugar prices have been correlated in recent years, by no means have they moved in lockstep. The modeling work reported here assumes the U.S. and Mexican markets continue to be imperfectly integrated. If they become more closely linked, trade will be even more sensitive to relative prices in the two markets, and a North American market will be supplied by the low-cost producers. In contrast, government policies and the actions of large players in the market could keep the ties between the two markets relatively weak.

NAFTA presents a new economic and trading environment for managers of firms that produce and utilize sugar. The results of this analysis indicate that in this environment, agribusiness managers will need to closely monitor conditions affecting production, consumption, imports, and exports to prevent adverse impacts on their operations in both Mexico and the United States. The fact that both producer and agribusiness experts in the sweetener sector may differ over the outlook for the future, sends a clear signal that there is good reason to closely follow developments in sweetener markets and be flexible. These results clearly suggest that we may be in a new economic environment with strategic implications that should not be taken lightly. It is also important to note that the conditions that lead to this conclusion and to its implications also apply to the broader scope of agricultural commodities. As in the past, these conditions will be affected by both political and economic variables. However, with freer trade, economic forces can play a greater role in influencing margins and returns. The usefulness of this research to agribusiness lies in providing greater insight into the economic and competitive forces influencing sweetener production, utilization, and more generally to the changing conditions in agricultural commodity markets.

References

Castillo, M.J., S. Bucaram, and A. Schmitz. 2008. "Price Relationships in the U.S. Sugar and Sweetener Market: A Cointegration Approach." *International Sugar Journal.* 110(131): 358-63.

ERS, Economic Research Service, USDA. 2010. "USDA. Sugar and Sweeteners: Background" http://www.ers.usda.gov/Briefing/sugar/background.htm (accessed January 10, 2010).

ERS, Economic Research Service, USDA. 2009. "Sugar and Sweetener Yearbook Tables," http://www.ers.usda.gov/Briefing/Sugar/data.htm#yearbook (accessed January 10, 2010).

Farah, Hodan and Jean Buzby. 2008. "High-Fructose Corn Syrup Usage May Be Leveling Off." Amber Waves. ERS/USDA. Feb.

FAPRI, Food and Agricultural Policy Research Institute. 2010. "FAPRI 2010 U.S. and World Agricultural Outlook." FAPRI Staff Report 10-FSR 1. FAPRI, Iowa State University, Ames, Iowa.

Haley, Stephen and Erik Dohlman. 2009. Sugar and Sweetener Outlook. SSS-256, ERS/USDA. Oct.5.

Haley, Stephen and Andy Jerardo. 2009. Sugar and Sweetener Outlook. SSS-255, ERS/USDA. June 2.

Kennedy, P. Lynn and Andrew Schmitz. 2009. "Production Response to Increased Imports." *Journal of Agricultural and Applied Economics.* 41(12):777-89.

Lieu, Gwo-Jiun M., M. Andrew Schmitz, and Ronald D. Knutson. 1987. "Gains and Losses of Sugar Program Policy Options." *American Journal of Agricultural Economics* 69(3): 591-602.

Meyers, William H., Patrick Westhoff, Jacinto Fabiosa, and Dermot Hayes. 2010. "The FAPRI Global Modeling System and Outlook Process." *Journal of International Agricultural Trade and Development.* Forthcoming.

Science Daily. 2007. "What Does Scientific Research Say About HFCS." August 23. http://www.sciencedaily.com/releases/2007/08/070823094819.htm (accessed January 11, 2010).

Sherwell, Pablo, Patrick Westhoff, and Ronald D. Knutson. 2010. Mexico Agriculture Sector Baseline : Projections 2010-2019. SAGARPA. Forthcoming.

AFDC, Alternative Fuels and Advanced Fuels Data Center. 2009. DOE, U.S. Department of Energy. "World Fuel Ethanol Production, 2008." www.afdc.energy.gov/afdc/ethanol/production.htm?print (accessed January 11, 2010).

Westhoff, Patrick. 2008. "Farm Commodity Prices: Why the Boom and What Happens Now?" *Choices* 23(2):6-10.

World Agricultural Outlook Board. 2010. "World Demand and Supply Estimates." WASDE-478, USDA. (January 12):16.

Brand Information Mitigating Negative Shocks on Animal Welfare: Is It More Effective to "Distract" Consumers or Make Them Aware?

Domenico Dentoni[⊕a], Glynn T. Tonsor[b], Roger Calantone[c], and H. Christopher Peterson[d]

[a]*Lecturer, School of Agriculture, Food and Wine, University of Adelaide, 10 Pulteney Street, Adelaide, South Australia 5005, Australia*

[b]*Associate Professor, Department of Agriculture, Food, and Resource Economics, Michigan State University, 317B Agriculture Hall, Urbana East Lansing Michigan, 48824-1039, U.S.A.*

[c]*Professor, Department of Marketing, Eli Broad Graduate School of Business, Michigan State University, N307 Business Complex, East Lansing, Michigan, 48824-112, U.S.A.*

[d]*Professor, Nowlin Chair of Consumer-Responsive Agriculture, Department of Agriculture, Food, and Resource Economics, Michigan State University, 83 Agriculture Hall, Urbana East Lansing, Michigan, 48825-1039, U.S.A.*

Abstract

To create and sustain a competitive advantage in markets that increasingly value animal welfare attributes, meat companies need to meet public and private production standards while communicating to final consumers through their brands. Data are collected from a representative sample of 460 U.S. residents through an on-line experiment on McDonald's chicken breast sandwiches and analyzed with Latent Growth Modeling. This study assesses which content of positive brand information effectively mitigates the risk of negative information shocks on animal welfare. On average, brand information has the same positive impact on consumers' beliefs and attitudes, regardless of whether it is related or unrelated to animal welfare. However, there is strong market segmentation in terms of consumers' response when exposed to brand information, suggesting that brand managers would benefit from tailoring brand information according to consumers' age, education, gender and income.

Keywords: animal welfare; brand; information; consumer behavior; multivariate statistics.

[⊕]Corresponding author: Tel: + 61 415 615777
                               Email: domenico.dentoni@adelaide.edu.au
Other contact information: G. Tonsor: gtonsor@msu.edu
                               R. Calantone: rogercal@msu.edu
                               H. C. Peterson: peters17@msu.edu

Introduction

Animal welfare is currently one of the most contentious issues in animal agriculture (American Veterinary Medical Association 2006, Farm Foundation 2006). While there appears to be no standardized definition of "animal welfare", ongoing public discussions and agricultural economics literature generically use this phrase to define the subject of how production practices impact the treatment of farm animals. From the perspective of meat companies, tackling the issue of animal welfare requires both undertaking a significant change in practices and engaging in a complex net of interactions with governments, retailers, final consumers and non-governmental organizations (NGOs).

First of all, meat companies have to meet public standards of governments banning practices that make animals suffer while raised, transported and slaughtered. In the US, residents have recently expressed ethical concerns for animal welfare issues with successful ballot initiatives banning the use of gestation crates in swine production in three states (Videras 2006). In the European Union (EU), the Commission signed a protocol in 2006 obliging the European Institutions to pay full regard to the welfare requirements of animals when formulating and implementing Community legislation (EU Commission 2009). Furthermore, meat companies often have to meet the private requirements of major players along the supply chain. The European retailers' association GLOBALGAP, which *de facto* controls the access of the majority of food imports in Europe (Reardon et al. 2010), has set animal welfare species-specific standards at the production and processing level. Global fast food chains such as McDonald's and Burger King are sourcing an expanding share of their food from crate free sources (Martin 2007).

As meeting public and private standards on animal welfare brings additional costs to meat companies (Henson and Traill 2000, Stott et al. 2005), estimating consumers' willingness to pay a premium (WTPP) for animal welfare become necessary for assessing industry profitability. A large recent strand of the literature has evidenced that a segment of consumers are willing to pay a premium for pork, chicken and beef with animal welfare attributes (Harper and Nilsson 2006, Lagerkvist et al. 2006, Carlsson et al. 2007, Lijenstolpe 2008, Tonsor et al. 2009a, Tonsor et al. 2009c). Results from this research strand are consistent with qualitative studies on consumers' attitudes and perceptions for "animal welfare" products (Harper and Makatouni 2002, Schröder and McEachern 2004). Consumers' preferences for animal welfare do not seem to vary significantly depending on demographic variables (Nilsson et al. 2006, Carlsson et al. 2007, Tonsor et al. 2009c), although they may vary according to their altruism and tendency of free riding (Lusk et al. 2007).

However, in the new era of global food systems, meat companies cannot limit their efforts in meeting the public standards and their private buyers' requirements. They are also increasingly called to communicate directly to their final consumers by managing their brands effectively, especially to counteract the negative information from NGOs advocating either against the entire meat industry (Verbeke and Viaene 2000) or against targeted firms (Bracke et al. 2005, Fulponi 2006). The case of McDonald's and Burger King responding to negative information by the People for Ethical Treatment of Animals (PETA) (Hudson and Lusk 2004, Martin 2007) is emblematic and similar to other situations currently occurring in other food sectors (Mintel GNPD 2010, Rockwood 2010). Therefore, analyzing which positive information effectively

mitigates the risk of negative shocks affecting a brand would represent a timely and important implication for food managers.

Therefore, although literature on animal welfare is rapidly expanding, a significant knowledge gap that remains unexplored is how consumers change their perceptions and preferences for meat products when receiving information on animal raising, handling and processing practices. Only Tonsor et al. (2009b) appear to have so far explored the impact of media coverage with animal welfare information on consumer preferences for meat products. However, no study has so far analyzed the impact of different contents of positive information that aims at mitigating the impact of negative information on animal welfare. This paper seeks to start filling this gap by analyzing the differences in the impact on consumers' perceptions and attitudes of positive information which is either (1) about the brand or product but not about the specific issue contained in a negative shock on animal welfare (this is called "distracting" or "unrelated" information, consistently with the term used by Okada and Reibstein 1998), or (2) strictly about the issue in the negative shock (this is called "related" information), in this case, about animal welfare.

In the marketing literature, much research has focused on the effect on consumers of positive information which is directly related to the content of negative information shocks (Tybout et al. 1981, Smith and Vogt 1995, Okada and Rubstein 1998, Klein and Dawar 2004, Roehm and Tybout 2006), but rarely has positive information been given *before* negative information (Smith and Vogt 1995). In many circumstances, however, a company may find it appropriate to anticipate the risk of future negative shocks and provide *ex ante* positive information to effectively manage its brand. Therefore, in this paper we complete our analysis by assessing if results are robust when positive brand information is given either *ex ante* or *ex post* a negative shock on animal welfare.

To analyze the different impact of positive information related and unrelated to animal welfare on consumers' perceptions and buying intentions, data for this study were collected from 460 US residents through an experiment on fast food chicken breast sandwiches. The analysis is conducted with a Latent Growth Modeling (LGM) approach (Duncan et al. 1999), which is an application of structural equation modeling (SEM) to the context of changes in variables over time.

Similarly to SEM and other multi-variate techniques, applying LGM to the context of agri-food marketing provides two key features. First, LGM gives the researcher a means to assess a set of relationships among variables simultaneously as part of a unique model, rather than in separate analyses (Hair et al. 2006). Second, it offers the opportunity of exploring the mediators and the moderators playing a role in explaining the impact of an independent variable on a dependent variable (Kaplan 2009). In turn, this provides the opportunity of exploring *why* and *under which conditions* a piece of information or a claim on food attributes has an impact on consumers' buying intentions. This allows expanding knowledge on how consumers change their food perceptions and values and so ultimately on how they make their food buying and consumption decisions. Therefore, in a market where companies are increasingly pushed to be consumer-responsive to create and sustain competitive advantage by increasing their product benefits, tackling research questions with LGM responds to the needs of food marketing managers.

The remainder of this paper is organized as follows. In the next section, the literature on brand equity management, negative information shocks, the role of positive brand information and the concepts of consumers' perceptions and attitudes are reviewed. Hypotheses are developed in the following section, before the research methods and the model are presented. After illustrating the results, conclusions are provided in the last section.

Literature Review

Managing Brand Equity through Information

From a customer perspective, brand equity is commonly defined as "the differential of brand knowledge on consumer response to the marketing of the brand" (Keller 1993, p.8). It is established in marketing theory and practice that building and managing brand equity is a primary source of sustainable competitive advantage and long-term financial performance (Aaker 1991; Keller 1993). Building brand equity means creating a brand that is familiar to consumers and that has strong, unique and favorable associations. Managing the brand means creating value by increasing consumers' brand awareness and/or by maintaining, changing or creating new favorable, strong and unique associations (Keller 1993). To effectively manage a brand, it is crucial 1) to understand the rational process that consumers undertake to evaluate and to make decisions related to the brand; 2) to know how consumers would respond to different types of marketing activities (Keller 1993).

For brand managers, a particularly challenging task is protecting the brand from the risk of harmful events (Shocker et al. 1994), such as the arising of sudden negative information shocks (Scott and Tybout 1981; Tybout et al. 1981). Very often, negative information shocks are related to brand attributes that were previously ignored or scarcely taken into consideration by consumers but that become "suddenly salient" attributes once the negative information reaches the consumers. The suspected presence of worms in McDonald's hamburgers (Tybout et al. 1981), the unethical labor conditions in multinationals' suppliers in Asia (Elliott and Freeman 2003) and the practice of sheep *mulesing* mutilation in Australian and New Zealand wool products (Chen 2008) are examples of attributes made "suddenly salient" by negative information shocks. Before the information shock, attributes such as the presence of worms, labor conditions and sheep mutilation practices were ignored, but after the shock these attributes suddenly become important in the evaluation of a brand at least for some consumer segments. Managing the brand and protecting it from the risks of negative information may be particularly difficult when the "suddenly salient" attribute is a credence attribute (Darby and Karni 1973) rather an experience attribute (Nelson 1970). In the case of credence attributes, when consumers are affected by a negative information shock about the brand, managers cannot easily restore consumers' perceptions and attitudes through product trials or other tangible verifying signals, but can only convince consumers through intangible signals such as positive information. Animal welfare is a clear example of credence attribute which suddenly became salient to consumers and so affected brands in different sectors after the release of negative information shocks by advocacy groups such as PETA (Hudson and Lusk 2004, Martin 2007).

In this paper, we investigate how positive information can be used with different contents - either related or unrelated to credence attributes - and at different times - either *ex ante* or *ex post* - to

prevent the negative effects of information shocks on credence attributes such as animal welfare, which became or is likely to become "suddenly salient" to some consumers groups. Therefore, we integrate the existing branding literature by exploring how brand equity can be managed effectively through information in a novel context, such as when the "suddenly salient" attributes stemming from negative shocks have credence nature.

Negative Information Shocks

Negative information shocks can be defined as strong evidence from a well defined source that suddenly makes an attribute salient to consumers (Dawar and Pillutla 2000, Klein and Dawar 2004, Roehm and Tybout 2006). In the field of agricultural economics, researchers have analyzed the impact of negative information shocks on consumer demand for food and agricultural products (Brown 1969, Dahlgran and Fairchild 1987, Smith et al. 1988, Robenstein and Thurman 1996, Piggott and Marsh 2004, Kalaitzandonakes et al. 2004). These studies have analyzed the impact of information shocks on food safety and healthiness, but not on animal welfare issues. In marketing, researchers have found negative information shocks can create negative brand associations (Klein and Dawar 2004), affect consumers' attitudes toward the brand, and ultimately harm brand equity (Dawar and Pillutla 2000).

Negative shocks can stem from media information of bad outcomes of the consumption of a brand's product, in the case of product-harm crises (Klein and Dawar 2004) such as food-borne disease outbreaks. Negative shocks can also be brought about by negative publicity of non-governmental organizations (NGOs) advocating against an industry or company practices, such as unethical treatment of workers (Elliott and Freeman 2003). However, negative information can also come from word-of-mouth (Scott and Tybout 1981, Tybout et al. 1981, Smith and Vogt 1995) and rumors, when the source of information transmitted through the word-of-mouth is not well defined (Kamins et al. 1997). There is evidence that word-of-mouth has a stronger negative effect on consumers' evaluation of an object than rumors (Smith and Vogt 1995).
The magnitude of the effect of negative information shocks on consumers' brand evaluations depends on various factors. First of all, it depends on the content of the information shock, which means whether the negative information is a product-harm crisis (Klein and Dawar 2004) or a scandal (Roehm and Tybout 2006). In the case of product-harm crises, such as the consumer outrage at contaminated Coca-Cola cans in Belgium and France in 1999 (Coombs 1999), consumers may perceive a threat for themselves that they were unaware of (Klein and Dawar 2004), experience fear and develop responses to cope with it (Rogers 1975, Floyd et al. 1990, Tanner et al. 1991). In the case of scandals revealing that a firm harms other entities, such as other people (Elliott and Freeman 2003), animals, or the environment, consumers may perceive compassion or solidarity (Batson 1998), as well as egregiousness towards the harming firm (Klein et al. 2004), which may lead to brand boycotting (Klein et al. 2004). However, consumers may also create inferences between scandals and product-harm crises. In the case of animal welfare, researchers have found consumers associate scandals about firms mistreating animals with food safety concerns and specifically to product-harm crises (Verbeke and Viaene 2000, Harper and Makatouni 2002).

A second key factor driving the magnitude of the effect of negative information shocks on consumers' brand attitudes is the initial equity of the targeted brand (Ahluwalia et al. 2000,

Dawar and Pillutla 2000, Pullig et al. 2006). In particular, when consumers have a strong positive attitude towards the targeted brand (Petty and Krosnick 1995) or commitment for it (Ahluwalia et al. 2000), negative information shocks have a weaker effect. Moreover, differentiation of a brand from competitors can limit the negative spillover from information shocks targeting a competing brand (Roehm and Tybout 2006). For example, the presence of strong consumers' beliefs that a brand owner follows corporate social responsibility (CSR) principles is likely to mitigate the effect of negative information shocks about that brand, when the negative information is unrelated to the CSR principles.

A third important factor that explains variation in the effect of negative information shocks on a brand is the target of the information shock. That is if the information shock targets the brand directly, one of its competing brands within the same industry, or instead the whole industry, without any specification about individual brands (Roehm and Tybout 2006). In some circumstances, the negative information shocks targeting a competing brand (Brand B) may have a negative effect on Brand A. In this case, an information shock on Brand B has a "negative spillover" on Brand A (Roehm and Tybout 2006), whereas "spillover" is commonly defined as any phenomenon in which information influences beliefs that are not directly addressed in a communication (Ahluwalia et al. 2000; Balachander and Ghose 2003).

Relative to this literature on negative information shocks, this research provides contributions in the following three areas. First, an analysis is presented on how the impact of negative information shocks on consumers' attitudes varies in the context of a scandal on animal welfare practices. Second, an analysis is done on how the impact of such a negative information shock varies when positive information is given beforehand. Third, an analysis is provided on how the effect of the negative information shock on consumers' attitudes varies according to whether the *ex ante* positive information is related or unrelated to animal welfare issues.

Positive Brand Information

Positive information about the brand can stem from the firm owning the brand, through advertising (Weinberger et al. 1981), or from external sources that are tied to the firm, such as sponsors or CSR partners (Klein and Dawar 2004). Positive brand information usually has the effect of creating or strengthening positive brand associations (Keller 1993) but it has also the role of moderating the effect of negative information shocks about the same brand (Weinberger et al. 1981; Okada and Reibstein 1998). In the agricultural economics literature, many studies on the interaction between negative and positive information has been applied to the case of genetically-modified food products (Fox et al. 2002, Rousu et al. 2002, Lusk et al. 2004, Wachenheim and VanWechel 2004, Nayga et al. 2005). Positive information usually has an impact weaker than negative information shocks (Smith and Vogt 1995, Fox et al. 2002), as it is recognized to attract less attention than negative information shocks (Scott and Tybout 1981, Tybout et al. 1981).

When it is used to moderate the effect of negative information shocks on consumers' brand attitudes, positive brand information has a different outcome according to two major dimensions: the order in which the positive information is received (Smith 1993, Smith and Vogt 1995) and the distance in the content of positive and negative information, that is, whether the two pieces of

information strictly contradict each other or are about different brand attributes (Tybout et al. 1981, Okada and Reibstein 1998, Klein and Dawar 2004). When provided *ex ante*, positive information generally mitigates the negative effect of word-of-mouth (Smith and Vogt 1995) and negative product trial (Smith 1993), even if the positive and the subsequent negative information contradict each other. When the positive information is provided *ex post* and denies a negative information shock or a rumor (i.e., it is "related" to the negative information), it might be ineffective in moderating the negative brand association or even strengthening it (Tybout et al. 1981, Okada and Reibstein 1998). When creating positive associations that are distant from the negative associations, *ex post* positive information (i.e., "unrelated" information) moderates the effect of negative information shocks (Tybout er al. 1981, Klein and Dawar 2004).

A third factor explaining variability of the positive information in mitigating negative shocks to competing brands is the initial brand differentiation (Roehm and Tybout 2006), which means having strength and uniqueness of brand associations (Keller 1993). When Brand A is not clearly differentiated from the brand targeted by the negative shock (Brand B) and the positive information on Brand A is an *ex post* denial message - such as "the bad thing happened to Brand B has not happened to our Brand A" – then the positive information can reduce or eliminate the negative spillover effect (Roehm and Tybout 2006). However, in the same circumstance, when Brand A is clearly differentiated from Brand B, positive information on Brand A that denies what happened to Brand B can create a negative spillover that would not otherwise exist and ultimately damage Brand A (Roehm and Tybout 2006).

Relative to this literature on the role of positive brand information mitigating negative information shocks, this research provides a contribution in the following two areas. First, an analysis is provided on how the mitigating role of positive information varies in the context of a scandal on animal welfare practices. Second, an analysis is presented on how the effect of positive information on consumers' beliefs, attitudes and buying intentions varies according to whether its content is unrelated to the subject of the scandal or directly related to it.

In the attempt to bring such a contribution to the animal welfare debate and to the literature on negative and positive information, this study proposes and tests a theoretical framework that builds upon the theory of attitude formation (Fishbein 1967; Fishbein and Ajzen 1975).

Consumers' Beliefs, Attitudes and Buying Intentions

Consumers' cognitive process to create their attitudes towards brands and ultimately to establish their buying behavior usually starts from evaluating brand attributes (Fishbein 1967). By processing information about the attributes of a brand, consumers establish both evaluations and belief strengths for each attribute, such that the combination of the two determines their attitudes towards the brand (Fishbein 1967). Brand attributes are a category of brand associations, which in turn are a key dimension of brand equity: when a brand has strong, favorable and unique associations, then it is clearly differentiated from other brands (Aaker 1991, Keller 1993). Brand attributes may be observed before consumption (search attributes) or only after consumption (experience attributes, Nelson 1970), but some of them may not be visible either before or after consumption (credence attributes, Darby and Karni 1973). In the case of credence attributes,

consumers' belief strengths play a crucial role in establishing their attitudes towards products, and brand information has a crucial importance in determining consumers' beliefs.
However, consumers' attitudes towards a brand do not always predict buying behavior (Fishbein and Ajzen 1975). On the other hand, consumers' attitudes towards buying the brand, moderated by their subjective norms, predict buying intentions much more accurately (Fishbein and Ajzen 1975, Sheppard et al. 1988). In turn, buying intentions predict behavior "unless intent changes prior to performance" or "unless the intention measure does not correspond to the behavioral criterion in terms of action, target, context, time-frame and/or specificity". The intention of buying a brand has various measurable dimensions. The most general one is the willingness to do an effort to perform to the buying action (Fishbein and Ajzen 1975, Eagly and Chaiken 1993), whereas the nature of the effort may vary according to the context: it may be the willingness to pay to obtain a product from that brand, the likelihood to pay a premium for that brand, or the likelihood to buy the product even if it is not sold in a favorite purchasing location. A second key dimension of buying intentions is the choice of the brand among alternatives (Fishbein 1967, Fishbein and Ajzen 1975), which is the process of comparing and selecting among the intentions associated with each alternative in the choice set.

This study borrows from these theories predicting the formation of attitudes and buying intentions to use the concepts of consumers' beliefs in the presence of an attribute associated to the brand and attitudes towards a brand (Fishbein 1967).

Hypotheses Development

The conceptual framework of this study is built upon the theory of attitude formation (Fishbein 1967, Fishbein and Ajzen 1975) and the theories of the interaction between positive and negative information shocks developed in consumer economics (Fox et al. 2002, Rousu et al. 2002, Lusk et al. 2004, Wachenheim and Van Wechel 2004, Nayga et al. 2005) and consumer psychology (Tybout et al. 1981, Smith 1993, Smith and Vogt 1995, Okada and Reibstein 1998, Klein and Dawar 2004, Roehm and Tybout 2006).

When analyzing the interaction between the negative shocks and the positive brand information, two assumptions are made based on the extent literature. First, negative information has a stronger marginal impact than positive information, no matter neither the information sequence nor the content of positive information, as already found by Smith and Vogt (1995), Fox et al. (2002) and Lusk et al. (2004). Second, *ex ante* positive information has a larger effect on mitigating the effect of the negative shock than *ex post* positive brand information, as already tested in extant literature (Smith 1993, Smith and Vogt 1995, Klein and Dawar 2004). This assumption is also consistent with the theory explaining the impact of prior beliefs and the order of information on consumers' evaluations of objects (Russo et al. 1998, Carlson and Pearo 2004, Carlson et al. 2006).

Building upon these assumptions, two major hypotheses are tested. First, *ex ante* brand information which is related to the content of the following negative shock is more effective in moderating the negative effect of the information shock than brand information which aims at distracting from that content (i.e., unrelated information). Providing positive information on environment, social welfare and animal welfare attributes of a brand and of the brand owner may

be considered the strategy of companies that are trying to minimize the future risk of being affected by future negative information shocks caused by advocating Non-Governmental Organizations (NGOs) or other civil society organizations. From this perspective, major food companies that joined multi-stakeholder dialogue initiatives such as the Sustainable Agriculture Initiative Platform (SAI Platform 2009), may be interested in developing positive brand information on sustainability issues even if their consumers value other attributes of their brands more. Therefore, it is hypothesized:

> **H1.** Consumers receiving *ex ante* positive information related to animal welfare discount the following negative information shock on animal welfare more than consumers receiving *ex ante* unrelated positive information.

This hypothesis juxtaposes with findings from previous literature suggesting that positive information is more effective when it "distracts" consumers from the negative shock, as it creates negative associations or rational suspiciousness (Tybout et al. 1981, Okada and Reibstein 1998, Roehm and Tybout 2006). If data provide evidence supporting this hypothesis, then providing *ex ante* positive information on issues that are related to future information shocks may be considered as a form of insurance for protecting the brand from scandals. Moreover, if the positive brand information has the strength of differentiating the brand from competitors, then the brand may become immune to any negative information shocks affecting its industry, consistent with the finding of Roehm and Tybout (2006).
On the other hand, how should a company act when it has already been affected by a negative information shock? Should it react by developing brand information related to the content of the negative information, or should it choose to provide unrelated positive information? Consistent with existing literature on product crises (Tybout et al. 1981, Okada and Reibstein 1998), which highlights the risk that *ex post* information relevant to the negative shock just strengthen consumers' negative associations, it is hypothesized here that unrelated positive information has a more positive effect on consumers' attitudes than related positive information. In other words:

> **H2.** Consumers receiving *ex post* positive information unrelated to animal welfare issues after a negative information shock have a stronger increase in attitudes than consumers receiving *ex post* information related to animal welfare.

After these two hypotheses are tested, further exploration will be made of which consumers' demographic and attitudinal characteristics significantly explain variation across the effects of positive brand information related or unrelated to animal welfare issues.

Methods

Sample and Product Selection

To test the hypotheses, data was collected from an on-line experiment focused on fast food boneless chicken sandwiches and animal welfare issues administered to 460 US-based residents in November 2009[1]. Data was collected randomly from a representative sample recruited

---

[1] As we collected primary data from human subjects, before starting the data collection we obtained a formal approval by the Institutional Review Board (IRB) at Michigan State University certifying that the researchers took

according to state, age, ethnic group and education level criteria by a professional survey company. Response rate was around 20%, while on-line questionnaire completion rate was around 75%. As agreed with the professional survey company recruiting the sample, we made sure that the population that completed the questionnaire was representative of the US population according to the criteria established. As some population segments were more responsive than others, it took four more days and one further sample draw to obtain a sufficient number of completed questionnaires from the less responsive population segments. Only one reminder was sent to the people belonging to the less responsive population segments that did not complete the questionnaires within two days from our first contact. On average, respondents took around 14 minutes to complete the questionnaire.

A fast food brand was chosen as the object of our experiment because, similarly to other private actors within the meat industry, they have been recently targeted by negative information shock about their animal welfare practices by advocating NGOs (Hudson and Lusk 2004, Martin 2007). Although other negative information affected both fast foods and other actors competing in different industries, the case of animal welfare and fast foods was chosen because it is a relatively new issue, where respondents are less likely to have strong beliefs prior to the experiment. Therefore, we expect to find more variation after each information treatment on animal welfare than for after treatments on, say, environmental issues, labor issues or genetically-modified issues. On these latter issues, US respondents received a much heavier information load in the past five to ten years and so they are likely to have stronger prior beliefs (Fox et al. 2002, Rousu et al. 2002, Lusk et al. 2004). Furthermore, fast food restaurants have been already the object of previous studies on negative information regarding different attributes (Roehm and Tybout 2006). Finally, chicken boneless sandwiches were chosen as the product of interest because various fast food brands offer a similar product and because many ethical concerns were focused on the quality of life of chickens.

Research Design

After accepting the invitation to participate in this study, respondents were redirected to a web link with the questionnaire page. The experiment was divided in three major parts. First, participants answered questions on demographics, on their food value and their consumption habits related to chicken consumption. In the initial demographics section, along with a few preliminary questions about age, gender, ethnic group and nationality, respondents were asked how much they value origin, naturalness, sustainability and taste when purchasing and consuming food. Moreover, they were asked how often they consume chicken products. Every question has been measured with a seven-point Likert-scale item.

Second, respondents were divided into four groups, each receiving a different set of treatments. The four treatments consisted of positive information *unrelated to* or *related to* animal welfare issues, as well as provided before a negative information shock (i.e. *ex ante*) or after the same shock (i.e. *ex post*) (see Figure 1). The positive brand information consisted of a set of reported declarations from differences sources: an advocating NGO (Greenpeace), a certifying NGO

---

into consideration all the issues related to voluntariness of recruitment, informed consent, confidentiality and anonymity, research risks and benefits, adverse events and unanticipated problems involving risks to subjects or others, adverse events from exercise testing, and record retention.

(Animal Welfare Society), a university expert on meat and animal welfare and a self-claim from McDonald's. The negative information treatment, published by the People for Ethical Treatment of Animals (PETA), denounced that McDonald's suppliers mistreat chicken and inflict them terrible pains while stocking, transporting and slaughtering them.

Group 1 *Ex Ante* Positive Information *Unrelated* to Animal Welfare Issues	**Group 3** *Ex Ante* Positive Information *Related* to Animal Welfare Issues
Group 2 *Ex Post* Positive Information *Unrelated* to Animal Welfare Issues	**Group 4** *Ex Post* Positive Information *Related* to Animal Welfare Issues

Figure 1. The Four Treatments Interacting Positive and Negative Information

Third, after each treatment, participant responses were elicited on animal welfare beliefs, attitudes towards McDonald's chicken sandwiches and willingness-to-pay a premium price (WTPP). Respondents' belief strength in the association between animal welfare and the brands was measured with a seven-point Likert-scale, where the respondents are asked to strongly disagree/strongly agree with the following statement: "I believe that McDonald's takes effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products sold in their restaurants." Respondents' attitudes towards the brands were measured with one seven-point Likert-scale question asking "How would you describe your attitudes towards McDonald's?" where the scale was from very negative to very positive. WTPP has been elicited with two consecutive questions. First, respondents were simply asked whether they were willing to pay a premium price or not for a McDonald's chicken sandwich, compared to a similar sandwich by a competing fast food brand. Participants responding "yes" were then asked which interval of price premium, expressed in percentage terms, were willing to pay. Therefore, we modeled WTPP as a continuous variable where the participants responding "no" had a zero value, while the participants responding "yes" had a value equal to the average value of the interval of price premium chosen. As the distribution of the variable WTPP was strongly skewed to the right, we added one point to each value and took the natural logarithm in order to make the WTPP distribution more normally distributed.

The Model

In order to capture the dynamic nature of the data we have collected, analysis was conducted through a set of latent growth models (LGMs). LGMs can be considered a specific category of structural equation models (SEMs) where the latent factors are the intercept and the slope of the growth of a variable across a group of individuals (Duncan et al. 1999). Compared to longitudinal panel modes, LGMs have the advantage of both describing single individual's development trajectory of variables and capturing individual differences in these trajectories over time (Duncan et al. 1999). In particular, the latter characteristic allows the researcher to explore the factors moderating the intercept and slope of the development trajectory. Similarly to SEMs, limitations of LGMs include the assumption of multi-normally distributed variables and the necessity of large samples (Duncan et al. 1999).

As common in use in LGMs (Duncan et al. 1999), we fixed the loadings from factors to the measured variables (i.e., respondents' animal welfare beliefs, attitudes and WTPP) at arbitrary values, while we let the model estimate the factors' means and variances, as well as the co-variances among factors. The factors' mean indicates the expected difference between the measurable variables at two different times, while the factors' variance indicates the inter-individual variability around the mean. Finally, the co-variance among factors indicates weather the initial levels of beliefs and attitudes are significantly associated with future changes or not.

In this study, to compare the impact of positive information related and unrelated to animal welfare issues, the LGM was built in four sequential steps: (1) with a simple piece-wise LGM for each respondents' group, (2) with an associative LGM for each respondents' group, (3) with a multi-group LGM and (4) with a predictive LGM for each respondents' group. Building the model in sequential steps is common in use in LGM as well as in SEM, such that it is easier to detect which added component to the basic model makes increase or decrease the overall fit with the data. First of all, we test a simple piece-wise LGM as it specifically allows analyzing trends that are affected by structural shocks over time (Duncan et al, 1999). In this study, the structural shocks are the contrasting pieces of information that respondents receive at two different times prior to each measurement of beliefs, attitudes and WTPP. Second, with an associative LGM we explore if changes across respondents' beliefs, attitudes and WTPP are significantly associated. Third, through a multi-group LGM we test the structural growth differences across treatments with different information contents (i.e., relevant versus distracting information). Therefore, with such a multi-group LGM we can formally test our hypotheses. Finally, with a predictive LGM we can explore what are the drivers of change in beliefs, attitudes and WTPP across different individuals. We evaluated each of these models both in terms of overall fit with the data and by analyzing the significance of individual effects among variables (Bagozzi and Yi 1988, Browne and Cudeck 1993, Hu and Bentler 1999).

The generic simple piece-wise LGM applied to the case of *ex ante* positive information treatments has the following form, consistent with LGM literature (Duncan et al. 1999) (see Figure 2):

$$(1)\ V_1 = l_{11}F_1 + l_{21}F_2 + l_{31}F_3 + e_1;$$
$$(2)\ V_2 = l_{12}F_1 + l_{22}F_2 + l_{32}F_3 + e_2;$$
$$(3)\ V_3 = l_{13}F_1 + l_{23}F_2 + l_{33}F_3 + e_3;$$

$$(4) \; F_1 = a_1M_1 + b_1D_1;$$
$$(5) \; F_2 = a_2M_2 + b_2D_2.$$
$$(6) \; F_3 = a_3M_3 + b_3D_3.$$

In these expressions, V_1, V_2 and V_3 stand for the measured variables of interest (i.e., respondents' animal welfare beliefs, attitudes and WTPP) at time 0, time 1 and time 2. F_1, F_2 and F_3 represent respectively the intercept, the growth factor caused by the positive information and the decrease factor caused by the negative information. Moreover, l_{ij} represent the fixed loadings from the factors to the measured variables and e_i are the errors. Along with the loadings, also the measured variable errors are fixed in order to make the model perfectly identified. Moreover, M_i are the inter-individual means of the intercept and the slope, while D_i are the inter-individual variances of the intercept of the slope to be estimated. Finally, $Cov(D_i, D_j)$ is estimated to understand if intercept and slope are significantly associated.
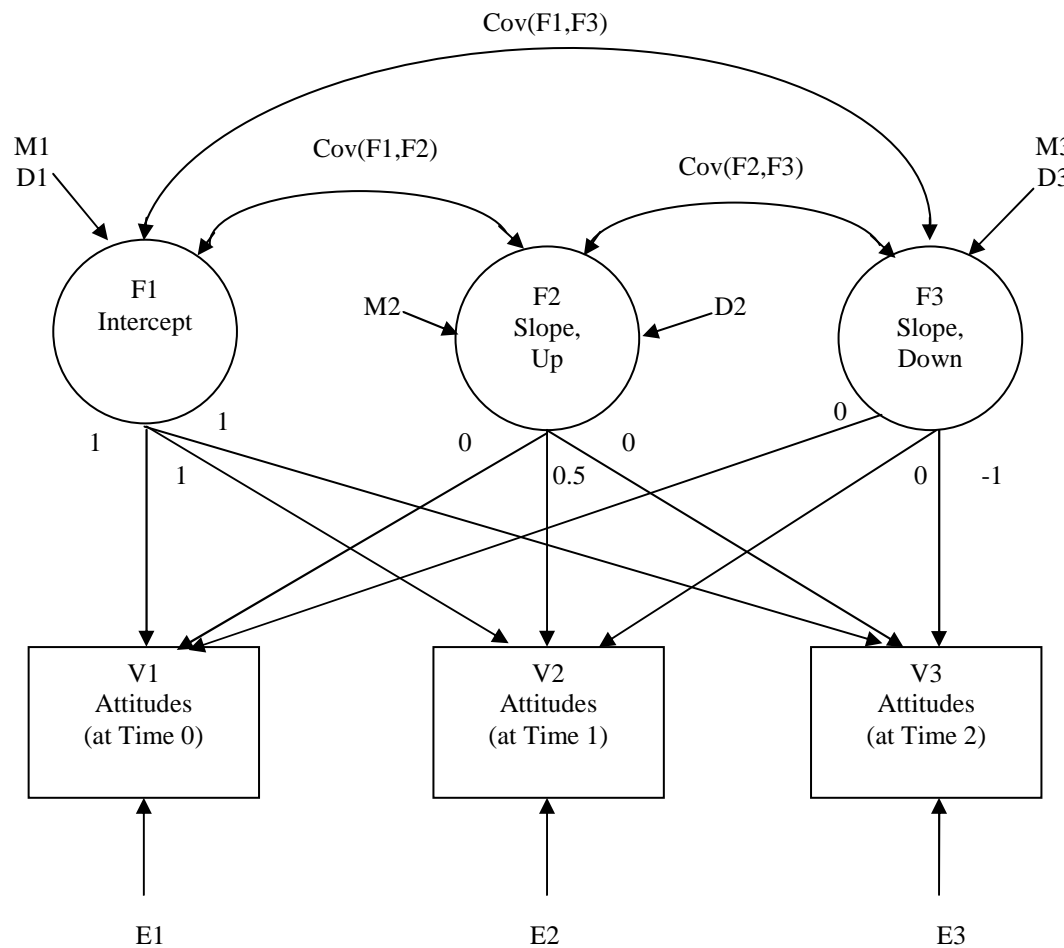
Figure 2. The Generic Piecewise Latent Growth Model
Legend: V1: Initial Consumers' Attitudes; V2: Consumers' Attitudes after receiving Positive Information; V3: Consumers' Attitudes after receiving Negative Information; F1: Latent Factor driving Prior Attitudes; F2: Latent Factor driving Attitudes after receiving the Positive Information; F3: Latent Factor driving Attitudes after receiving the Negative Information. M1, M2 and M3 respectively indicate the means of the Latent Factors F1, F2 and F3. D1, D2 and D3 respectively indicate the variances of the Latent Factors F1, F2 and F3. E1, E2 and E3 respectively indicate the estimated errors of V1, V2 and V3.

Results

Distracting versus Relevant Ex Ante Brand Information

Results from the set of LGMs with data from the two groups of respondents receiving related and unrelated positive information *before* the negative information provide four major insights. First, respondents' beliefs on animal welfare, attitudes and WTPP increase significantly at 95% level both when they receive related and unrelated positive information. Based on the two associative LGMs with the two respondents' group, we find that when respondents receive positive information unrelated to animal welfare issues at McDonald's, their animal welfare beliefs increase on average from 3.41 points to 3.92 and then decrease to 2.91 points when negative information on animal welfare is provided (see Table 1, first column). This may seem odd, as the provided information aimed at distracting respondents from animal welfare issues, but it is likely that positive information about healthiness of McDonald's products has been used as a cue to increase beliefs on animal welfare. Also, their attitude towards the McDonald's product increase on average from 4.06 to 4.46 points and then decrease to 3.36 points, while their willingness to pay a premium for it increases from 2.8% to 4.6% and then decreases to 2.4%.

Table 1. Multi-Group Associative LGM: Unrelated versus Related *Ex Ante* Positive Information

	Unrelated Info		Related Info		Equality LM Test (Chi-Square)	
	Mean	*Var.*	*Mean*	*Var.*	*Mean*	*Var.*
AWBelief0	3.41 *	1.894 *	3.76 *	2.515 *	3.98 **	0.98
Attitude0	4.06 *	2.679 *	4.53 *	2.427 *	4.26 **	0.55
WTPP0	2.8% *	0.007 *	2.0% *	0.003 *	0.56	28.10 **
AWBelief1	3.92 *	4.868 *	4.79 *	7.892 *	14.59 **	4.40 **
Attitude1	4.46 *	2.435 *	4.93 *	4.765 *	0.19	14.36 **
WTPP1	4.6% *	0.019 *	3.6% *	0.015 *	0.06	0.74
AWBelief2	2.91 *	2.357 *	3.29 *	2.953 *	0.01	1.43
Attitude2	3.36 *	2.070 *	3.63 *	2.901 *	0.93	3.12 **
WTPP2	2.4%	0.005 *	1.8%	0.003 *	0.19	9.93 **
Overall Fit Indexes:						
Chi-Square	805.25 with 45 d.f.		745.97 with 45 d.f.		1551.23 with 90 d.f.	
CFI					0.920	
RMSEA					0.148	

Legend:
AWBelief0, Attitude0, WTPP0: initial consumers' Animal Welfare (AW) beliefs, attitudes and percentage of consumers with WTPP (time 0). AWBelief1, Attitude1, WTPP1: consumers' AW beliefs, attitudes and percentage of consumers with WTPP after the positive information shock (time 1). AWBelief2, Attitude2, WTPP2: consumers' AW Beliefs, attitudes and percentage of consumers with WTPP after a subsequent negative information shock (time 2). Note: *95% probability that the parameter is significantly different from zero; **90% probability of significant drop of chi-Square when the equality constraint is removed.

Similarly, when respondents receive related positive information on animal welfare practices at McDonald's, their beliefs increase on average from 3.76 points to 4.79 and then decrease to 3.29 points when negative information on animal welfare is provided (see Table 1, second column). Also, their attitude towards the product increase on average from 4.53 to 4.93 points and then decrease to 3.63 points, while their willingness to pay a premium increases from 2.0% to 3.6%

and then decreases to 1.8%. However, the analysis reveals that the decrease of respondents' willingness to pay a premium that received the negative information is not significant at 95% level, either when they *ex ante* received related or unrelated positive information. This is probably driven by high censoring of WTPP at 0%, which takes place around 85% of respondents. The two associative models with unrelated and related positive information have both a good overall fit with the data, as their chi-square is respectively 805.25 and 745.97 with 45 degrees of freedom (d.f.).

Second, there is a strong inter-individual variation around the average increase and decrease in respondents' beliefs, attitudes and WTPP. In both the associative LGMs with the two respondents' groups, the variance of all the measured variables is significant at 95% level (see Table 1, first and second column). This provides a strong justification for exploring the individual demographic drivers of changes in beliefs, attitudes and buying intentions as a response to positive and negative information in the following steps of the analysis.

Third, related *ex ante* positive information does not mitigate the effect of negative information significantly more than unrelated *ex ante* positive information. As a result from the multi-group LGM, the Lagrange Multiplier (LM) test does not show that overall fit would improve significantly when the equality constraints of the increase and decrease factors' means were released. As a matter of facts, chi-square would drop of only 0.01, 0.93 and 0.19 points respectively by removing the equality constraints on the factors describing the decrease in animal welfare beliefs, attitudes and WTPP (see Table 1, third column). Therefore, this result provides no evidence supporting hypothesis H1.

Fourth, although the average trend of increase and decrease in respondents' beliefs, attitudes and WTPP is similar across the two groups, there are still significant differences between the impacts of unrelated versus related *ex ante* positive information. As a matter of fact, the overall fit of the restricted multi-group model with the data is poor (chi-square is 1551.23 with 90 d.f., CFI=0.920 and RMSEA=0.148), which means that the two models with unrelated and related positive information cannot be effectively constrained to be equal (see Table 1, third column). Specifically, there are three significant differences across groups. The first difference is that when respondents receive relevant positive information, their animal welfare beliefs are significantly higher than when they receive unrelated positive information. The Lagrange Multiplier (LM) test indicates that the overall fit of the model would increase significantly (with a drop equal to 14.59 chi-square points) if this equality constraint is removed. The second difference is that the initial attitudes and animal welfare beliefs are significantly higher for the group receiving related positive information. We claim that this difference across group is casual rather than due to demographic differences across the two groups, as the differences across average age, income, education, gender and state of residency are not significant. However, from descriptive statistics, we found that the group receiving the relevant positive information had both higher initial attitudes for sustainability, naturalness and taste related to the other group, but obviously this was difficult to be controlled during the sample selection. The third significant difference across groups regards the variances of the increase and decrease factors. Specifically, when respondents receive related positive information, the variance of the increase and decrease factors in attitudes is significantly larger than when they receive unrelated information.

Moreover, the variance of the increase in their animal welfare beliefs is higher and the variance of the decrease in their willingness to pay a premium is smaller. This shows that related positive information on animal welfare causes a larger variation of individual responses compared to unrelated positive information. This provides further rationale to the search for demographic variables explaining the change in beliefs, attitudes and buying intentions caused by related positive information on animal welfare practices.

Distracting versus Relevant Ex Post Brand Information

Results from the set of LGMs with data from the remaining two groups of respondents who received unrelated and related positive information *after* the negative information can be summarized in the following four points.

First, respondents' animal welfare beliefs and attitudes increase at a 95% significance level both when they receive unrelated and related positive information even when positive information follows the negative information shock, but WTPP do not increase. Findings from the associative LGM show that when respondents receive positive information unrelated to animal welfare issues at McDonald's after the negative information shocks, their animal welfare beliefs increase from 3.18 to 3.56 points but are still lower than their initial beliefs before receiving the negative information shock (3.91 points) (see Table 2, first column).

Similarly, their attitudes towards the McDonald's product and their WTPP increase, but they are still lower than their initial attitudes before receiving the negative information shock. However, the analysis reveals that the increase of consumers' WTPP receiving the positive information is not significant at a 95% level. When instead consumers receive *ex post* related positive information on animal welfare practices at McDonald's, their beliefs increase from 2.94 to 3.66 points, which is higher than their initial beliefs before receiving the negative information shock (3.53 points) (see Table 2, second column). On the other hand, consumers' attitudes towards McDonald's and their willingness to pay a price premium for it increase, but they are still lower than their initial attitudes and WTPP before receiving the negative information shock. The two models have both a good overall fit with the data, as their chi-square is respectively 735.56 and 661.90 with 45 d.f. (see Table 2, first and second column).

Second, similarly to the case of *ex ante* positive information, there is strong inter-individual variation around the average decrease and then increase in respondents' beliefs, attitudes and WTPP. As a matter of fact, the variance of all the measured variables is significant at a 95% level. Again, this confirms that it is important to explore the individual demographic drivers of respondents' reaction to negative and positive information in the next stage of the analysis.

Third, similarly to the case of *ex ante* positive information, unrelated *ex post* positive information does not have a significantly more positive effect on respondents' attitudes and WTPP than related *ex post* positive information, nor vice versa. In the multi-group LGM, the LM test does not show that the overall fit would improve significantly when the equality constraints of the increase and decrease factors' means were released (see Table 2, third column). Therefore, our results provide no evidence supporting hypothesis H2. The LM test shows instead that respondents' animal welfare beliefs are significantly higher when they receive information

related to animal welfare rather than unrelated information, but this difference disappears when comparing respondents' attitudes and buying intentions.

Table 2. Multi-Group Associative LGM: Unrelated versus Related *Ex Post* Positive Information

	Unrelated Info		Related Info		Equality LM Test (Chi-Square)	
	Mean	*Var.*	*Mean*	*Var.*	*Mean*	*Var.*
AWBelief0	3.91 *	2.484 *	3.53 *	2.216 *	2.95	0.27
Attitude0	4.44 *	2.144 *	4.64 *	2.267 *	0.84	0.88
WTPP0	2.5% *	0.006 *	2.8% *	0.008 *	0.06	1.77
AWBelief1	3.18 *	2.199 *	2.94 *	2.225*	0.44	0.00
Attitude1	3.47 *	2.640 *	3.85 *	2.412 *	2.57	1.49
WTPP1	2.1 %	0.002 *	1.5% *	0.005 *	4.60 **	5.30 **
AWBelief2	3.56 *	6.399 *	3.66 *	9.765 *	6.18 **	5.46 **
Attitude2	4.20 *	6.077 *	4.30 *	8.319 *	0.19	1.18
WTPP2	2.2%	0.008 *	2.2%	0.022 *	0.05	5.02 **
Overall Fit Indexes:						
Chi-Square	735.56 with 45 d.f.		661.90 with 45 d.f.		1715.96 with 90 d.f.	
CFI					1.000	
RMSEA					0.000	

Legend: AWBelief0, Attitude0, WTPP0: initial consumers' Animal Welfare (AW) beliefs, attitudes and percentage of consumers with WTPP (time 0). AWBelief1, Attitude1, WTPP1: consumers' AW beliefs, attitudes and percentage of consumers with WTPP after the negative information shock (time 1). AWBelief2, Attitude2, WTPP2: consumers' AW Beliefs, attitudes and percentage of consumers with WTPP after a subsequent positive information shock (time 2). Note: *95% probability that the parameter is significantly different from zero; **90% probability of significant drop of chi-Square when the equality constraint is removed.

Fourth, differently from the case of *ex ante* positive information, the trends of decrease and increase in average respondents' beliefs, attitudes and buying intentions can be considered equal with a 95% statistical significance. The overall fit of the restricted multi-group LGM with the data is perfect as CFI=1.000 and RMSEA=0, indicating that the two models with unrelated and related positive information can be broadly constrained to be equal (see Table 2, third column). Still, the LM test suggests releasing three equality constraints across the two groups. The first difference is that, consistently with the previous finding, the average increase in consumers' animal welfare beliefs is significantly higher for consumers receiving related information than for those receiving unrelated information, as removing the equality constraint would lead to a drop of 6.18 chi-square points. The second difference is that the decrease in WTPP when negative information is provided is significantly higher in one of the two groups, although no difference in treatments was given beforehand. Also in this case, we believe that this is probably driven by high censoring of WTPP at 0%, which takes place around 85% of respondents. The third difference across groups regards the variances of two measured variables. Specifically, the variance of the WTPP decrease factor and the variance of the beliefs and WTPP increase factors is significantly higher in the group receiving the *ex post* related positive information. These differences in variances confirm that related positive information on animal welfare causes a larger variation of responses compared to unrelated positive information.

Predictors of the Impact of Distracting versus Relevant Information

Since there is strong inter-individual variation around the mean values of the decrease and increase factors both when positive information is provided *before* and *after* the negative shock, we explore the role of individual demographics and food values as drivers of the change in beliefs, attitudes and buying intentions.

Broadly speaking, results from the predictive LGM confirm that individuals of different age, sex, education, frequency of chicken consumption and food values react differently to different orders and contents of positive information. In particular, results provide the following four insights.

First, when positive information about McDonald's is given *ex ante* and it is distracting from animal welfare issues, respondents with higher income tend to be significantly more sensitive to positive unrelated information at a 95% level and to discount negative information on animal welfare, while males tend to discount positive unrelated information, which is relative to the healthiness of McDonald's products. The overall fit of this predictive LGM with the data is close as CFI is 0.989 and RMSEA is 0.097 (see Table 3, first column).

Table 3. Predictive LGM: Unrelated versus Related *Ex Ante* Positive Information on Respondents' Attitudes

Unrelated Info	**Indep. Var.**	**Coeff.**	**Std. Err.**	*Related Info*	**Indep. Var.**	**Coeff.**	**Std. Err.**
Intercept (F1)	*Mean*	4.23 *	0.60	**Intercept (F4)**	*Mean*	5.85 *	0.45
	Male	0.32	0.35		Education	-0.26 *	0.09
	Age	0.06	0.12		Age	-0.01	0.09
	Income	-0.13	0.09		Ev.Sustainable	-0.15	0.08
					Ev. Taste	0.28	0.14
Growth (F2)	*Mean*	0.20	0.49	**Growth (F5)**	*Mean*	0.62	0.64
	Male	-0.74 *	0.29		Education	0.01	0.13
	Age	0.05	0.10		Age	0.34 *	0.12
	Income	0.20 *	0.07		Ev.Sustainable	0.06	0.11
					Ev. Taste	-0.07	0.20
Decrease (F3)	*Mean*	1.44 *	0.49	**Decrease (F6)**	*Mean*	2.73 *	0.57
	Male	-0.31	0.29		Education	0.21 *	0.09
	Age	0.05	0.10		Age	-0.22 *	0.09
	Income	-0.19 *	0.07		Ev.Sustainable	0.19 *	0.08
					Ev. Taste	0.36 *	0.15

Covariance Matrix:				*Covariance Matrix:*			
	F1	**F2**	**F3**		**F4**	**F5**	**F6**
F1	2.91 *			**F4**	2.19 *		
F2	-0.70 *	1.92 *		**F5**	-0.71 *	4.45 *	
F3	0.93 *	-0.31	1.91 *	**F6**	1.00 *	-0.48 *	2.38*

Overall Fit Indexes:		*Overall Fit Indexes:*	
Chi-Square	235.80 with 18 degrees of freedom	**Chi-Square**	184.96 with 24 degrees of freedom
CFI	0.989	**CFI**	1.000
RMSEA	0.097	**RMSEA**	0.000

Note: In the Predictive LGM, n=93 because there are 22 cases with missing income data that were excluded from the analysis.

Second, when positive information about McDonald's is given *ex ante* and it is related to animal welfare issues, respondents with higher education have lower initial attitudes towards McDonald's chicken sandwich and are more sensitive to negative information on animal welfare issues. On the other hand, elder individuals tend to be significantly more sensitive to positive related information while they tend to discount negative information. Finally, respondents with higher values for food sustainability and flavor tend to be more sensitive to negative information on animal welfare. The overall fit of this predictive LGM with the data is perfect as CFI is 1.000 and RMSEA is 0.000 (see Table 3, second column).

Third, when positive information about McDonald's is given ex post and it is unrelated to animal welfare issues, respondents with higher income tend to discount negative information on animal welfare, while people consuming chicken more frequently tend to be more sensitive to negative information on animal welfare. This direct association between frequency of chicken consumption and sensitiveness to negative information on animal welfare seems to contradict the common perception that frequent consumers of meat tend to discount information on animal welfare. A possible explanation of this association may be that frequent chicken consumers in the US are strengthening their inferences across the animal welfare attributes and both food safety and flavor, which are obviously salient attributes for frequent meat consumers. However, the overall fit of the model is poor, as RMSEA=0.145 and CFI=0.916 (see Table 4, first column).

Fourth, when positive information about McDonald's is given *ex post* and it is related to animal welfare issues, respondents with higher education have lower initial attitudes towards McDonald's products and they are more sensitive to positive information on animal welfare. The overall fit of the model is perfect, as RMSEA=0.000 and CFI=1.000 (see Table 4, second column).

Finally, independently from the individual demographics and food values, from the predictive LGM we could learn also how prior individual beliefs, attitudes and buying intentions influence respondents' response to positive and negative information.

Broadly speaking, consistently with established consumer psychology literature (Russo et al. 1998, Carlson and Pearo 2004, Carlson et al. 2006), results confirm that prior beliefs and attitudes can significantly explain individual response to information in the case of McDonald's chicken sandwiches with animal welfare attributes. In particular, results provide three major interesting insights.

First, respondents with higher initial attitudes towards McDonald's generally have a lower marginal increase in positive information and a higher marginal decrease in negative information, no matter whether the content of the positive information. As a matter of fact, when *ex ante* positive information is given, the covariance between F1 and F2 and between F4 and F5 is negative and significant (respectively -0.70 and -0.71), while the covariance between F1 and F3 and between F4 and F6 is positive and significant (respectively 0.93 and 1.00, see Table 3). This partially contrasts the findings of Lusk et al. (2004), who found that consumers with stronger priors are less sensitive to genetically-modified information. Moreover, when *ex post* positive information is given, the stronger the decrease in attitudes, the weaker the following effect of positive information, no matter if related or unrelated to animal welfare issues (as covariance between F2 and F3 is -1.83 and covariance between F5 and F6 is -2.76).

Second, as an exception to the previous point, when *ex post* positive information tackles the animal welfare issue, initial attitudes are positively associated with the attitude increase. As a matter of fact, the covariance between F4 and F6 is 1.57 and is significant at a 95% level. On the other hand, this effect is not present in the case of *ex post* unrelated positive information (as the covariance between F4 and F6 is -0.63 and is not significant at a 95% level). This is an important point, as it illustrates that, once a negative shock occurred, related positive information on animal welfare can be more useful than unrelated information to restore the initial attitudes of those consumers that really like McDonald's.

Table 4. Predictive LGM: Unrelated vs. Related Ex Post Positive Information on Respondents' Attitudes

Unrelated Info	Indep. Var.	Coeff.	Std. Err.	*Related Info*	Indep. Var.	Coeff.	Std. Err.
Intercept (F1)	*Mean*	4.34 *	1.07	**Intercept (F4)**	*Mean*	5.22	0.43
	Income	-0.12	0.07		Education	-0.22*	0.10
	Freq. Cons.	0.19	0.17		Ev.Sustainable	0.02	0.08
	Ev.Sustainable	0.01	0.08				
	Ev. Taste	-0.08	0.09				
Decrease (F2)	*Mean*	0.08	1.12	**Decrease (F5)**	*Mean*	0.94	0.45
	Income	-0.20*	0.07		Education	-0.19	0.10
	Freq. Cons.	0.36 *	0.17		Ev.Sustainable	0.11	0.08
	Ev.Sustainable	0.13	0.08				
	Ev. Taste	-0.09	0.09				
Growth (F3)	*Mean*	-0.13	0.11	**Growth (F6)**	*Mean*	-2.03	0.84
	Income	0.20	0.11		Education	0.42 *	0.19
	Freq. Cons.	-0.47	0.27		Ev.Sustainable	0.04	0.15
	Ev.Sustainable	0.19	0.13				
	Ev. Taste	0.08	0.14				

Covariance Matrix:				*Covariance Matrix:*			
	F1	**F2**	**F3**		**F4**	**F5**	**F6**
F1	2.06 *			F4	2.16 *		
F2	0.60 *	2.28 *		F5	0.78 *	2.30 *	
F3	-0.63	-1.83 *	5.24 *	F6	1.57 *	-2.76*	7.97 *

Overall Fit Indexes:		*Overall Fit Indexes:*	
Chi-Square	163.92 with 24 degrees of freedom	**Chi-Square**	144.26 with 13 degrees of freedom
CFI	0.916	**CFI**	1.000
RMSEA	0.145	**RMSEA**	0.000

Note: In the Predictive LGM, n=93 because there are 22 cases with missing income data that were excluded from the analysis.

Third, only when information tackles *ex ante* the animal welfare issue, individuals whose attitudes increase most will be less sensitive to any following negative information on the same issue. In other words, when *ex ante* related positive information is given, the stronger their growth in attitudes with *ex ante* positive information, the smoother their decrease in attitudes following the negative information shock. As a matter of fact, the covariance between F5 and F6 is -0.48 and significant at a 95% level (see Table 3, second column). On the other hand, the same negative association is not significant in the case of respondents receiving *ex ante* unrelated positive information (as covariance between F2 and F3 is -0.31 and is not significant at a 95% level, see Table 3, first column). Therefore, related positive information is more useful than

unrelated information to mitigate the effect of negative information for those consumers that are more sensitive to positive information.

Conclusions

In the new era of global food systems, effective communication of food quality attributes to final consumers through brands is becoming a managerial task that goes far beyond meeting public and private standards imposed by governments and private retailers.

This study provides insights for fast food company managers that are responsible for communicating the quality attributes of their brands to final consumers and that need to tailor brand information to specific consumer characteristics. To do that, we investigate which content and order of positive brand information is more effective to protect a brand from information shocks on animal welfare and which consumers are more sensitive to different information content. Results show that on average consumers' attitude growth and decrease do not differ significantly across different content of information, but different consumer groups have very different reactions when exposed to animal welfare information.

Specifically, results from this study provide relevant information to managers of a fast food company such as McDonald's on two possible scenarios. When negative information shock on animal welfare at McDonald's is released first, managers should consider that the most affected individuals would be frequent consumers of chicken and lower income individuals. Moreover, individuals having initial higher attitudes towards McDonald's would be more sensitive to related subsequent positive information. Finally, individuals with higher education, although less likely to have high initial attitudes towards McDonald's, would be more responsive to subsequent positive related information. In the scenario that positive information anticipates the negative shock on animal welfare at McDonald's, managers should instead consider that individuals with higher income would be more sensitive to unrelated information and then less sensitive to the negative shock. On the other hand, elder individuals would be more sensitive to related positive information and to the negative information shock. Moreover, males would be less sensitive to unrelated positive information than females. Finally, individuals with stronger values for food sustainability and flavor would be more sensitive to negative shocks.

By tackling such a research question and providing these insights to the industry, this study contributes to the rapidly expanding animal welfare literature (Lagerkvist et al. 2006, Carlsson et al. 2007, Lijenstolpe 2008, Tonsor et al. 2009a, Tonsor et al. 2009c), where only a few studies have so far analyzed how media coverage affects consumers' preferences for meat products (Tonsor et al. 2009b). Specifically, this appears to be the first study analyzing the interaction of positive and negative information about animal welfare on consumers' perceptions and intentions to buy a product. Outside the boundaries of the animal welfare literature, this study also attempts to integrate current knowledge on the impact of sequences of positive and negative information shocks on consumer behavior, developed across the fields of economics (Fox et al. 2002, Rousu et al. 2002, Lusk et al. 2004, Wachenheim and Van Wechel 2004, Nayga et al. 2005) and psychology (Russo et al. 1998, Smith and Vogt 1995, Roehm and Tybout 2006), by analyzing inter-individual and inter-group differential effects with a Latent Growth Modeling (LGM) approach (Duncan et al. 1999).

Although results have useful managerial implications, the analysis of this study has a number of limitations. First, we conducted this analysis only on one specific fast food brand, i.e. McDonald's, without any comparison with other competing brands. Therefore, although we captured initial respondents' beliefs, attitudes and buying intentions for McDonald's to avoid the presence of confounding effects, we did not tackled the question of how information affects different initial levels of consumers' perceptions and attitudes. By comparing initial consumers' attitudes towards competing brands, future research can investigate how different brands with different levels of initial equity would react to information on animal welfare. Second, the analysis of this paper is limited to the context of fast food industry and to the case of animal welfare. Future research should seek for a generalization of these results across industries and across content of attribute information. For example, it would be interesting to test if the same conclusion could be drawn in the same industry when consumers are exposed to environmental friendly production or on labor conditions. Moreover, it would be interesting to test if, when exposed to the same animal welfare attribute negative and positive information, consumers' perceptions change across meat products, across individual brands or across different levels of the supply chain of the product. Finally, in this study we created the treatments by choosing the information content and source arbitrarily, but other contents, images and source of information may have different effects. In future research, it would be useful to analyze how different contents and different sources of positive information act on mitigating the negative impact of information shocks. We believe that the suggested future research questions could be effectively tackled by applying the LGM analysis introduced in this study while changing the set of information treatments appropriately.

References

Aaker, D. 1991. *Managing Brand Equity: Capitalizing on the Value of a Brand Name*. New York, NY: The Free Press.

Ahluwalia, R., R.E. Burnkrant and H.R. Unnava. 2000. Consumer response to negative publicity: The moderating role of commitment. *Journal of Marketing Research*, 37: 203-214.

American Veterinary Medical Association. 2006. American Veterinary Policy Statements. www.avma.org (accessed December 15, 2006).

Bagozzi , R. and Y. Yi. 1988. On the Evaluation of Structural Equation Models. *Journal of the Academy of Marketing Science,* 16 (1): 74-94.

Browne, M. and R. Cudeck. 1993. Alternative Ways of Assessing Model Fit. In *Testing Structural Equation Models,* edited by K.A. Bollen and J.S. Long, 136-162. Thousand Oaks, CA: Sage.

Carlson, K.A. and L.K. Pearo. 2004. Limiting predecisional distortion by prior valuation of attribute components.*Organizational Behavior and Human Decision Processes,*94:48-59.

Carlson, K.A., M.G. Meloy and J.E. Russo. 2006. Leader-Driven Primacy: Using Attribute Order to Affect Consumer Choice. *Journal of Consumer Research,* 32: 513-518.

Carlsson, F., P. Flykblom and C.J. Lagerkvist. 2007. Consumer willingness to pay for farm animal welfare: mobile abattoirs versus transportation to slaughter. *European Review of Agricultural Economics,* 34 (3): 321-344.

Darby, M. and E. Karni. 1973. Free competition and the optimal amount of fraud. *Journal of Law and Economics* 16 (1): 67-88.

Dawar, N. and M.M. Pillutla. 2000. Impact of product-harm crises on brand equity: The moderating role of consumer expectations. *Journal of Marketing Research,* 37: 215-227.

Duncan, T.E., S.C. Duncan, L.A. Strycker, F. Li and A. Alpert. 1999. *An introduction to latent variable growth curve modeling*. Mahwah, NJ: Erlbaum.

Eagly, A. and S. Chaiken. 1993. *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.

Coombs, T.W. 1999. Coca Cola: Bad For You. *The Economist*, June 19.

Elliot, K.A. and R.B. Freeman. 2003. *Can Labor Standards Improve Under Globalization?* Washington, DC: Institute for International Economics.

EU Commission. 2009. Animal Welfare Protocol. ec.europa.eu (accessed 15 November 2009).

Farm Foundation. 2006. *Future of Animal Agriculture in North America.* Oak Brook, IL: Farm Foundation.

Fishbein, M. 1967. A Behavior Theory Approach to the Relations between Beliefs about an Object and the Attitude toward the Object. In *Readings in Attitude Theory and Measurement*, New York, NY: John Wiley, 389-400.

Fishbein, M. and I. Ajzen. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MS: Addison-Wesley.

Floyd, D.L., S. Prentice-Dunn and R.W. Rogers. 2000. A Meta-Analysis of Research on Protection Motivation Theory. *Journal of Applied Social Psychology,* 30 (2): 407-429.

Fox, J.A., D.J. Hayes and J.F. Shogren. 2002. Consumers Preferences for Food Irradiation: How favorable and unfavorable descriptions affect preferences for irradiated pork in experimental auctions. *Journal of risk and Uncertainty,* 24 (1): 75-95.

Hair, J.F., W.C. Black, B.J. Babin, R.E. Anderson and R.L. Tatham. 2006. *Multivariate Data Analysis,* Upper Saddle River, NJ: Pearson Prentice Hall.

Harper, G.C. and A. Makatouni. 2002. Consumer perception of organic food production and farm animal welfare. *British Food Journal,* 104 (3-5): 287-299.

Hayes, D.J., J.A. Fox and J.F. Shogren. 2002. Experts and activists: how information affects the demand for food irradiation. *Food Policy,* 27 (2): 185-193.

Henson, S., and W. Traill. 2000. Measuring perceived performance of the food system and consumer food-related welfare. *Journal of Agricultural Economics,* 51: 388–404.

Hu, L. and P.M. Bentler. 1999. Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling,* 6 (1): 1-55.

Hudson, D. and J. Lusk. 2004. Activists and Corporate Behavior in Food Processing and Retailing: A Sequential Bargaining Game. *Journal of Agricultural and Resource Economics*, 29 (1): 79-94.

Kamins, M.A., V.S. Folkes and L. Perner. 1997. Consumer Responses to Rumors: Good News, Bad News. *Journal of Consumer Psychology,* 6 (2): 165-187.

Kaplan, D. 2009. *Structural Equation Modeling: Foundations and Extensions*. Thousand Oaks, CA: Sage.

Keller, K.L. 1993. Conceptualizing, Measuring, and Managing Customer-Based Brand Equity. *Journal of Marketing,* 57 (1): 1-22

Klein, J. and N. Dawar. 2004. Corporate social responsibility and consumer's attributions and brand evaluations in a product harm crisis. *International Journal of Research in Marketing,* 21: 203-217.

Klein, J.G., N.C. Smith and A. John. 2004. Why We Boycott: Consumer Motivations for Boycott Participation. *Journal of Marketing,* 68: 92-109.

Lagerkvist, C.J., F. Carlsson and D. Viske. 2006. Swedish Consumer Preferences for Animal Welfare and Biotech: A Choice Experiment. *Journal of Agrobiotechnology Management and Economics,* 9(1): 51-58.

Liljenstolpe, C. 2008. Evaluating Animal Welfare with Choice Experiments: An Application to Swedish Pig Production. *Agribusiness,* 24 (1): 67–84.

Lusk, J.L., L.O. House, C. Valli, S.R. Jaeger, M. Moore, J.L. Morrow and W.B. Traill. 2004. Effect of information about benefits of biotechnology on consumer acceptance of genetically modified food: evidence from experimental auctions in the United States, England, and France. *European Review of Agricultural Economics* 31(2): 179-204.

Martin, A. 2007. Burger King Shifts Policy on Animals. *The New York Times*, March 28.

McDonald's. 2009. Values in Action. www.mcdonalds.com (Accessed November 15)

Mintel GNPD. 2010. Mintel Global New Product Database. www.gnpd.com (Accessed February 1).

Nayga, R.M., W. Aiew and J.P. Nichols. 2005. Information Effects on Consumers' Willingness to Purchase Irradiated Food Products. *Review of Agricultural Economics,* 27 (1): 37-48.

Nelson, P. 1970. Information and Consumer Behavior. *Journal of Political Economy,* 78 (2): 311-329.

Nilsson, T., K. Foster and J.L. Lusk. 2006. Marketing Opportunities for Certified Pork Chops. *Canadian Journal of Agricultural Economics*, 54 (4): 567–583.

Okada, E. M. and D.J. Reibstein. 1998. When !@#? (bad stuff) happens: Effects of related and unrelated positive associations on the influence of negative secondary associations. In *Advances in Consumer Research,* edited by J. W. Alba and J.W. Hutchinson. Provo, UT: Association for Consumer Research, 349-356.

Pullig, C., R.G. Netemeyer and A. Biswas. 2006. Attitude basis, certainty, and challenge alignment: A case of negative brand publicity. *Journal of the Academy of Marketing Science,* 34: 528-543.

Reardon, T., S. Henson and A. Gulati. 2010. Links between Supermarkets and Food Prices, Diet Diversity and Food Safety in Developing Countries. In *Trade, Food, Diet and Health: Perspectives and Policy Options*, edited by C. Hawkes, C. Blouin, S. Henson, N. Drager, and L. Dube', New York, NY: Blackwell Publishing Ltd.

Rockwood, K. 2010. Will Walmart's "Sustainability Index" Actually Work? www.fastcompany.com (Accessed February 1).

Roehm, M.L. and A.L. Tybout. 2006. When Will a Brand Scandal Spill Over, and How Should Competitors Respond? *Journal of Marketing Research,* 43: 366–373.

Rogers, R.W. 1975. A Protection Motivation Theory of Fear Appeals and Attitude Change. *Journal of Psychology,* 91: 93-114.

Rousu, H. and T. Shogren. 2002. The value of verifiable information in a controversial product market: evidence from lab auctions of genetically modified foods. *Staff Working Paper 3*, Iowa State University, IA.

Russo, J.E., M.G. Meloy and V.H. Medvec. 1998. Predecisional Distortion of Product Information. *Journal of Marketing Research,* 35 (4): 438-452.

SAI Platform. 2009. Sustainable Agriculture Initiative Platform Home Page. http://www.saiplatform.org/ (Accessed November 25)

Schröder, M.J.A. and M.G. McEachern. 2004. Consumer value conflicts surrounding ethical food purchase decisions: a focus on animal welfare. *International Journal of Consumer Studies*, 28 (2): 168–177.

Scott, C.A. and A.M. Tybout. 1981. Theoretical Perspectives on the Impact of Negative Information: Does Valence Matter? In *Advances in Consumer Research,* edited by B. Kent and B. Monroe, Ann Arbor, MI: Association for Consumer Research, 408–409.

Smith, R.E. 1993. Integrating information from advertising and trial: Processes and effects on consumer response to product information. *Journal of Marketing Research,* 30: 204-219.

Smith, R.E. and C.A. Vogt. 1995. The effects of integrating advertising and negative word-of-mouth communication on message processing and response. *Journal of Consumer Psychology,* 4: 133-151.

Stott, A.W., C.E. Milne, P.J. Goddard and A. Waterhouse. 2005. Projected effect of alternative management strategies on profit and animal welfare in extensive sheep production systems in Great Britain. *Livestock Production Science,* 97: 161–171.

Tanner, J.F., J.B. Hunt and D.R. Eppright. 1991. The Protection Motivation Model: A Normative Model of Fear Appeals. *The Journal of Marketing,* 55 (3): 36-45.

Tonsor, G.T., N. Olynk and C. Wolf. 2009a. Consumer Preferences for Animal Welfare Attributes: The Case of Gestation Crates. *Journal of Agricultural and Applied Economics*, Forthcoming.

Tonsor, G.T., N. Olynk and C. Wolf. 2009b. Media Coverage of Animal Handling and Welfare: Influence on Meat Demand. Paper prepared for presentation at the *American Agricultural Economics Association Annual Meetings*, Milwaukee, WI.

Tonsor, G.T., C. Wolf and N. Olynk. 2009c. Consumer voting and demand behavior regarding swine gestation crates. *Food Policy* 34: 492–498.

Tybout, A.M., B.J. Calder and B. Sternthal. 1981. Using Information Processing Theory to Design Marketing Strategies. *Journal of Marketing Research,* 18 (1): 73-79.

Verbeke, V.A.J. and J. Viaene. 2000. Ethical Challenges for Livestock Production: Meeting Consumer Concerns about Meat Safety and Animal Welfare. *Journal of Agricultural and Environmental Ethics,* 12: 141–151.

Videras, J. 2006. Religion and animal welfare: Evidence from voting data. *Journal of Socio-Economics,* 35(4): 652-659.

Wachenheim, C.J. and T. VanWechel. 2004. The Influence of Environmental-Impact Information on Consumer Willingness to Pay for Products Labeled as Free of Genetically Modified Ingredients. *Journal of Food Distribution Research,* 35 (2): 1-13.

Weinberger, M.G., C.T. Allen and W.R. Dillion. 1981. The impact of negative marketing communications: The consumers' union/Chrysler controversy. *Journal of Advertising,* 10: 20-28.

Appendix 1

Survey Instrument

Thank you for participating to this research study. This study is conducted by the Department of Agricultural, Food and Resource Economics and the Department of Marketing at Michigan State University. Mr. Domenico Dentoni is the research coordinator and Prof. Christopher H. Peterson is the responsible principal investigator.

From this study, we hope to learn insights on how consumers perceive various attributes of meat products and process product information. You will be asked questions about both beef steak and chicken breast. Your participation to this research project is completely voluntary and we will preserve the confidentiality of your information. Your participation in this study will take no more than 20 minutes.

Feel free to ask the researchers any questions you may have at the following contacts:

- Mr. Domenico Dentoni, 409 Agricultural Hall, Michigan State University, 48825 East Lansing, Michigan. Email: dentonid@msu.edu. Phone: 517-488-9277.

- Prof. Christopher H. Peterson, 83 Agriculture Hall, Michigan State University, 48825, East Lansing, Michigan. Email: peters17@msu.edu. Phone: 517-355-1813.

Demographics

1. I am: ___ Male ___ Female

2. I am _____ years old (fill-in the blank or drop down).

3. The best description of my educational background is:

   a. Did not graduate from high school
   b. Graduated from high school, Did not attend college
   c. Attended College, No Degree earned
   d. Attended College, Associates or Trade Degree earned
   e. Attended College, Bachelor's (B.S. or B.A.) Degree earned
   f. Graduate or Advanced Degree (M.S., Ph.D., Law School)
   g. Other (please explain): _____

4. There are ____ adults and ____ children living in my household (please fill-in the two blanks)

5. My ZIP code is: _____.

6. What best describes your race?

   a. White, Caucasian
   b. Black, African American
   c. Asian, Pacific Islander
   d. Mexican, Latino
   e. American Indian
   f. Other (please describe): _____

Food Attitudes and Values

7. How frequently do you consume the following meat products at any meal, either at home or away from home consumption:

	4 or more times per week	2-3 times per week	Once per week	2-3 times per month	Once per month or less	Never
Chicken						
Beef						

8. How much time have you spent residing outside the US during your entire life?

   a. None, I've always lived in the US
   b. Between 1 month and 6 months
   c. Between 6 months and 1 year
   d. Between 1 year and 2 years
   e. Between 2 years and 5 years
   f. Between 5 years and 10 years
   g. Between 10 and 20 years

Please rate to what extent you agree or disagree with the following statements:

9. When I choose the food I eat, an important thing I consider is the country or region where it is produced. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

10. When I choose the food I eat, an important thing I consider is if it is natural (that is, if it is produced without modern technologies) (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

11. When I choose the food I eat, an important thing I consider is if it is "sustainable" (that is, if it is produced by a company that respects the social and environment conditions within the area of production). (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

12. When I choose the food I eat, an important thing I consider is its taste and appearance (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

Initial McDonald's Brand Equity

Please answer the following questions about McDonald's.

A McDonald's logo is placed here.

13. How would you describe your attitude towards McDonald's? (Seven-point scale, from 1. Very Negative to 7. Very Positive)

Please rate to what extent you agree or disagree with the following statement.

14. I believe that McDonald's takes effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

15. Do you believe that McDonald's takes MORE, EQUAL or LESS effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants relative to its competitors?

    a. More
    b. Equal
    c. Less
    d. I don't know

Now please answer the following questions about Burger King.

A Burger King logo is placed here.

16. How would you describe your attitude towards Burger King? (Seven-point scale, from 1. Very Negative to 7. Very Positive)

Please rate to what extent you agree or disagree with the following statement.

17. I believe that Burger King takes effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

18. Do you believe that Burger King takes MORE, EQUAL or LESS effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants relative to its competitors?

   a. More
   b. Equal
   c. Less
   d. I don't know

19. If the price of a Boneless Chicken Sandwich were the same across the following brands, which brand would you choose?

   a. McDonald's
   b. Burger King
   c. Kentucky Fried Chicken
   d. Wendy's
   e. Others
   f. None

20. Would you be willing to pay a premium if it costs more to purchase a McDonald's Chicken Sandwich than another brand's Chicken Sandwich?

   a. Yes
   b. No

21. How much more are you willing to pay to get a McDonald's Chicken Sandwich rather than another brand of Chicken Sandwich?

   a. Between 0% and 10% more
   b. Between 10% and 20% more
   c. Between 20% and 40% more
   d. Between 40% and 60% more
   e. Between 60% and 80% more
   f. Between 80% and 100% more
   g. At least 100% more

Information Treatment 1

Please read this further piece of information about McDonald's.

   Havin' fun!!!

McDonald's is one of life's many small pleasures that millions of people around the world enjoy every day. Great food. Fun to eat. Casual environment. Local and familiar. And always something new!

You want the very best for your kids, and so do we at McDonald's. That's why we've made quality a top priority:

    a. McDonald's coffee is made with 100% pure Arabica coffee beans.
    b. McDonald's burger patties are cooked straight on the grill with no added fat or oil.
    c. McDonald's Premium Chicken Sandwiches are made with all white meat real chicken.
    d. McDonald's premium salads contain no preservatives, and are assembled fresh in the restaurant daily.
    e. McDonald's Happy Meal Milk jugs contain real 1% low fat white or chocolate milk.
    f. McDonald's Apple Dippers are made with farm-fresh apples selected for their crispness, color and texture.

A picture with a group of McDonald's products is placed here.

Now please answer the following questions about McDonald's.

A McDonald's logo is placed here.

22. How would you describe your attitude towards McDonald's? (Seven-point scale, from 1. Very Negative to 7. Very Positive)

Please rate to what extent you agree or disagree with the following statement about McDonald's.

23. I believe that McDonald's takes effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

24. Do you believe that McDonald's takes MORE, EQUAL or LESS effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants relative to its competitors?

    a. More
    b. Equal
    c. Less

    d. I don't know

25. Would you be willing to pay a premium if it costs more to purchase a McDonald's Chicken Sandwich than another brand's Chicken Sandwich?

    a. Yes
    b. No

26. How much more are you willing to pay to get a McDonald's Chicken Sandwich rather than another brand of Chicken Sandwich?

    a. Between 0% and 10% more
    b. Between 10% and 20% more
    c. Between 20% and 40% more
    d. Between 40% and 60% more
    e. Between 60% and 80% more
    f. Between 80% and 100% more
    g. At least 100% more

Now please answer the following questions about Burger King.

A Burger King logo is placed here.

27. How would you describe your attitude towards Burger King? (Seven-point scale, from 1. Very Negative to 7. Very Positive)

Please rate to what extent you now agree or disagree with the following statement about Burger King.

28. I believe that Burger King takes effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

29. Do you believe that Burger King takes MORE, EQUAL or LESS effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants relative to its competitors?

    a. More
    b. Equal
    c. Less
    d. I don't know

30. If the price of a Boneless Chicken Sandwich were the same across the following brands, which brand would you choose?

   a. McDonald's
   b. Burger King
   c. Kentucky Fried Chicken
   d. Wendy's
   e. Others
   f. None

Information Treatment 2

Please read this further piece of information about production practices at McDonald's.

> PETA's "McCruelty – I'm hatin' it" campaign message:
>
> "McDonald's chicken suppliers in the United States kill birds with cruel methods. Chickens typically suffer broken limbs, they have their throats cut while they are still conscious and are often scalded to death in defeathering tanks.
>
> It would cost McDonald's NOTHING to demand that its chicken suppliers switch to a far less cruel slaughter method. But McDonald's refuses.
>
> Tell McDonald's to stop the cruelty."

A "McCruelty: I'm hatin it" logo by PETA is placed here.

Now please answer the following questions about McDonald's.

A McDonald's logo is placed here.

31. How would you describe your attitude towards McDonald's? (Seven-point scale, from 1. Very Negative to 7. Very Positive)

Please rate to what extent you now agree or disagree with the following statement about McDonald's.

32. I believe that McDonald's takes effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

33. Do you believe that McDonald's takes MORE, EQUAL or LESS effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for

production of food products (e.g., chicken nuggets and eggs) sold in their restaurants relative to its competitors?

    a. More
    b. Equal
    c. Less
    d. I don't know

34. Would you be willing to pay a premium if it costs more to purchase a McDonald's Chicken Sandwich than another brand's Chicken Sandwich?

    a. Yes
    b. No

35. How much more are you willing to pay to get a McDonald's Chicken Sandwich rather than another brand of Chicken Sandwich?

    a. Between 0% and 10% more
    b. Between 10% and 20% more
    c. Between 20% and 40% more
    d. Between 40% and 60% more
    e. Between 60% and 80% more
    f. Between 80% and 100% more
    g. At least 100% more

A Burger King logo is placed here.

36. How would you describe your attitude towards Burger King? (Seven-point scale, from 1. Very Negative to 7. Very Positive)

Please rate to what extent you now agree or disagree with the following statement about Burger King.

37. I believe that Burger King takes effective measures to provide proper animal welfare to chickens and hens raised, transported, and processed for production of food products (e.g., chicken nuggets and eggs) sold in their restaurants. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

38. If the price of a Boneless Chicken Sandwich were the same across the following brands, which brand would you choose?

    a. McDonald's
    b. Burger King

    c. Kentucky Fried Chicken
    d. Wendy's
    e. Others
    f. None

Please rate to what extent you agree or disagree with the following statement.

39. When I buy meat products, I like to receive detailed information about product quality. I am not particularly bothered by receiving too much information on the product. (Seven-point scale, from 1. Strongly Disagree to 7. Strongly Agree)

40. My annual pre-tax, household income is:

    a. Less than $ 20,000
    b. $ 20,000-$ 39,999
    …
    j. 180,000 $ or more

41. When you buy a beef steak for your consumption, which one of this two products would you choose assuming that they have the same price:
    a. A USDA-certified beef steak which is produced with animal welfare, environment friendly practices, from grass-fed animals.
    b. A beef steak which is "simply a beef steak".
    c. None of the two.

Appendix 2

Methodological Note

This methodological note provides a detailed report of the analysis conducted as part of this study. Results obtained from the analysis described within the paper are derived after undertaking the following intermediate steps:

- Simple Piecewise LGM
- Associative LGM
- Curve-of-Factors LGM
- Multi-group Associative LGM
- Predictive LGM with WTPP
- Predictive LGM with Attitudes

The entire analysis has been performed with the structural equation program EQS, copyright by P.M. Bentler, Multivariate Software, Inc., Version 6.1, 1985-2006 (B91).

Simple Piecewise LGM

Piecewise LGM represent a specific case of LGM that describes structural changes in observed measures over time (Duncan et al., 1999). Therefore, in this study piecewise LGM is used to describe structural changes in consumers' beliefs, attitudes and WTPP created by the sequence of positive and negative information treatments. When building the models, the difference between piecewise LGMs and general LGMs is only in the arbitrary choice of the values of the fixed parameters (i.e., loadings) linking the factors to the observed variables. In general LGMs, the values of these loading is linearly dependent for all factors, such as:

$$(1) \ V1 = 1*F_1 + 0*F_2 + 0*F_3 + e_1;$$
$$(2) \ V2 = 1*F_1 + 1*F_2 + 2*F_3 + e_2;$$
$$(3) \ V3 = 1*F_1 + 2*F_2 + 4*F_3 + e_3;$$
$$(4) \ F_1 = a_1M_1 + b_1D_1;$$
$$(5) \ F_2 = a_2M_2 + b_2D_2;$$
$$(6) \ F_3 = a_3M3 + b_3D_3;$$

where the loadings of the linear growth F_2 are 0, 1, 2 and the loadings of the quadratic growth factor are 0, 2, 4 (Duncan et al., 1999). The interpretation of the parameters is the same as in the text of the paper. In a piecewise model describing a structural change, the fixed parameters of the loadings are not necessarily linearly dependent and can be of opposite directions among factors. For example, in the piecewise LGM described in Figure 2, the loadings of F_2 are 0, 0.5, 0, while the loadings of F_3 are 0, 0, -1. Then, in this case F_2 has to be interpreted as an increase factor, while F_3 as a decrease factor after the structural change (i.e., the negative information treatment) occurs.

A simple piecewise LGM model is first built for each measure individually. This provides information about the individual significance of coefficients describing growth and decrease

after the shocks (Mi), as well as a measure of each factor variance (Di). Results of the piecewise LGM for attitudes of respondents included in Group 1 of the experiment are reported in Table 5.

Table 5. Simple Piecewise LGM with Consumer Attitudes in Group 1

	Mean	Std. Dev.		Mi	Di
V1	4.07	1.64	**F1**	4.07*	0.36*
V2	4.46	1.56	**F2**	0.78*	0.39*
V3	3.36	1.68	**F3**	0.70*	3.56*
Chi-Square	0.000 with -3 d.f.				
CFI	0.987				

Legend: V1 to V3 indicate observed measures of attitudes from Time 0 to Time 2. F1 = Intercept Factor of Attitudes; F2 = Increase Factor of Attitudes; F3 = Decrease Factor of Attitudes.
Note: the asterisk (*) indicates significance at the 95% level.

Results provide evidence that the growth and decrease trends are significant when the information treatment is given and that variance is significantly large. The model is under-identified because the number of free parameters to be estimated is higher than the number of known parameters; therefore we add parameters in the following steps of building a LGM. A similar piecewise LGM model has been run for the measures of animal welfare beliefs and WTPP of respondents in Group 1 and for all respondents' measures in Groups 2, 3 and 4.

Associative LGM

The associative LGM is one large model that describes the change factors for several measures at the same time to analyze if there is covariance among the change across the measures (Duncan et al., 1999). An associative LGM is built where the increase and decrease factors load to measures of beliefs, attitudes and WTPP simultaneously, where the co-variances among each of the nine factors (three factors for each measure) are estimated. The factor loadings are the same as in the simple piecewise LGM for each of the three variables. The co-variance matrix from the associative LGM is reported in Table 6.

Table 6. Co-variance Matrix of the Associative LGM with Consumer Attitudes in Group 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9
F1	2.68*								
F2	1.36*	1.89*							
F3	0.02	0.00	0.01*						
F4	-0.86*	-0.03	0.03*	2.43*					
F5	0.79*	-0.71*	0.05*	0.26	4.87*				
F6	0.02	0.01	0.00	0.04*	0.08*	0.02*			
F7	0.97*	0.38*	0.00	-0.57*	0.21	0.00	2.07*		
F8	0.24	0.80*	-0.02	0.20	-1.21*	0.00	1.31*	2.36*	
F9	0.00	-0.01	0.00	0.02	0.00	-0.01	0.03*	0.02	0.01*

Legend: F1 = Intercept Factor of Attitudes; F2 = Intercept Factor of Beliefs; F3 = Intercept Factor of WTPP; F4 = Increase Factor of Attitudes; F5= Increase Factor of Beliefs; F6 = Increase Factor of WTPP; F7 = Decrease Factor of Attitudes; F8= Decrease Factor of Beliefs; F9 = Decrease Factor of WTPP.
Note: values on the diagonal are factor variances Di; the asterisk (*) indicates significance at the 95% level.

Results provide evidence that there is covariance among the increase and decrease factors across the three measures of beliefs, attitudes and WTPP. The associative LGM model has also been run with data of the measures from respondents in Groups 2, 3 and 4.

Multi-Group Associative LGM

The multi-group associative LGM is used to analyze if there are differences across the parameters from respondents' data in Group 1 and Group 3, which provide evidence also to test the stated hypotheses in the paper. In particular, a control has been performed to establish if there are differences across factor means and factor variances across Group 1 and Group 3, where respondents in Group 1 received positive information which is unrelated to animal welfare and respondents in Group 3 received positive information related to animal welfare.
To control for these differences across parameters in the two groups, an equality constraint is imposed to the model. Therefore, the LM test is performed to explore which constraints have to be released in order to obtain a significant fit improvement. Results are presented in Table 1 in the paper.

The same procedure has been used to compare differences in parameters across Group 2 and Group 4. An interpretation of these results is provided in the text of the paper.

Curve-of-Factors LGM

The curve-of-factor LGM describes the change of several measures with only one set of factors to analyze if the same pace of change is the same across several measures or not (Duncan et al., 1999). In this case, a curve-of-factors LGM is built to analyze if a unique set of factors can describe the change occurring across beliefs, attitudes and WTPP.
When running the model with data from respondents in group 1, as the overall fit of the model with data is low (chi-square=248.68 with 30 d.f. and p-value<0.001; CFI=0.697; RMSEA= 0.285), results show that the changes in the three measures cannot be effectively described by only one set of factors and so that there are differences in the pace of change across beliefs, attitudes and WTPP. The same curve-of-factors LGM is also run with only two out of the three variables and repeated the same analysis with measures of respondents in Group 2, 3 and 4. In each evaluated case, the curve-of-factors LGM failed to provide an adequate fit.

Predictive LGM with WTPP

As the curve-of-factors LGM suggests that no unique change factor can effectively describe the change in beliefs, attitudes and WTPP simultaneously, an analysis of what are the predictors of the change factor for each measure independently has been done.
First, a predictive LGM is run with the WTPP measures by adding all the expected predictive variables (i.e., demographics, chicken consumption habits, food values) to the simple piecewise WTPP model and estimating the impact of each of these variables on the intercept, increase and decrease factors.

The output indicates that parameters are linearly dependent, and so that the output of this model cannot be trusted. From the EQS 6.1 output, results indicate that linearly dependent parameters

are the errors of the three WTPP measures over time (e_1, e_2 and e_3 in the generic piecewise LGM). This is due to the fact that the majority of WTPP values are zero (around 85%), as only few respondents are WTP a premium price for McDonald's chicken sandwiches, no matter their demographics and the information treatments they receive. Output is similar when the same predictive LGM with WTPP from respondents' data in Group 2, 3 and 4 is run. Therefore, data collected do not allow analyzing predictors of WTPP changes over time. The same predictive LGM is then repeated with respondents' attitudes.

Predictive LGM with Attitudes

Results of final predictive LGM are presented in Tables 15 and 16 in the Chapter. To build the final predictive LGM illustrated in these tables, a first preliminary predictive LGM is run with only demographic and chicken consumption habit predictors. A second preliminary predictive LGM with only food value predictors is also run. As overall goodness-to-fit with the data was bad, a Wald Test is performed to drop the independent variables that bring the least contribution in explaining the dependent variables and those that create serious problems of multicollinearity. Therefore, in the predictive LGM with attitudes measures from respondents in Group 1, respondents' education (which has high co-variance with income), chicken consumption frequency and value for food sustainability and origin (as suggested by the Wald test) are dropped.

Therefore, a third predictive LGM is run with all the predictors but the variables dropped previously, and then evaluated the model looking again at the overall goodness-to-fit, the Wald test and the co-variance among independent variables. At this stage, the respondents' value for taste variable is also dropped, as suggested by the Wald test. Therefore, a fourth and final predictive LGM is built with the remaining variables, which are respondents' gender, income and age, and obtained the results in Table 15 in the Chapter. The same procedure has been used to come up with the final predictive LGM with attitudes of respondents in group 2, 3 and 4.

Hedonic Analysis of Sustainable Food Products

Thasanee Satimanon[⊕a] and Dave D. Weatherspoon[b]

[a]*Graduate Student, Agricultural, Food and Resource Economics, Michigan State University, 108 Cook Hall, East Lansing Michigan, 48824-1039, U.S.A.*

[b]*Associate Professor, Department of Agricultural Economics, Michigan State University, 213C Agriculture Hall, East Lansing Michigan, 48824-1039, U.S.A.*

Abstract

This study aims to determine price premiums of sustainable attributes for fresh eggs by using hedonic analysis. The sustainable attributes defined include welfare-managed egg production and recyclable packaging attributes. Welfare-managed eggs have a price premium equal to 3.57 cents per egg; while the sustainable packaging variable was not found to be significant. The strategies for egg manufactures and retailers include offering organic or welfare-managed eggs independently until consumers perceive these attributes as being different, and using sustainable packaging for each specific region of the U.S. since each state has different laws and opportunities to recycle paper, plastic and Styrofoam products.

Keywords: hedonic, sustainable, sustainability, eggs, free-range, cage-free

⊕Corresponding author: Tel: + 1 517.353.6847
Email: tonganup@msu.edu

Other contact information: D. D. Weatherspoon: weathe42@msu.edu

Introduction

Sustainability is one of the most important issues facing the global food supply chain. There are 9,450 new food and beverage products claimed to be ethically or environmentally produced[1] globally from February 2009 to January 2010 (Mintel 2010). This represents almost 10% of all new food and beverage products (Mintel 2010). This nebulous concept has the ability to change international trade patterns, make firms invest millions of dollars to change suppliers (i.e. McDonalds' sustainable supply chain (McDonald 2010), and change product components to minimize damage to brand name image.

There are four critical reasons why analyses need to be conducted on food manufacturers and retailers concerning sustainability. First, from the CIES survey[2] of the largest food supermarket retailers globally, corporate social responsibility emphasizing sustainability was the top issue that CEOs were concerned about in 2008 (CIES 2008). In the previous years, sustainability was ranked 5th in 2007 and 11th in 2006. One of the main reasons supermarket chains are concerned is that NGOs and customers are putting more pressure on them to source "Sustainably," and are being graded by certain NGOs, i.e., Greenpeace (Greenpeace 2009). CEOs realize the importance of sustainability to the competitiveness of their businesses, but they are not certain of which investments to make in order to strengthen their brands.

Second, companies are trying to improve their supply chain by reducing costs and carbon use simultaneously. The reduction in carbon emissions not only reduces the costs to the firm, but may also promote the firm's image and goodwill. For instance, in April 2008, Tesco announced the launch of "The Carbon Reduction Label," which focuses on energy usage and adopting the concept of "sustainability" policies to its retail center and its own private brand products (CarbonTrust 2008). Promoting energy saving is popular, for example, many companies began to use wind energy, and reclaim cooking oil and solar energy to substitute gas in their production processes (Weil 2008).

Third, consumers are becoming more aware of environmental problems and are interested in consuming products that are considered to be sustainably produced. This has led to a growing number of green consumers[3]. In the United States, the growth of consumers who are always or almost always green consumers increased from 12% in 2006 to 36% in 2007 (Mintel 2008). This implies more market opportunities for sustainable products since consumers are willing to pay for high quality products as well as products that help improve the environment.

Lastly, several standards and regulations were implemented to support environmental and sustainable policies. The examples of voluntary standards related to the environment are the ISO 14000 series. Also, there are several certifications for sustainable seafood products, such as, Marine Stewardship Council's fishery certification program and seafood eco-label, and dolphin

---

[1] Ethical categories include ethical-animal, ethical charity, and ethical-human categories. Moreover, Environmental categories include environmentally-friendly package, and environmentally-friendly product categories.
[2] The CIES survey is a survey of the Consumer Goods Forum which is an independent global parity-based Consumer Goods network. (www.ciesnet.com)
[3] A green consumer is a person who is concerned about environmental or social issues constantly when deciding on purchasing products (Peattie 1992).

safe label. Governments have announced regulations to control pollution emissions from factories as well. These regulations are perceived to be increasing sustainable production, which includes animal welfare policies in Europe and in California (Proposition 2 of 2008)[4].

Due to the pressure from retailers, consumers, legislation and competition, more sustainable food products are being launched (i.e. dolphin safe tuna products, cereal with recyclable packaging, and free range and other environmentally-friendly eggs). This study analyzes the value of sustainable attributes for fresh eggs by using hedonic price analysis and survey data of fresh egg prices in five city areas along the Eastern coast of the United States.

Sustainability has been defined by various organizations and companies and has led to a brand definition. Therefore, we will focus only on why two attributes in this study represent sustainable attributes. The first attribute is a welfare-managed attribute. In our study, welfare-managed eggs include free-range eggs and free-cage eggs[5]. To understand why the welfare-managed attribute represents a sustainable attribute, the concept of sustainable agriculture is introduced. According to the USDA, sustainable agriculture is defined as an integrated system of plant and animal production practices that has a site-specific application that will occur over the long term (USDA 2007b). Also, there are many approaches to define "animal welfare". A well-known definition is that 'welfare' is the state of a being in relation to its environment (Broom 1991); (Blandford et al. 2002). The conventional process for raised hens is a battery cage system which provides space of 67 to 86 inches per bird (United Egg producers 2010); consequently, hens in battery cages do not have enough space for free movement. Welfare-managed systems including free range/cage free systems can improve animal welfare by allowing them to extend their limbs freely. Hence, the welfare-managed attribute represents one of the sustainable attributes as stated in Bennett (1998) "Consumers who are concerned about animal welfare prefer and are willing to pay more for methods of animal husbandry that allow hens to roam freely instead of being in cages".

The second attribute representing a sustainable attribute is paper-pulp packaging since sustainability also includes an environmental dimension of recycling. For example, Spartan Stores and Wegmans changed their packaging of their store-brand eggs to be new recyclable and biodegradable molded fiber packaging to replace Styrofoam cartons that are not biodegradable (Progressivegrocer 2009); (Wegmans 2010). Therefore, paper-pulp packaging, which is recyclable and/or made from recycled material, is considered to be one of the sustainability attributes in this study.

Objectives

This study aims to determine price premiums for sustainable attributes of fresh eggs by using hedonic analysis. The sustainable attributes defined here include the free range/cage free

---

4 Proposition 2 entails improving animal production practices, such as, allowing animals to run around freely, lie down, stand up, and fully extend their limbs outside cages. This proposition will become operative on January 1, 2015 (Ballotpedia 2008).

[5] There is no legal definition for free-range and free-cage eggs in the U.S.; however, according to the Egg Nutrition Center, free-range eggs are from hens that are either raised outdoors or can access outside. Free-cage eggs are from hens that live in indoor floor facilities, but do not necessarily have access to the outdoors.

attribute and recyclable attribute for packaging which is paper-pulp packaging. Furthermore, we will focus on the interaction between organic and sustainable attributes; that is, whether sustainable attributes of eggs have a higher value when eggs are organic.

This work is unique for several reasons. First, most of the literature focuses on analyzing the value of organic attributes more than sustainable attributes. Examples of papers that analyzed the price premiums of organic products are: Gil et al. 2000; Canavari et al. 2002; Soler et al. 2002; Ara 2003; Wang and Sun 2003; Batte et al. 2007; Griffith and Nesheim 2008. Second, most of the literature concerning price premiums for sustainable attributes used the contingent valuation approach (Loureiro et al. 2001); (Loureiro and Hine 2002); (Loureiro et al. 2002). Third, the unique data set was collected from five East coast U.S. cities and has not been analyzed for sustainable attributes for fresh eggs and the economic implications thereof. Moreover, there is no literature on price premiums for sustainable attributes of eggs in the U.S. Most egg literature studied specialty egg characteristics and the overall U.S. egg industry (Patterson et al. 2000); (Knudson 2004); (Oberholtzer et al. 2006); (Patterson et al. 2008). Lastly, recent studies suggest that eco-labels, an example of a sustainable attribute, should be added to complement other valued product attributes such as organic attribute in order to attract more consumer purchases (Johnston et al. 2001); (Arquitt and Cornwell 2007). Hence, this work also aims to test the hypothesis that multi-attribute eggs such as sustainable attributes and organic eggs are more valued.

Egg Industry

The egg industry is a great industry to better understand consumer evaluations of sustainable attributes of food products for several reasons. First, the fresh egg industry in the U.S. is a huge and important industry which had a market size equal to $ 5.12 billion in 2007 (Mintel 2008). Second, quality survey data for egg prices and their attributes in key eastern U.S. cities are available. Third, eggs are not complicated food products and consumers can easily understand the marketing messages, and the sustainable attributes are easily included into our model. Fourth, organic eggs and free range/cage free are easily understood and well known attributes among egg consumers.[6] Lastly, due to the vote for proposal 2 in California in 2008, the industry recognizes the importance of free range/cage free in the future to their market and the potential for this movement to spread across America.

There are two main segments for the egg market which are fresh shell eggs, and egg substitutes.[7] In 2007, fresh eggs had a market share equal to 94.8%, while egg substitutes had a market share of only 5.2% (Mintel 2008). Hence, this study focuses only on the fresh egg market. There are two types of fresh eggs, which are regular eggs and specialty eggs. Examples of specialty eggs

---

[6] Organic regulations require outdoor access for birds (Oberholtzer et al. 2006); therefore, organic eggs are a subset of free-range/cage-free eggs. However, we define organic and welfare-managed attributes separately because we are interested in the interaction between these two attributes. Egg manufactures sometimes label their organic eggs as cage-free eggs; while, others do not. Consumers might be confused whether organic eggs are welfare-managed eggs or not. The study is based on consumers' perception; therefore, we identify the attributes of each observation based on information on the label.

[7] Breaker or breaker plant category is not in the scope of this study because our study focuses on consumer goods. Breakers are industrial goods which are not available in supermarkets but are used in restaurants, hospitals, schools, and other foodservice (USDA 2010).

are free-range eggs, organic eggs, eggs fortified with Omega-3 fatty acids, low-cholesterol eggs, and vegetarian-fed eggs.

Store brands[8] dominate national brands and regional brands in the egg market. In 2007, store brands had a market share equal to 68.8%, while Eggland's Best, Rose Acre Farms, Land O'Lakes Inc, Cal Maine Foods, Dean Food Co., Michael Foods Inc., ConAgra Foods, Inc., and others had market shares equal to 7.9%, 2%, 1.4%, 1.2%, 1.1%, 0.9%, 0.9%, and 15.8%, respectively (Mintel 2008).

Methodology

Lancaster (1966) stated that a good does not give utility directly to a consumer, but it possesses characteristics or attributes which give utility to the consumer. Hedonic prices are defined as the implicit prices of attributes embodied in each good (Rosen 1974). Economic agents can determine hedonic prices of attributes by observing prices of differentiated products and specific amounts of attributes related to them (Rosen 1974). Examples of attributes are brand, packaging, color, taste, etc. If a good has a number of characteristics or attributes, z, equal to k, $z = (z_1, z_2, ..., z_k)$, the price for a good is determined by a set of attributes or vector z, that is $price(z) = f(z_1, z_2, ..., z_k)$. Hedonic pricing analysis and contingent valuation are the two main approaches used to calculate price premiums of unique attributes. The contingent valuation requires consumer survey data to determine if the premium of each attribute has value. Numerous papers have utilized this approach to address price premiums for food product attributes (Wessells et al. 1999); (Gil et al. 2000); (Loureiro et al. 2001); (Canavari et al. 2002); (Loureiro and Hine 2002); (Loureiro et al. 2002); (Ara 2003); (Cranfield and Magnusson 2003); (Batte et al. 2007). The weakness of this approach is that it only reflects consumers' intentions but not their actual actions in terms of purchasing behavior. Moreover, it is possible that the survey might create a bias in the sense that consumers might over-estimate their willingness to pay for sustainable products, which leads to the problem of over-estimating the price premium for sustainable attributes. Several papers analyzed or have referred to the biases of the contingent valuation approach (Diamond and Hausman 1994); (Blumenschein et al. 1998); (Aadland and Arthur 2003); (Ajzen et al. 2004); (Lockie et al. 2004); (Blumenschein et al. 2008).

Historically, hedonic analysis primarily has used scanner data[9] or privately collected secondary data. Several authors used hedonic analysis for measuring a price premium of differentiated food product (wine, coffee, etc.) attributes (Nimon and Beghin 1999); (Combris et al. 2000); (Donnett et al. 2008); (Griffith and Nesheim 2008). The data for this study was collected from retailers who are concerned about consumer demand and maximize their profits by determining the optimal attributes, prices and quantities to offer (Steiner 2004); (Karipidis et al. 2005). The partial derivative of the hedonic price function with respect to a particular attribute is an implicit or shadow price at equilibrium that reflects both, the maximum price consumers are willing to pay for an additional attribute, and the minimum price for which suppliers are willing to sell

---

[8] Store brand is interchangeable with private label.
[9] Scanner data are "retail purchase information (such as price, brand, product size, amount purchased) gathered at the point of purchase by an electronic device that reads a coded ticket on the product through the use of an electronic reader over which the product passes." (www. Answer.com)

according to their costs (Sanjuan-Lopez et al. 2009). Moreover, consumers decide whether they should accept the price and purchase the eggs or not based on the retailers' offered price. Therefore, the price and attributes collected from retailers can be used to find the value of attributes by using hedonic analysis without ignoring the consumer side.

There are two advantages of using hedonic price analysis over contingent valuation. First, the hedonic price approach does not require joint consumption of goods within a group. Therefore, we can estimate the inverse demand of specific goods individually rather than modeling the whole system of demand and supply. Second, according to Butler (1982), since all estimates of hedonic price models are to some extent misspecified, models that use a small number of key variables generally suffice. Butler suggested that only those attributes that are costly to produce and yield utility are to be considered in the regression equation. Therefore, we need to use less attributes in our model so that we reduce the misspecification problem and increase the degrees of freedom.

Assume that an egg has k attributes plus sustainable attributes, organic attribute, and a sustainable and organic attribute. The egg price then depends on its attributes (Rosen, 1974) defined as follows:

$price(\boldsymbol{x})$ = f ($x_1, x_2,..., x_k$, sustainable attribute, organic attribute, sustainable and organic attribute),

where $price(\boldsymbol{x})$ represents the price of an egg, and vector $\boldsymbol{x}$ represents attributes of the egg. Specifically, the model in our study is specified as the following:

$$
\begin{aligned}
priceperegg = \ & \beta_0 + \beta_1 o + \beta_2 wm + \beta_3 owm + \beta_4 vd + \beta_5 ne \\
& + \beta_6 regional + \beta_7 national + \beta_8 brown + \beta_9 AA \\
& + \beta_{10} plastic + \beta_{11} paper + \beta_{12} l \arg e + \beta_{13} extral \arg e + \beta_{14} jumbo \\
& + \beta_{15} acme + \beta_{16} giant + \beta_{17} pathmark + \beta_{18} safeway + \beta_{19} shopper \\
& + \beta_{20} shaws + \beta_{21} shoprite + \beta_{22} \sup erfresh + \beta_{23} stopandshop \\
& + \beta_{24} wegmans + \beta_{25} weis \\
& + \beta_{26} shelllable + \beta_{27} eggage + \beta_{28} unitsize + \varepsilon,
\end{aligned}
$$

where β's represent the coefficient for the product attributes and ε is the error term. The definitions, minimums, maximums, and means of each variable are depicted in Table 1. In this model, the base variables for each category of dummy variable attributes are dropped in order to prevent perfect multicollinearity.

Data and Variable Description

The data used in our analysis are survey data of fresh egg prices and their attributes[10]. The data have 207 usable observations and were collected from retailers in five east coast cities (Baltimore, MD; Boston, MA; New York, NY; Philadelphia, PA; and Washington DC) in 2007. The data come from retail supermarkets (ACME, Giant, Pathmark, Safeway, Shoppers Food

---

[10] We would like to thank Dr. Paul H. Patterson, from the Poultry Science Department at Penn State University for providing us with the data.

Warehouse, Shaw's, ShopRite, Super Fresh, Stop and Shop, Walmart, Wegmans, and Weis) in each of these cities.

From Table 1 (see Appendix), the first group of attributes is a group of specialty characteristics of the eggs which are regular, organic, vegetarian-fed, welfare-managed including free range and free cage, nutritionally enhanced[11], and a stacked attribute, organic and welfare-managed. The second group is categorized by brand. To preserve the degrees of freedom, we separate egg brands into three groups which are national, regional and store brands. The third group is categorized by colors which are white and brown. The fourth attribute is grouped by grades of eggs (grades A and AA), which reflect the quality and the freshness of the eggs, i.e., the firmness of the yolk, and the air cell in the egg. The fifth group is defined by packaging materials which are Styrofoam, paper pulp, and clear plastic. The sixth group is determined by egg sizes which are medium, large, extra large, and jumbo. The seventh group of attributes is determined by the retailers where consumers purchase eggs (ACME, Giant, Pathmark, Safeway, Shoppers Food Warehouse, Shaw's, ShopRite, Super Fresh, Stop and Shop, Walmart, Wegmans, and Weis). The eighth attribute is defined based on whether there is a label on the egg shell or not. The next variable is the age of the egg that is defined as the number of days from when an egg is laid until it is purchased at the store[12]. The last attribute is an egg unit which is the number of eggs per package.

Credence Goods

The attributes can be categorized into three categories which are search, experience, and credence attributes (Caswell and Mojduszka 1996); (Bureau et al. 1998); (Loureiro et al. 2002); (Pelsmacker et al. 2005). Search attributes are those that consumers can observe immediately before purchase, i.e. color, size, and price. Experience attributes, such as taste, are attributes that consumers discover only after consumption. Credence attributes are attributes of which consumers can detect the quality neither before nor after buying the product. The ethical attribute, such as cage-free, is an example of a credence attribute. This leads to the problem of asymmetric information in the cage-free egg market.

Asymmetric information is addressed by manufacturers labeling their products; however, the credibility of manufactures is critical to getting price premiums and higher profits. Third Party Certification proof with high public trust can increase ethical label credibility (Loureiro et al. 2002); (Pelsmacker et al. 2005); however, there is no well-known certification for cage-free eggs in the U.S. market. Consequently, reputation of egg manufactures is the only signal for the cage-free attribute and U.S. consumers might be still confused and reluctant to trust cage-free labels, which could lead to low cage-free eggs purchasing.

---

[11] From our survey data, nutritionally-enhanced eggs are high-omega 3, high-vitamins, and low-cholesterol.

[12] Egg cartons with the USDA grade shield on them are regulated to display the "pack date" which is defined as the day that the eggs were washed, graded, and placed in the carton (USDA 2007a). We get the information about the age of the egg by using the pack date and assuming that eggs are packed the same day as they are laid.

Egg Packaging

There are three types of material for egg packaging which are paper pulp, clear plastic, and Styrofoam. Paper-pulp packaging is claimed to be recyclable and made from recycled paper. Clear plastic and Styrofoam are technically plastics and recyclable. Clear plastic packaging for eggs is made from polyolefins and defined as code 1 (Polyethylene terephthalate: PET) recyclable symbol. Styrofoam packaging is made from polystyrene (PS) and defined code 6 for its recyclable symbol (Marsh and Bugusu 2007).

Even though all materials for egg packaging are recyclable, paper and paperboard have the highest recycle rate. In 2007, 54.5% of paper and paperboard was recovered for recycling; while, plastics including Styrofoam had a recycle rate equal to 6.8% (United States Environmental Protection Agency 2008). Moreover, some egg manufactures marketed their eggs by changing material for their packaging from Styrofoam to paper pulp and claimed that their new packaging was more environmentally-friendly. For example, Spartan Store and Wegmans changed their egg packaging from Styrofoam packaging to paper-pulp packaging and claimed that their packaging is more sustainable or more environmentally-friendly (Progressivegrocer 2009); (Wegmans 2010). As a consequence, this study used paper-pulp packaging as its sustainable packaging attribute.

Results

Table 2 (see Appendix) presents hedonic prices of egg attributes from the estimation. The R-squared for the model shows that all egg attributes explain about 81.2% of the variation in the prices of eggs. The attributes that significantly affect the price of eggs are specialty characteristics, brands, grades, sizes, retailers (places where consumers buy eggs), and unit sizes. Signs of significant variables are as expected and the same as previous literature (Ness and Gerhardy 1994); (Fearne and Lavelle1996); (Philippos et. al. 2005); (Goddard et. al. 2007) except the sign for the stacked variable attribute organic and welfare-managed (owm).

Most specialty characteristic coefficients which are organic attribute (o), welfare-managed attribute (wm), and nutritionally-enhanced attribute (ne) have positive values and are significant. Organic, welfare-managed, and nutritionally-enhanced eggs have price premiums over regular eggs equal to 16.50, 3.57, and 2.30 cents per egg, as shown in figure 1 respectively. This means that these attributes create value-added for the shell egg category. The coefficient for the vegetarian-fed attribute is a negative value, but not significant. Hence, it is ambiguous to conclude the value of the vegetarian-fed attribute.

The coefficient for the stacked variable attribute, organic and welfare-managed, equals -8.81 cents per egg and is significant. Therefore, an organic and welfare-managed egg has a premium over a regular egg equal to 11.26 cents which is less than the premium for an organic egg (11.26 = 16.50 + 3.57 – 8.81 cents representing the premium for organic, welfare-managed, and organic and welfare-managed attributes). The authors did not expect the negative sign for the stacked variable. We expected that welfare-managed eggs would get higher premiums when they are also marketed (labeled) as organic because consumers can easily associate the perceived animals health benefits and be willing to pay a premium for it. There are three hypotheses to explain this

result. First, consumers might be confused about the definition of eggs with these attributes and hence not be willing to pay more for the stacked attributes. Second, it might be possibly related to retailers' strategies (Greenblum[13] 2009) to promote theirs store brands as sustainable brands; hence, offer promotions for the organic and welfare-managed products. Lastly, farmers might be able to share some production costs for the organic, free range and/or free cage methods; hence, the prices reflect supply and demand side effects. The prices of regular eggs and specialty eggs are compared in figure 1.
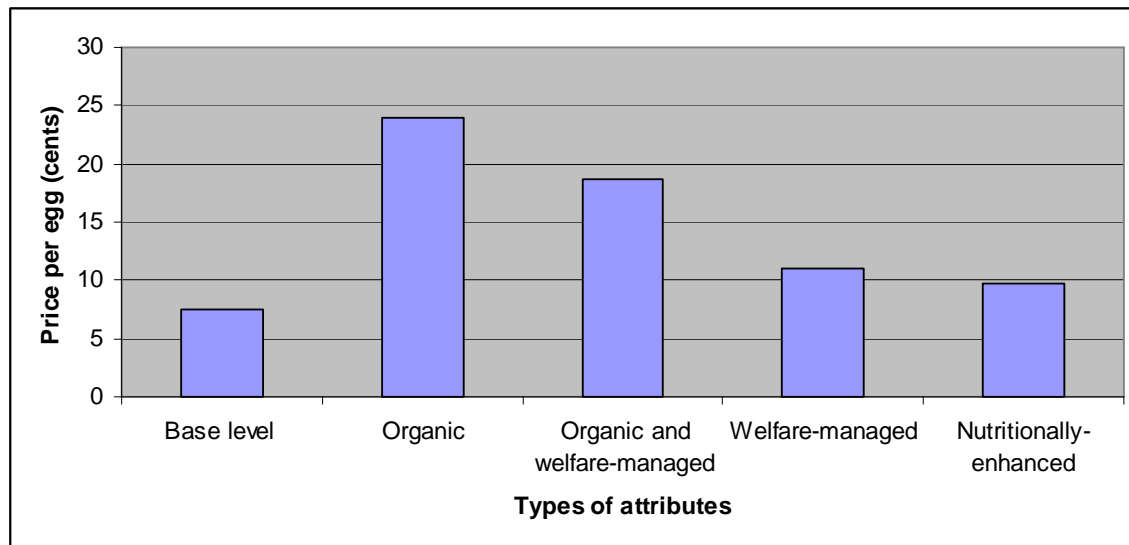

Figure 1. Prices of the base level and specialty eggs[14] (cents per egg)

National brand eggs and regional brand eggs have price premiums equal to 5.33 cents and 3.95 cents compared to store brand eggs. Prices of grade AA eggs are significantly higher than prices for grade A eggs. Its price premium equals to 3.28 cents. All coefficients of sizes are significant. That is the larger size egg has a higher price premium. The coefficient for unit size is negative and significant. Therefore, the price per egg is lower when consumers buy eggs in bigger packages. Eggs from almost all retailers[15] have significantly higher prices than the price of eggs from Walmart. Lastly, the coefficients of the rest of the variables which are various types of packaging, brown color, shell label and egg age are all insignificant.

Conclusion and Management Implications

We tested two attributes that we consider sustainable, welfare-managed, and paper-pulp packaging; only one was found to positively and significantly influence price. Welfare-managed eggs receive the price premium equals to 3.57 cents per egg as compared to regular egg. The

---

[13] Ms. Greenblum is a senior director of Nutrition Education, Egg Nutrition Center.

[14] Assuming that other attributes are the same, the base level egg for each category is defined as an egg with the following attributes: regular, store brand, white color, grade A, Styrofoam packaging, medium size, no shell label, egg age of 14 days, a dozen egg unit size, and Walmart is the base store. Specialty eggs have the same attributes as the base level eggs except they are not regular eggs.

[15] From Table 2, these retailers are ACME, Giant, Pathmark, Safeway, Shoppers Food Warehouse, Shaw's, ShopRite, Super Fresh, Stop and Shop, Wegmans, and Weis.

attribute that has the greatest impact on price was the organic attribute which increase the price per egg by 16.50 cents. Interestingly, when organic and welfare-managed were combined the price premium was only 11.26 cents per egg. This implies that consumers are not willing to pay for both labeled attributes simultaneously, which has major implication for egg manufactures and retailers. In the short run, egg manufactures should maximize profit by offering and labeling either organic or welfare-managed eggs, and hence continue to segment the market until consumers perceive these attributes as being different.

Our results are ambiguous for the paper-pulp packaging attribute. Some egg manufacturers have claimed that their Styrofoam packaging and/or clear-plastic packaging are recyclable. A survey of consumers' perception about recyclable packaging might be helpful to answer this question; however, it is beyond the scope of this study. The best strategy for manufactures and retailers may be to market sustainable packaging for each specific region of the U.S. since each state has different laws and opportunities to recycle plastic and Styrofoam products.

References

Aadland, David, and Caplan, Arthur J. 2003. Cheap talk revisited: new evidence from CVM. Selected paper presented at the annual meetings for the American Agricultural Economics Association, July 27-30, Montreal, Canada.

Ajzen, Icek, Brown, Thomas C., and Carvajal, Franklin. 2004. Explaining the discrepancy between intentions and actions: the case of hypothetical bias in contingent valuation. *Personality and Social Psychology Bulletin* 30(9):1108–21.

Alcalde, Nuria, Garces, Concepcion, Pedraja, Marta, and Rivera, Pilar. 2005. The recycling of container and packaging waste in the Spanish retail distribution sector. *Environment and Planning A* 37(8): 1461-1477.

Ara, Shihomi. 2003. Consumer Willingness to Pay for Multiple Attributes of Organic Rice: A Case Study in the Philippines. Contributed paper selected for presentation at the 25th International Conference of Agricultural Economists, August 16-22, Durban, South Africa.

Arquitt, Steven P., and Cornwell, T. Bettina. 2007. Micro-Macro Linking Using System Dynamics Modeling: An Examination of Eco-Labeling Effects for Farmed Shrimp. *Journal of Macromarketing* 27(3): 243-255.

Ballotpedia. 2008. California Proposition 2 (2008). http://ballotpedia.org/wiki/index.php/California_Proposition_2_(2008) (accessed June 1, 2010).

Batte, Marvin T., Hooker, Neal H., Haab, Timothy C., and Beaverson, Jeremy. 2007. Putting their money where their mouths are: consumer willingness to pay for multi-ingredient, processed organic food products. *Food Policy* 32(2): 145-159.

66

Bennett, R. 1998. Measuring Public Support for Animal Welfare Legislation: A Case Study of Cage Egg Production. *Animal Welfare* 7(1): 1–10.

Bennett, R.M. 1997. Farm Animal Welfare and Food Policy. *Food Policy* 22(4): 281-288.

Bennett, Richard M., and Blaney, Ralph J.P. 2003. Estimating the benefits of farm animal welfare legislation using the contingent valuation method. *Agricultural Economics* 29(1):85–98.

Blandford, David, Bureau, Jean-Christophe, Fulponi, Linda, and Henson, Spencer. "Potential Implications of Animal Welfare Concerns and Public Policies in Industrialized Countries for International Trade." In *Global Food Trade and Consumer Demand for Quality*. New York: Kluwer Academic/Plenum Publishers, 2002.

Blumenschein, Karen, Blomquist, Glenn C., Johannesson, Magnus, Horn, Nancy, and Freeman, Patricia. 2008. Eliciting willingness to pay without bias: evidence from a field experiment. *Economic Journal* 118(525): 114–137.

Blumenschein, Karen, Johannesson, Magnus, Blomquist, Glenn C., Liljas, Bengt, and O'Conor, Richard M. 1998. Experimental results on expressed certainty and hypothetical bias in contingent valuation. *Southern Economic Journal* 65(1): 169–177.

Broom, D. M. 1991. Animal Welfare: Concepts and Measurement. *Journal of Animal Science* 69(10): 4167-4175.

Bureau, Jean-Christophe, Marette, Stephan, and Schiavina, Alessandra. 1998. Non-Tariff Trade Barriers and Consumers' Information: The Case of the EU-US Trade Dispute over Beef. *European Review of Agricultural Economics* 25(4):437-462.

Butler, Richard V. 1982. The specification of hedonic indexes for urban housing. *Land Economics* 58(1): 96-108.

Canavari, Maurizio, Bazzani, Guido M., Spadoni, Roberta, Regazzi, Domenico. 2002. Food safety and organic fruit demand in Italy: a survey. *British Food Journal* 104(3/4/5): 220–232.

CarbonTrust. 2008. Tesco and Carbon Trust join forces to drive forward carbon labeling. http://www.carbontrust.co.uk/news/news/archive/2008/Pages/29_04_08_Carbon_Label_Launch.aspx (accessed, June 1, 2010).

Caswell, Julie A., Mojduszka, Eliza.M. 1996. Using informational labeling to influence the market for quality in food products. *American Journal of Agricultural Economics* 78(5): 1248-1253.

CIES. 2008. Top of Mind Survey. http://www.ciesnet.com/ (accessed June 1, 2010).

Combris, Pierre, Lecocq, Sebastien, and Visser, Michael. 2000. Estimation of a Hedonic Price Equation for Burgundy Wine. *Applied Economics* 32(8): 961-967.

Cranfield, J. A. L., and Magnusson, Erik. 2003. Canadian consumers' willingness-to-pay for pesticide free food products: an ordered probit analysis. *International Food and Agribusiness Management Review* 6(4): 13–30.

Diamond, Peter A., and Hausman, Jerry A. 1994. Contingent valuation: is some number better than no number? *Journal of Economic Perspectives* 8(4): 45–64.

Donnet, Laura M., Weatherspoon, Dave D., and Hoehn, John P. 2008. Price determinants in top-quality e-auctioned specialty coffees. *Agricultural Economics* 38 (3): 267-276.

Dow Jones Sustainability Indexes. 2006. Dow Jones Sustainability World Indexes Guide. http://www.sustainability-index.com/djsi_pdf/publications/Guidebooks/DJSI_Guidebook_World_80.pdf (accessed June 1, 2010).

EPA. 2010a. Air and Radiation – Regulations and Statutes. http://www.epa.gov/air/oarregul.html (accessed June 1, 2010).

EPA. 2010b. Wastes – Laws & Regulations. http://www.epa.gov/osw/laws-regs/index.htm (accessed June 1, 2010).

EPA. 2010c. Wastes – Non-Hazardous Waste – Industrial Waste. http://www.epa.gov/osw/nonhaz/industrial/guide/chap6s.htm (accessed June 1, 2010).

Fearne, Andrew, and Lavelle, David. 1996. Perceptions of food "quality" and the power of marketing communication: results of consumer research on a branded-egg concept. *Journal of Product and Brand Management* 5(2): 29-42.

Gil, J. M., Gracia, A., and Sanchez, M. 2000. Market segmentation and willingness to pay for organic products in Spain. *International Food and Agribusiness Management Review* 3(2): 207–226.

Goddard, Ellen, Boxall, Peter, Emunu, John P., Boyd, Curtis, Asselin, Andre, and Neall, Amanda. 2007. "Consumer Attitudes, Willingness to Pay and Revealed Preferences for Different Egg Production Attributes: Analysis of Canadian Egg Consumers." *Project Report* no. 07-03, Department of Rural Economy, University of Alberta, Canada, (July, 2007) http://ageconsearch.umn.edu/bitstream/52087/2/PR%2007-03.pdf (accessed June 1, 2010).

Gore, Albert A. 2006. Al Gore Gives Policy Address at NYU on Solving the Climate Crisis. http://www.nyu.edu/community/gore.html (accessed November 1, 2009).

Greenblum, Marcia D. Telephone interview. 18 Nov 2009.

Greenpeace. 2009. More than Half of Leading U.S. Supermarkets Show Progress in Latest Greenpeace Sustainable Seafood Scorecard. (June 30, 2009) http://www.greenpeace.org/usa/press-center/releases2/more-than-half-of-leading-u-s (accessed June 1, 2010).

Griffith, Rachel, and Nesheim, Lars. 2008. "Household willingness to pay for organic products." *cemmap working paper* CWP 18/08, The Institute for Fiscal Studies, Department of Economics, UCL, (July, 2008) http://eprints.ucl.ac.uk/14668/1/14668.pdf (accessed June 1, 2010).

Hassan, Daniel, and Monier-Dilhan, Sylvette. 2006. National Brands and Store Brands: Competition through Public Quality Labels. *Agribusiness* 22(1): 21 – 30.

Johnston, Robert J., Wessells, Cathy R., Donath, Holger, and Asche, Frank. 2001. Measuring Consumer Preferences for Ecolabeled Seafood: An International Comparison. *Journal of Agricultural and Resource Economics* 26(1): 20-39.

Kaiser, Michel J. and Edwards-Jones, Gareth. 2006. The role of ecolabeling in fisheries management and conservation. *Conservation Biology* 20(2): 392–398.

Karipidis, Philippos, Tsakiridou, Efthimia, Tabakis, Nikolaos, and Konstantinos, Mattas. 2005. Hedonic analysis of retail egg prices. *Journal of Food Distribution Research* 36(3): 68-73.

Kassaye, W. Wossen, and Verma, Dharmendra. 1992. Balancing traditional packaging functions with the new green packaging concerns. *SAM Advanced Management Journal* 57(4): 15-23.

Knudson, William A. 2004. "The Market for Organic and Fortified Eggs." *Working Paper* no. 2-0104, The Strategic Marketing Institute, MSU Product Center for Agriculture and Natural Resources, (January 2004) http://www.productcenter.msu.edu/documents/Working/2-0104.pdf (accessed November 1, 2009).

Lancaster, Kelvin J. 1966. A New Approach to Consumer Theory. *The Journal of Political Economy* 74(2): 132-157.

Laroche, Michel, Bergeron, Jasmin, Barbaro-Forleo, Guido. 2001. Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing* 18(6): 503-20.

Lewis, Helen 2005. Defining product stewardship and sustainability in the Australian packaging industry. *Environmental Science and Policy* 8(1): 45-55.

Loureiro, Maria L., and Hine, Susan. 2002. Discovering Niche Markets: A Comparison of Consumer Willingness to Pay for Local (Colorado-Grown), Organic, and GMO-Free Products. *Journal of Agricultural and Applied Economics* 34(3):477-487.

Loureiro, Maria L., McCluskey, Jill J., and Mittelhammer, Ron C. 2001. Assessing Consumers Preferences for Organic, Eco-labeled and Regular Apples. *Journal of Agricultural and Resource Economics* 26(2): 404-416.

Loureiro, Maria L., McCluskey, Jill J., and Mittelhammer, Ron C. 2002. Will consumers pay a premium for eco-labeled apples? *The Journal of Consumer Affairs* 36(2): 203-219.

McDonald. 2010. McDonald's Corporate Responsibility: Values in Practice Video. http://www.aboutmcdonalds.com/mcd/csr/video/sustainable_supply.10.html (accessed June 1, 2010).

Marsh, Kenneth, and Bugusu, Betty. 2007. Food packaging: roles, materials, and environmental issues. *Journal of Food Science* 72(3): R39–R55.

Mintel. 2008. "Green Living-US-February 2008." *Mintel/TechnoMetrica/SSI/Greenfield Online* http://academic.mintel.com.ezproxy0.ats.msu.edu/sinatra/oxygen_academic/search_results/show&/display/id=295904/displaytables/id=295904 (accessed June 1, 2010).

Nerlove, Marc. 1995. Hedonic price functions and the measurement of preferences: The case of Swedish wine consumers. *European Economic Review* 39(9): 1697-1716.

Ness, Mitchell R., and Gerhardy, Hubert. 1994. Consumer preferences for quality and freshness attributes of eggs. *British Food Journal* 96(3): 26-34.

Nimon, Wesley, and Beghin, John. 1999. Are Eco-labels Valuable? Evidence from the Apparel Industry. *American Journal of Agricultural Economics* 81(4): 801-811.

Oberholtzer, Lydia, Catherine, Greene, andLopez, Enrique. 2006. "Organic poultry and eggs capture high price premiums and growing share of specialty markets." *Outlook Report*, U.S. Dept. of Agriculture, Economic Research Service, (December, 2006) http://www.ers.usda.gov/Publications/LDP/2006/12Dec/LDPM15001/ldpm15001.pdf. (accessed Oct 1, 2007).

Patterson, P.H., Koelkebeck, K.W., Bell, D.D., Carey, J.B., Anderson, K.E., and Darre, M.J. 2001. Egg marketing in national supermarkets: Specialty eggs—Part 2. *Poultry Science* 80(4):390–395.

Patterson, Thesmar, Reynnells, Darre, and Cravener. 2008. Specialty Eggs in North America.

Peattie, Ken, and Charter, Martin. 1992. "Green marketing." Chap. 28 In *The M + E Handbook Series*, Longman, London.

Pelsmacker, Patrick De, Driesen, Liesbeth, and Rayp, Glenn 2005. Do consumers care about ethics? Willingness to pay for fair-trade coffee. *The Journal of Consumer Affairs* 39(2): 363-385.

Progressivegrocer. 2009. Spartan Store Brand Eggs Now in Green Packaging. (Jan 23, 2009) http://www.progressivegrocer.com/progressivegrocer/content_display/features/corporate-social-responsibility/e3i8e1f30d51da4f8e86906c7d215fef836 (accessed June 1, 2010).

Rahn, Allan P. 2001. Caged Laying Hen Well-Being: An Economic Perspective. Prepared for inclusion in the proceedings and presentation at the 52nd North Central Avian Disease Conference and Symposium on The Science Behind Poultry Husbandry. September 30, Grand Rapids, Michigan.

Rosen, Sherwin. 1974. Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy* 82(1): 34-55.

Sanjuan-Lopez, A.I., Resano-Ezcaray, H., and Camarena-Gomez, D.M. 2009. Developing marketing strategies for Jiloca saffron: a price hedonic model. *Spanish Journal of Agricultural Research* 7(2): 305-314.

Soler, Francisco, Gil, Jose M., and Sanchez, Mercedes. 2002. Consumers' acceptability of organic food in Spain Results from an experimental auction market. *British Food Journal* 104(8): 670-687.

Supermarketnews. 2009. FreshDirect Offers New Environmentally Friendly Egg Packaging. (Aug 25, 2009) http://supermarketnews.com/news/freshdirect_packaging_0825/index.html (accessed June 1, 2010).

United Egg producers. 2010. Housing, Space, Feed, and Water. http://www.uepcertified.com/program/guidelines/categories/housing-space-feed-water (accessed June 1, 2010).

United States Environmental Protection Agency. 2008. Municipal Solid Waste in The United States 2007 Facts and Figures. (November, 2008) http://www.epa.gov/osw/nonhaz/municipal/pubs/msw07-rpt.pdf (accessed June 1, 2010).

USDA. 2007a. Food Labeling. http://www.fsis.usda.gov/factsheets/food_product_dating/index.asp (accessed June 1, 2010).

USDA. 2007b. Sustainable Agriculture: Definitions and Terms. http://www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml#toc2 (accessed June 1, 2010).

USDA. 2010. Fact Sheets: Egg Products Preparation – Shell Eggs from Farm to Table. http://www.fsis.usda.gov/factsheets/focus_on_shell_eggs/index.asp (accessed June 1, 2010).

Vermeir, Iris, and Verbeke, Wim. 2006. Sustainable Food Consumption: Exploring the Consumer "Attitude – Behavioral Intention" Gap. *Journal of Agricultural and Environmental Ethics* 19(2): 169-194.

Walmart Watch. 2005. A Promise to the Environment Shedding Light on Walmart's Environment Practices. http://walmartwatch.com/environment (accessed June 1, 2010).

Wang, Qingbin, and Sun Junjie. 2003. "Consumer Preference and Demand for Organic Food: Evidence from a Vermont Survey." Paper prepared for presentation at the American Agricultural Economics association Annual meeting, July 27-30, Montreal, Canada.

Wegmans. 2010. The New Egg Cartons in Our Stores: How the Idea Was Hatched. (April 19, 2010) http://www.wegmans.com/webapp/wcs/stores/servlet/PressReleaseDetailView?langId= -1&storeId=10052&catalogId=1&productId=690897 (accessed June 1, 2010).

Weil, Marty. 2008. Consider alternative and renewable energy sources. (January 16, 2008) http://www.foodprocessing.com/articles/2008/008.html?page=1 (accessed June 1, 2010).

Wessells, Cathy R., Johnston, Robert J., and Donath, Holger. 1999. Assessing consumer preferences for ecolabeled seafood: The influence of species, certifier and household attributes. *American Journal of Agricultural Economics* 81(5): 1084–1089.

Appendix

Table 1. Definitions of the Variables and their Descriptive Statistics

Variables	Definition	Min (cent)	Max (cent)	Mean (cent)	Base Variables
Dependent variable					
Price per egg	A price per egg	0.06633	0.59667	0.23698	
Specialty Characteristics					
r, o, wm, owm, vd, and ne	DV* which is 1 for regular (*r*), organic (*o*), welfare-managed (*wm*), organic and welfare-managed (*owm*), vegetarian-fed (*vd*), and nutritionally-enhanced (*ne*) eggs, respectively and 0 otherwise	0	1	0.4198, 0.1481, 0.2305, 0.1111, 0.3868, and 0.2593	Regular (*r*)
Brands					
store, *regional*, and *national*	DV which is 1 for that type of brand, and 0 otherwise	0	1	0.4139, 0.2664, and 0.3197	Store brand (*store*)
Colors					
white, and *brown*	DV which is 1 for a white (brown) egg, and 0 for a brown (white) egg	0	1	0.4321, and 0.5679	White color (*white*)
Grades					
A, and *AA*	DV which is 1 for an egg is grade A (AA), and 0 if an egg is grade AA (A)	0	1	0.9508, and 0.0492	Grade A (*A*)
Types of Packaging					
foam, plastic, and *paper*	DV which is 1 for an egg package made from Styrofoam, plastic, and paper-pulp, respectively and 0 otherwise	0	1	0.2025, 0.4298, and 0.3678	Styrofoam (*foam*)
Size					
Medium, large, extra large, and *jumbo*	DV which is 1 for a medium, large, extra-large, and jumbo egg, respectively, and 0 otherwise	0	1	0.0459, 0.7156, 0.1651, and 0.0734	Medium size (*medium*)
Retailers					
Acme, Giant, Pathmark, Safeway, Shopper, Shaws, Shoprite, Superfresh, Stop and Shop, Walmart, Wegmans, and Weis	DV which is 1 for an egg sold by that retailers and 0 otherwise	0	1	0.0451, 0.0697, 0.1393, 0.1189, 0.0533, 0.0902, 0.0984, 0.0902, 0.0820, 0.0984, 0.0656, and 0.0492	Walmart (*walmart*)
Others					
Shell able	DV which is 1 for an egg with shell label, and 0 otherwise	0	1	0.1681	No shellable (*no shellable*)
Egg age	a number of days counted from when an egg is laid until it is bought at the store	1	41	14.02	
Unit size	a number of eggs per unit	6	60	12.45	

*Note: DV represents a dummy variable.

Table 2. Results for Hedonic Prices of Egg Attributes

Attributes	Coefficient (S.E.) Unit: Dollars	
Dependent variable	*Price per egg*	
Specialty Characteristics		
o	0.165***	(-0.023)
wm	0.0357***	(-0.0122)
owm	-0.0881***	(-0.0267)
vd	-0.0065	(-0.0089)
ne	0.0230***	(-0.00877)
Brands		
regional	0.0395***	(-0.0125)
national	0.0533***	(-0.00939)
Colors		
brown	0.00186	(-0.00834)
Grades		
AA	0.0328**	(-0.0127)
Types of packaging		
plastic	0.0106	(-0.0114)
pulp	-0.00306	(-0.00936)
Sizes of eggs		
large	0.0456***	(-0.0119)
extra large	0.0575***	(-0.0119)
jumbo	0.0715***	(-0.0135)
Retailers		
Shaws	0.0601***	(-0.0116)
Stop and shop	0.0540***	(-0.0167)
Giant	0.0597***	(-0.0117)
Safeway	0.116***	(-0.0149)
Wegmans	0.00609	(-0.0145)
Weis	0.0393**	(-0.0189)
Shopper	-0.0125	(-0.0124)
Pathmark	0.0775***	(-0.0133)
Shoprite	0.0634***	(-0.0128)
Superf resh	0.0502***	(-0.013)
Acme	0.0645***	(-0.0146)
Others		
shell label	0.00425	(-0.0121)
egg age	0.000214	(-0.000371)
unit size	-0.00149**	(-0.000728)
Constant	0.0897***	(-0.0174)
Observations	207	
R-squared	0.812	

Note: * significant at 10%; ** significant at 5%; *** significant at 1%

Risk - An Opportunity or Threat for Entrepreneurial Farmers in the Global Food Market?

Nicola Mary Shadbolt[⊕a], Femi Olubode-Awasola[b], David Gray[c], and Elizabeth Dooley[d]

[a] *Associate Professor, IFNHH, Massey University, Private Bag 11222, Palmerston North, Manawatu, 4442, New Zealand*

[b] *Researcher, AgResearch Ltd., Ruakura Research Centre, Private Bag 3123, Hamilton, New Zealand*

[c] *Senior Lecturer, INR, Massey University, Private Bag 11222, Palmerston North, Manawatu, 4442, New Zealand*

[d] *Researcher, AgResearch Ltd., Ruakura Research Centre, Private Bag 3123, Hamilton, New Zealand*

Abstract

Operating in a deregulated economy that provides minimal support to agriculture, New Zealand dairy farmers are exposed to considerable uncertainty. However, this uncertainty provides both opportunities and threats for New Zealand dairy farms and often it is the capacity of the farm manager to interpret and respond to external (and internal) information that determines the extent of the advantage or disadvantage that is eventually realized. The research question in this study is to determine whether the perceptions of risk (importance and likelihood) differ according to time horizon and according to whether the risk is viewed as an opportunity or a threat. Subsequent to this question is whether presenting farmer perceptions in a format that better illustrates and informs on the relativity between the sources of risk can enhance the capacity of farm managers to either avoid or exploit the threat and opportunity respectively. This paper reports on the development and application of a methodology to answer these questions. The methodology is then tested on a selected group of farmers with the results analyzed and presented.

Keywords: uncertainty, farm management, opportunities, threats

⊕Corresponding author: Tel: + 64.63569099
Email: N.M.Shadbolt@massey.ac.nz

Other contact information: F. Olubode-Awasola: femi.olubode-awosola@agresearch.co.nz
D. Gray: D.I.Gray@massey.ac.nz
E. Dooley: liz.dooley@agresearch.co.nz

Introduction

Operating in a deregulated economy that provides minimal support to agriculture, New Zealand dairy farmers are exposed to considerable uncertainty. However, this uncertainty provides both opportunities and threats for New Zealand dairy farms and often it is the capacity of the farm manager to interpret and respond to external (and internal) information that determines the extent of the advantage or disadvantage that is eventually realized.

There is however an interesting bias in the literature on the definition of uncertainty and/or risk. There is also a distinction made between uncertainty and risk. The extent of available information partly contributes to the concepts of uncertainty and risk in literature. While the difference is of significance to some (Hardaker et al. 1997), the terms risk and uncertainty are more often described as interchangeable (Chavas 2004; Newbury and Stiglitz 1981; Sonka and Patrick 1984). This is based on the argument that subjective probabilities are usually formed by decision makers in which case the distinction between the two (uncertainties exist when the probability of outcomes are unknown and risk implies an imperfect knowledge of the actual outcome but the probabilities of the possible outcomes are known) become less relevant (Anderson et al.1977; Hardaker et al., 2004; Sonka and Patrick 1984).

The bias in the literature relates to whether risk is seen as a positive or negative influence on the business. While, for example, Chavas (2004) states that risk represents any situation where some events are not known with certainty and Robison & Barry (1987,13) maintain that " …*uncertain events are important when their outcomes alter a decision maker's material or social well being",* neither provide a negative or positive bias in their definitions. In contrast a more negative bias is found in Hardaker et al. (1997) who define uncertainty as imperfect knowledge and risk as uncertain consequences, particularly exposure to unfavorable consequences. For example, they include in human risk death of owner, prolonged illness, or carelessness of a hired employee.

Similarly Harwood et al., (1999), cited by OECD (2008) state "…*risk is uncertainty that matters and may involve the probability of losing money, possible harm to human health, repercussions that effect resources and other types of events that affect a person' welfare."*

The negative bias presented by Hardaker et al. (1997, 2004) relates to their observation that technical risk in agriculture is downside risk, since significant deviations from plan, either greater or smaller, are likely to have adverse consequences e.g. large deviations in rainfall either way will reduce yields, and thus income. Despite definitions to the contrary, this bias has been pervasive as many studies in this area focus only on the negative impact of risk.

Consider, for example, Pinochet-Chateau et al. (2005) who compared the risk perceptions of New Zealand dairy farmers in 1992 from the study by Martin (1994) with those in 2004. They found that farmers' perceptions of risk changed over time and that the mean scores for the majority of risk sources increased. The three highest ranked risk sources in 2004 were market risks. The highest ranked risk source in both 1992 and 2004 was changes in product prices. Interestingly, the second and third ranked risk sources in 2004, changes in world economic and political situation and changes in input prices were ranked lower in 1992 (3rd and 5th

respectively). They also noted that the overall perception of production risk had not changed over the twelve-year-period, there was a change in some of the components of production risk. For example, the perceived risk from rainfall variability declined between 1992 and 2004 whereas that from pests and diseases increased. Farmers' perceptions of risks from regulatory risks increased between 1992 and 2004.

The work of Martin (1994) and Pinochet-Chateau et al. (2005) helped identify changes in how farmers both perceive and manage risk. However in both instances only the negative side of risk was presented and the management strategies described were assumed to be minimising the uncertainty associated with those sources of risk. There was also no distinction made between whether the risk was being assessed within a season or over a longer time frame.

This bias has important implications for the study of farm management, and is highlighted when one considers farming entrepreneurs. For McElwee (2006), entrepreneurship is a good risk attitude measure because he found that those farmers who had ventured into new farm enterprises in his study scored highly in what he termed risk attitude. While entrepreneurship has various definitions, as identified by Shadbolt et al (2009), a common theme is that farming entrepreneurs have more growth orientation, risk taking, innovativeness and personal control characteristics than their conventional farmer counterparts (Vesala et al. 2007). They seek to exploit opportunities (de Lauwere's 2005). Alsos et al. (2003) also state that farm-based entrepreneurship is the result of alert farmers discovering and exploiting business opportunities related to their prior knowledge. Therefore any survey that does not provide for farmers' identification of the opportunities that uncertainty creates and does not analyze how farmers adopt strategies that capture those opportunities is only telling half of the story.

Both entrepreneurship and risk management are being promoted as areas requiring improvement on-farm (Shadbolt et al. 2009). For example, in Europe, Phillipson et al. (2004) state that market liberalization has led to drastic changes in government policies and the subsequent promotion of entrepreneurship and business skills in the farming sector. Similarly Detre et al. (2006) identify that changes in the industry are creating new and different uncertainties than the traditional operational and financial uncertainties agribusinesses have faced in the past. Risk management skills are all the more important now with the recent increased volatility in market prices (Rabobank 2010).

An exception to the bias noted above is the work reported by Detre et al. (2006). In their research, they recognized that uncertainty has upside potential as well as downside exposure citing (Pascale et al. 2000) and developed a tool to promote and generate discussion around key areas of uncertainty. They presented a methodology to understand, assess and evaluate, and manage strategic uncertainty. They are guided by Boehlje et al. (2005)'s definition of strategic uncertainty:

"strategic uncertainty is the sensitivity of the company's value to inappropriate strategic choices, ineffective strategy implementation, or uncertainties in the business climate"

This definition differs from those quoted above in that it implicitly identifies the role of the manager in both managing and creating uncertainty in the business. Not only can the business

climate be turbulent, but also the manager can make the wrong choice or implement strategy poorly. Detre et al. (2006,73) maintain that "*firms must evaluate and manage strategic uncertainty through proactive strategies that capture the potential benefits of the uncertainty and mitigate the exposures if they fail to act*." Citing Talavera (2004) and Pascale *et al*, (2000) they identify how managing uncertainty can create long-term value and they caution that a focus only on "uncertainty avoidance" will cause a firm to overlook opportunities to create value. They tested their methodology with agribusiness executives working on a hypothetical seed company. The results suggest that the approach they had developed was useful, not only to understand the uncertainties from both a positive and a negative perspective, but also to communicate the impact of the uncertainties and discuss the various strategies open to the company – capitalize, share, transfer, reduce, avoid and monitor. So if managing uncertainty can create long-term value, how does it affect short-term value? Does the time horizon alter the effectiveness of, or requirement for, risk management due to outcomes being less certain?

The literature review failed to unearth other examples of farm or agribusiness management analysis in which both perspectives were explored. Most literature focused on risk mitigation to prevent an uncertainty from occurring. However a similar approach was found to be in use by the Government of Alberta, Department of Agriculture and Rural Development, with their Risk Choice Matrix tool (Millang et al. 2010). This tool helps to illustrate the uncertainties that are of greatest concern for a farm but it does not extend to the choice of strategy that either mitigates downside exposure or exploits upside potential.

Research Objectives

This research was part of a larger project designed to explore risk management on dairy farms in New Zealand, to review existing knowledge on farmer perceptions of risk in dairy farming and the risk management strategies they currently employ. The survey was initially undertaken to identify suitable case farmers for an in-depth multiple case study of the risk management strategies of New Zealand dairy farmers (Payne et al. 2009). The farmers in the survey were identified by the research team as operators who might provide useful insights into risk management across a range of regions in New Zealand. They had collaborated in previous studies and been used as case studies for students so were known to be receptive to enquiry. As such they are a biased and not a random sample.

The survey results were then further scrutinized to determine if it was a useful method to determine whether long- and short-term perceptions of risk differ from both a positive and a negative impact of risk perspective. Various methods were explored for describing these perceptions in an attempt to develop a tool of use to both farmers and the industry. The aim was to aid both farmer and industry understanding and prioritization of risks and hence guide the risk management and mitigation strategies they adopt or promote.

The research question in this study is to determine whether the perceptions of risk (importance and likelihood) differ according to time horizon and according to whether the risk is viewed as an opportunity or a threat. Subsequent to this question is whether presenting farmer perceptions in a format that better illustrates and informs on the relativity between the sources of risk can enhance the capacity of farm managers to either avoid or exploit the threat and opportunity

respectively. This paper reports on the development and application of a methodology to answer these questions. The methodology is then tested on a selected group of farmers with the results analyzed and presented.

Method

This study aimed to identify and assess strategic uncertainties in the New Zealand dairy industry using sample data from New Zealand dairy farmers and to develop a typical scale and importance index for the identified uncertainties. Such an index could then be used to help dairy farmers both exploit the opportunities created by uncertainty and mitigate the threats from those same uncertainties.

A questionnaire was completed by 27 dairy farmers from diverse locations across New Zealand. The sample size was small and biased as the farmers chosen were those who were being considered for an in-depth multiple-case study project. To get a better understanding of the characteristics of the selected group the first section of the questionnaire asked the respondents to assess their perceived ability to manage uncertainties within a season, and over the long-term, their attitude to planning, aptitude in decision making and degree of risk aversion.

Respondents were then asked to assess the potential for their businesses to benefit from a range of sources of uncertainty and state what they believed was the likelihood of this opportunity arising. They were then asked to assess the potential for their business to be disadvantaged from the same range of sources of uncertainty and state what they believed was the likelihood of this threat arising. This self-assessment was carried out twice, once from a within season perspective and then again from a longer term (5-10 year) perspective. The sources of uncertainty were taken from a combination of the studies of Pinochet-Chateau et al. (2005), Martin (1994) and Detre et al. (2006).

The sources of risk were then grouped into six categories and respondents were asked to assess their ability to respond to each category both within a season and over the long term. The respondents were then asked to assess, for both within season and the longer term, how well resourced they were to respond to the sources of risk with respect to land, labour, capital and management structure and ability.

A list of risk management techniques taken from Pinochet-Chateau et al. (2005) and Martin (1994) were provided to the respondents and they were asked to state their importance and whether they did or did not use that technique. The questionnaire finished with some questions about the respondents dairy farm and personal characteristics.

Apart from the last section, the questions were framed in a way that responses are captured as ordinal data on a scale of 1 to 5. Typical responses were constructed using median. Where the average median response was a fraction, the mode was used instead to represent the average response after considering extreme responses (outliers) by using standard deviation and skewness in responses. This scale allowed assigning of numbers to various levels of threat posed or opportunity created by an uncertainty, the likelihood of each uncertainty happening and other concepts measured.

The scale is similar to the popular Likert scaling technique which measures a respondent's degree of agreement or disagreement on an issue, opinion, or particular belief. Responses to a Likert scale can be considered to be interval level scores, thus allowing scores to be summed and treated statistically. Appropriate descriptive analyses were performed to complement the limited statistical analysis that Likert scale type or ordinal responses can allow. This helped to rate and score different uncertainty impacts and likelihood and other perceptions of the respondents required for the development of a number of tools.

Uncertainty scorecards, RiskChoice matrices and risk importance indices, as well as heat maps (extrapolation of exposure/likelihood graph on potential/likelihood map) were the tentative tools developed and tested on the data from the 27 dairy farmers' responses. In this study, the scorecards were integrated into a matrix developed by the Alberta Department of Agriculture and Rural Development (Millang et al. 2009).

The Uncertainty Scorecard

Detre et al. (2006, p. 72) identify that managers have a "*mental model that frames assessment of strategic uncertainty from both a potential and an exposure perspective*" and describe the assessment tools such as the scorecards and heat maps as ways to operationalise the mental model by providing quantitative rankings to communicate the impact of uncertainty on the business.

The response (qualitative ranking) from the farmers were coded into a scorecard showing the quantitative ranking (score) of each uncertainty source. On a separate scorecard for each of potential and exposure, the vertical axis is likelihood while the horizontal axis is the level of potential or exposure. To estimate or generate a scorecard from the graph and for a typical scorecard estimated from the respondents' response, a low score corresponds to a number less than 3 and a high score is a number greater than 3 using median score. Each graph is divided into four quadrants based on this summation, and the quadrants are color coded. As in Detre et al. (2006) symbols in the form of hand gestures can also be attached to each quadrant to aid visualization.

RiskChoice Matrix

The potential/likelihood graph (scorecard) is mirror-imaged and appended to the right edge of exposure/likelihood graph (scorecard) to create a RiskChoice matrix. The arrow of attention is drawn across the matrix from highest likelihood to lowest likelihood within the high to very high impact. The uncertainty scorecards can help farmers identify opportunities and threats, so that these can either be captured or avoided. When they are integrated into a risk choice matrix, they help to identify how each uncertainty may be both an opportunity and a threat. Simultaneous responses can then be conceptualized in a legend of generic uncertainty responses.
The RiskChoice matrix is a template that individual farmers can use to analyze specific sources of uncertainty. For each business, a particular uncertainty may be assessed as either a threat or an opportunity depending on a particular context and the outcome of a particular unknown.

Response Legend

It is proposed that the heat map, as described by Detre et al. (2006), be reconstructed as a legend of responses to different impacts and likelihood of uncertainty as read from the RiskChoice matrix. The Response legend can be created to serve as a filter for choosing a specific set of responses or activities to manage a strategic uncertainty. They can be based on the sixteen quadrants from the RiskChoice matrix. A combination of colors and hand gestures could be used to help visualization.

Risk Importance Index

Farmers have different perceptions about the impact and likelihood of each uncertainty source. This influences their rating or assessment of each uncertainty. It is difficult therefore to rank the uncertainties based on individual farmers' responses without normalizing (or weighting) the uncertainties to avoid distortions due to context, diversity (ranges from human capital to physical assets) or different measurement scales.

A risk importance index was constructed by assigning weights based on qualitative or subjective judgments from the respondents. Average uncertainty scores and proportion of respondents were used as weights to compute indices which were then ranked. The average uncertainty score was constructed from the impact score, the likelihood score and the proportion of respondents. This followed the approach used in Mclean-Meyinsse et al. (1994), Jose and Valluru (1997) and Alimi et al. (2006) where weights were constructed based on fewer factors - only impact and proportion of respondents.

 In addition, in this study the median scores (each for impact and likelihood) were used rather than arithmetic mean scores as used in previous studies (Mclean-Meyinsse et. al., 1994; Jose and Valluru, 1997; Alimi et al., 2006). The approach goes further than using the proportion of respondents that ranked a source of uncertainty as the most important. The uncertainty scores were first calculated from the multiplication of impact scores and likelihood scores. Then we considered the proportion of respondents with a risk score of 15 and higher. This is the level at which management action such as uncertainty mitigation measures are required according to an extract by David Champion, from a discussion by five experts on the future of enterprise risk management in Harvard Business Review (2009). Yet, this is not exhaustive as there is still a need to consider a risk score of 5 (e.g. when there is a likelihood score of 1, but an impact score of 5) as although an uncertainty event is very unlikely to happen, when it happens, the impact is very high. Incidentally, none of the sources of uncertainties considered in this study had a typical impact score of 5 and a likelihood score of 1. Finally the proportion of respondents that assessed an uncertainty source at a level of 15 and above was used to multiply the uncertainty score to arrive at an importance index.

The index is then ranked in descending order. The rank of each index is its size relative to other indices in the list such that if sorted in descending order (i.e. order of less importance), the rank of each index is its position. This analysis was done using the RANK function in Microsoft Excel which gives duplicate numbers the same rank. This happens when there is a tie. However, the presence of a tie (i.e. duplicate numbers) affects the ranking of subsequent numbers such that for instance, in a list of index sorted, if an index of 10 appears twice and has a rank of 5, then 11 would have a rank of 7 (no index has a rank of 6).

Constructing a risk importance index for a group of farmers, weighted by the proportion of responses from respondents, allows the relative importance of uncertainties to be determined. This is aimed at capturing industry and institutional value as this information can help to create awareness of the major and most important sources of uncertainty and guide entry strategy (for new farm businesses), industry strategy and policy formulation.

Results and Discussions

The farmers surveyed had considerable experience in dairy farming with 73% aged 41 and older. About 35 % were single-farm owner operators and another 35 % were owner operator with multiple operations. More than half (57%) of the farmers were at the growth stage in the farm family life cycle while 40 % were in a consolidation phase, none were at the entry or exiting stage. See summary statistics for respondents in Table 1 located in Appendix 1.

Half of the farmers have a debt to asset ratio of between 40 and 60 %, 78% had a debt to asset ratio 40 % or greater. The national mean debt to asset ratio was 34.6% in that year (DairyNZ 2009) which means that this sample of farmers carries above average debt levels. Nearly 70% of the farmers had 20% or greater debt servicing as a proportion of gross income (including off-farm income) as at June 2008. The national mean debt servicing capacity measure ((interest + rent) divided by gross farm revenue) was 17.5% in that year (DairyNZ 2009). Again this shows that this sample carries a higher debt servicing commitment than average.

Within a season, 66% agreed or strongly agreed that they have the ability to manage almost all uncertainty and over the longer-term, 61% agreed or strongly agreed that they have the ability to manage almost all uncertainty. About 40% have a neutral attitude to risk while 31% reported risk seeking behavior and 19% were risk averse.

The high level of debt, many in the growth stage of their business their confidence and the small number identified as risk averse would suggest the selected group were similar to Vesala et al., (2007)'s description of farming entrepreneurs. They stated that entrepreneurs had more growth orientation, risk taking, innovativeness and personal control characteristics than their conventional farmer counterparts. The perceived ability to manage risk of the selected group is more typical of a entrepreneur given their sense of control, self-efficacy and self-belief. Given these observations the selected group is hitherto described/defined as 'entrepreneurial' as compared with average dairy farmers in New Zealand.

Distribution of Risk Management Techniques

In common with previous studies (Pinochet-Chateau et al. 2005) the most widely used risk management techniques (accorded very high importance) include maintaining feed reserves, having short term flexibility, irrigation, managing debt, using futures markets (where applicable), planning the timing of capital expenditure, insurance, and a range of business planning techniques. Few farmers adopted the strategies of diversification, not producing to full capacity, keeping debt low, and the farm operator working off the property to add to farm income. This commonality with previous studies suggests that despite the biased sample these farmers were not atypical in their risk management strategies although their scores were higher. The higher scores indicated that they placed greater importance on the techniques available and made more

use of them. There are also some differences in the strategic planning area, these farmers rated some of the strategic management strategies much more highly and a much greater proportion of them used the strategies. This observation also reinforces their description as entrepreneurial as it fits with Alsos et al. (2003)'s conclusion that farm-based entrepreneurship is the result of alert farmers discovering and exploiting business opportunities related to their prior knowledge.

Table 2. Distribution of risk management strategies among the respondent dairy farmers

Risk management strategies	Within season		
	# Responses	*# Using*	*Median Score*
1. Having more than one type of animal or other enterprises on your property	26	10	3
2. Maintaining feed reserves	26	25	**5**
3. Not producing to full capacity so there are reserves in the system	25	11	3
4. Having short term flexibility: adjusting quickly to weather, price & others	26	24	**5**
5. Monitoring programme for diseases and climate	26	20	4
6. Routine spraying or drenching as a preventive measure	24	21	4
7. Irrigation	20	13	**5**
8. Spreading sales (reducing seasonality in milk production)	25	13	4
9. Geographic diversity (having property in different areas)	21	10	4
10. Using futures markets	22	2	**5**
11. Forward contracting	25	15	4
12. Gathering market information	26	23	4
13. Arranging overdraft reserves	25	24	4
14. Maintaining financial services: having cash and easily converted	26	16	4
15. Main farm operator working off property to add to farm income	25	5	3
16. Managing debt: monitoring debt and working closely with lenders	26	26	**5**
17. Keeping debt low: reducing debt or maintaining a low level of debt	26	8	3
18. Planning of capital spending: pacing investments and expansion	26	26	**5**
19. Having personal or business insurance	25	23	**5**
20. Using of practical planning steps in your business	26	25	**5**
21. Assessing strengths, weaknesses, threats and opportunities	26	24	**5**
22. Having a clear and shared vision or strategic purpose for your operation	26	22	**5**
23. Using of financial ratios for decision making	25	18	4
24. Others*	6	6	**5**

Score: Scale: 1 = not very important,… 5 = very important
*maintaining good health, involving family in business growth, other investment off-farm, varied team of skilled advisor, keep in touch with what is happening, measure net worth gain, calving more than once per year, variety of feeds available.

Typical Assessment Scorecards for Strategic Uncertainty

Within season, the typical scorecards developed for each of the uncertainty sources show that the production, financial, marketing, R&D and human/relationships categories of uncertainty all have a high positive impact. Within those categories, interest rates, global demand for dairy products, product prices, business relationships and skills and knowledge of those in or associated with the business have a high likelihood of occurring. By contrast although unexpected weather conditions, global demand for dairy products, product prices, input costs and local body laws and regulation have high negative impact, the farmers perceived that they have a low likelihood of occurring. The juxtaposition of the positive and negative impacts are best illustrated on the RiskChoice matrices (Figures 1 and 2) as they enable an "arrow of attention" to be recognized that, in turn, can guide the focus of the decision maker.
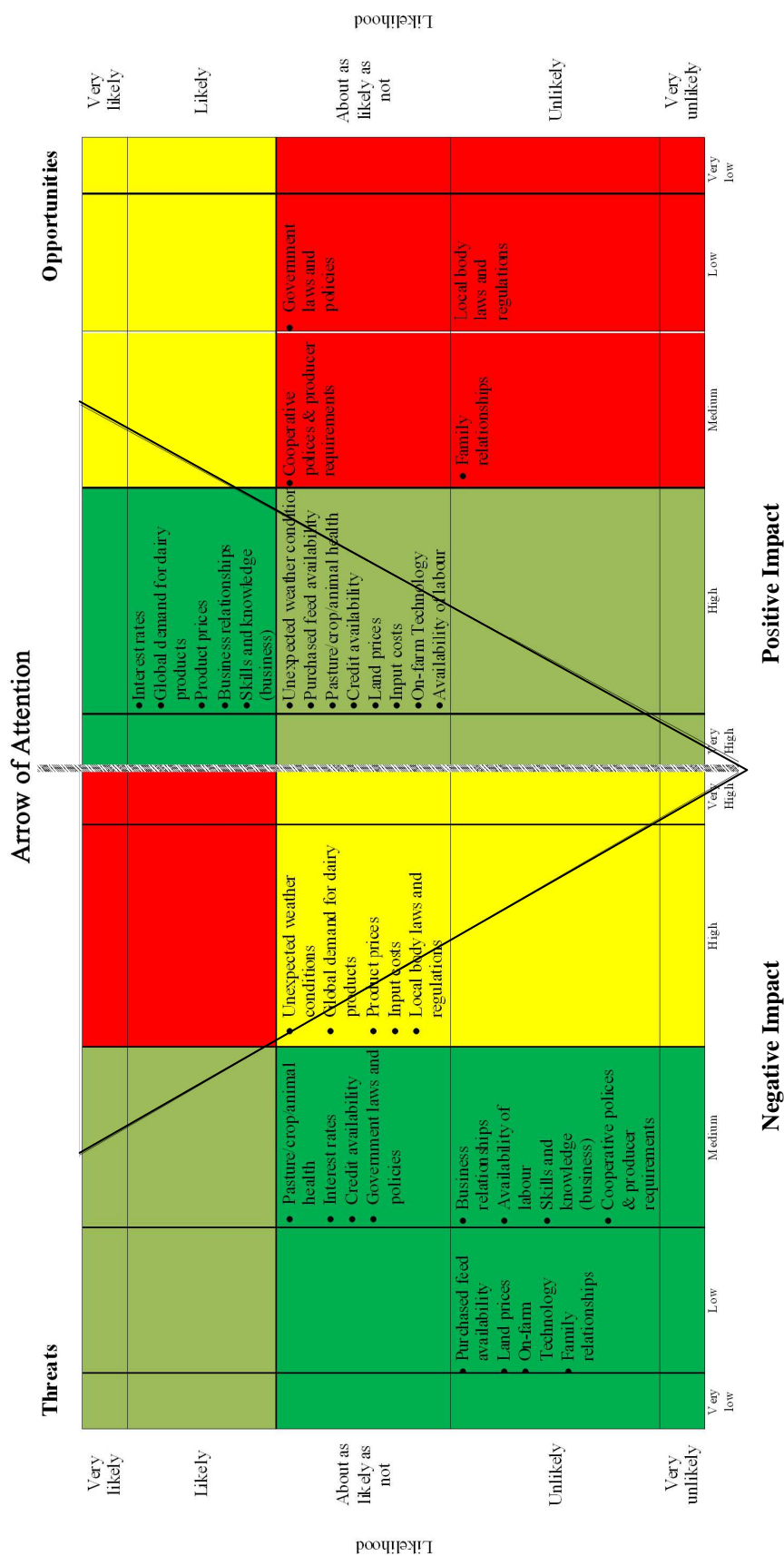
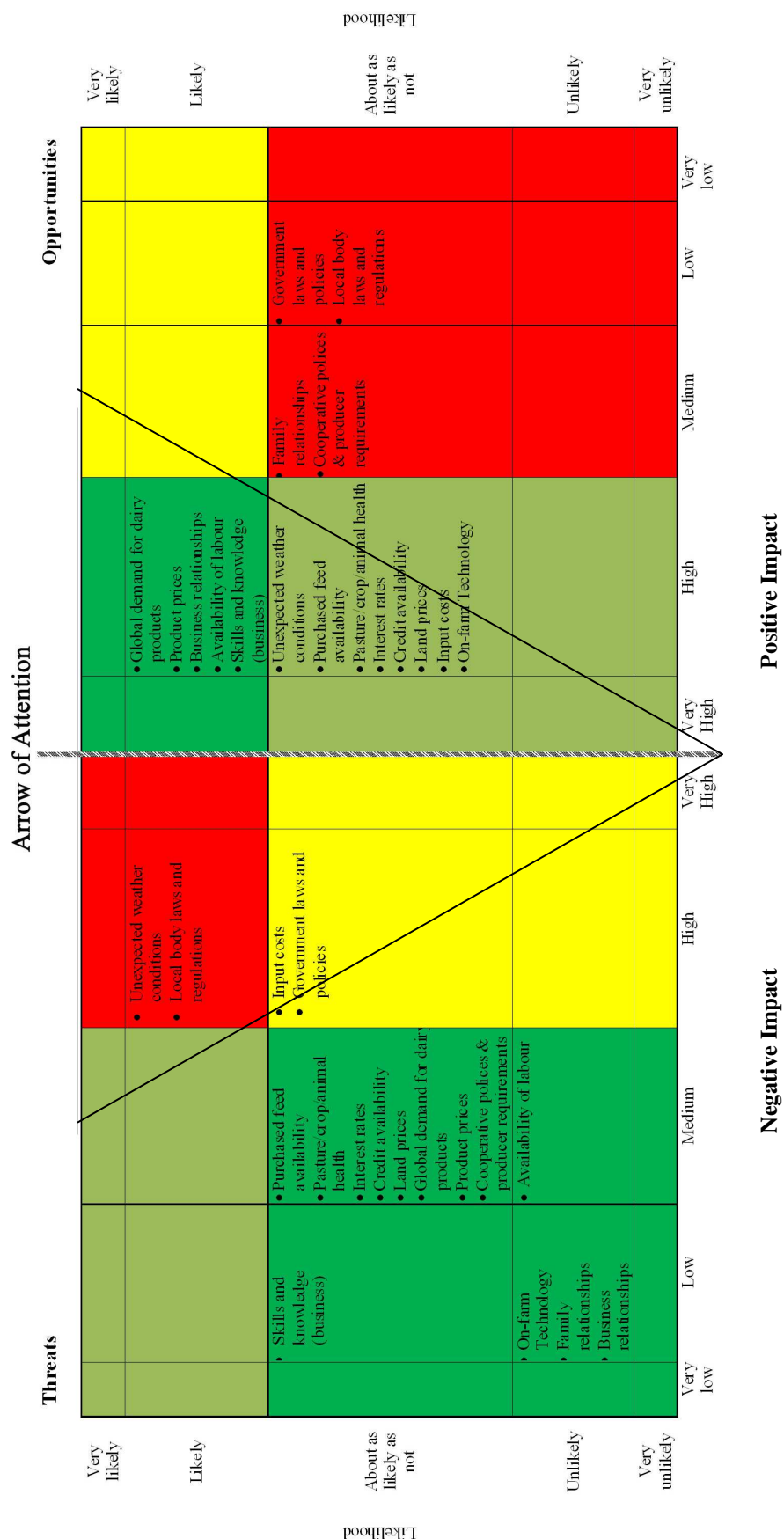**Figure 1.** Typical RiskChoice matrix season

Figure 2. Typical RiskChoice matrix over 5 – years

Table 3. Typical scorecards for strategic uncertainty within season as rated by the respondent dairy farmers

Sources of uncertainty	Opportunity		Threat	
	impact	*likelihood*	*impact*	*likelihood*
Production				
Unexpected weather conditions	4	3	4	3
Purchased feed availability	4	3	2	2
Pasture/crop/animal health	4	3	3	3
Financial				
Interest rates	4	4	3	3
Credit availability	4	3	3	3
Land prices	4	3	2	2
Market				
Global demand for dairy products	4	4	4	3
Product prices	4	4	4	3
Input costs	4	3	4	3
R&D				
On-farm technology (incl. Breeding)	4	3	2	2
Human/relationships				
Family relationships	3	2	2	2
Business relationships	4	4	3	2
Availability of labor (self, family, employees, contractors)	4	3	3	2
Skills and knowledge of those in or associated with the business	4	4	3	2
Policy & Regulation				
Government laws and policies	2	3	3	3
Local body laws and regulations	2	2	4	3
Cooperative policies and producer requirements	3	3	3	2

Score: Impact: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high
 Likelihood: 1 = very unlikely; 2 = unlikely; 3 = about as likely as not; 4 = likely; 5 = very likely

Table 4. Typical scorecards for strategic uncertainty over 5-10 years as rated by the respondent dairy farmers

Sources of uncertainty	Opportunity		Threat	
	impact	*likelihood*	*impact*	*likelihood*
Production				
Unexpected weather conditions	4	3	4	3
Purchased feed availability	4	3	3	3
Pasture/crop/animal health	4	3	3	3
Financial				
Interest rates	4	3	3	3
Credit availability	4	3	3	3
Land prices	4	3	3	3
Market				
Global demand for dairy products	4	4	3	3
Product prices	4	4	3	3
Input costs	4	3	4	3
R&D				
On-farm technology (incl. Breeding)	4	3	2	2
Human/relationships				
Family relationships	3	3	2	2
Business relationships	4	4	2	2
Availability of labor (self, family, employees, contractors)	4	4	3	2
Skills and knowledge of those in or associated with the business	4	4	2	3
Policy & Regulation				
Government laws and policies	2	3	4	3
Local body laws and regulations	2	3	4	4
Cooperative policies and producer requirements	3	3	3	3

Score: Impact: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high
Likelihood: 1 = very unlikely; 2 = unlikely; 3 = about as likely as not; 4 = likely; 5 = very likely

Over a longer-term it is a different situation. Again there are a number of issues recognized as having a high positive impact on the farm business – the production, financial, marketing, R&D

and Human/Relationships categories of uncertainty. Within those categories, global demand for dairy products, product prices, business relationships, availability of labor and skills and knowledge of those in or associated with the business have a high likelihood of occurring. When looking long-term the farmers identified unexpected weather conditions, input costs, government laws and policies and local body laws and regulations as having a high negative impact. Of these, unexpected weather conditions and local body laws were perceived to have a high likelihood of occurring.

When contrasting the two RiskChoice matrices it is clear that, for these entrepreneurial farmers, they perceive many positive impacts from uncertainty within a season and few negative impacts. However over the long-term although there are still a number of high positive impacts from the various sources of uncertainty they now also perceive uncertainties that create high negative impacts.

The survey data can also be used to develop heat maps and a RiskChoice matrix for individual farmers. The heat maps can then be used to identify those factors most in need of risk mitigation initiatives to reduce the likelihood or severity of an event and those requiring most focus to capture the full potential of an opportunity.

Risk Importance Index

Another approach is to develop uncertainty scores by multiplying the score for the impact of a particular uncertainty with the score for the likelihood of it happening (Tables 5,6,7,8). Within a season the highest uncertainty scores for the different sources of uncertainty that were perceived to generate opportunities are business relationships, skills and knowledge of those in or associated with the business, and interest rates. The highest uncertainty scores for the different sources of uncertainty within a season that generated the greatest threats were input costs, then product prices and unexpected weather conditions to a lesser extent. The data suggests that the farmers not only perceived input costs within a season as an important threat in terms of its impact on the farm business, but they also believed that there was a high likelihood that the threat would eventuate.

Over a longer time frame, skills and knowledge of those in or associated with the business has the highest uncertainty score of the various sources of uncertainty that generates the greatest opportunities. This is followed by product prices and then interest rates to a lesser extent. Threats are generated from input costs with local body laws and regulations to a lesser extent. While these results are exploratory in nature, it is of interest to note how this approach identifies the risks that can be managed (business relationships, skills and knowledge of those in or associated with the business and interest rates) as those providing the greatest opportunity, while those less easy to manage provide the greatest threats. The results also possibly reflect the entrepreneurial characteristics of the farmers in the survey and their confidence in their ability to leverage skills and knowledge to best effect.

Within season, (Tables 5 and 6) the uncertainties associated with interest rates, global demand for dairy products, product prices, business relationships, skills and knowledge of those in typically likely (likelihood score 4) to happen with a high potential (impact score 4) to create

Table 5. Typical assessment scorecards and risk scores for strategic uncertainty that create opportunities within season as rated by the respondent dairy farmers

Sources of uncertainty	N	Potential	Likelihood	Risk Score	Proportion of Respondents	Importance	
		Score	*Score*		*(%)**	*Index*	*Rank*
Skills and knowledge of those in or associated with the business	27	4	4	16	70.37	1,125.93	1
Global demand for dairy products	26	4	4	16	61.54	984.62	2
Interest rates	27	4	4	16	55.56	888.89	3
Business relationships	27	4	4	16	55.56	888.89	3
Product prices	26	4	4	16	42.31	676.92	5
Pasture/crop/animal health	24	4	3	12	50	600	6
On-farm technology (incl. Breeding)	26	4	3	12	50	600	6
Purchased feed availability	27	4	3	12	44.44	533.33	8
Availability of labor (self, family, employees, contractors)	27	4	3	12	44.44	533.33	8
Unexpected weather conditions	27	4	3	12	40.74	488.89	10
Land prices	27	4	3	12	40.74	488.89	10
Input costs	26	4	3	12	30.77	369.23	12
Credit availability	27	4	3	12	29.63	355.56	13
Cooperative policies and producer requirements	27	3	3	9	33.33	300	14
Family relationships	27	3	2	6	25.93	155.56	15
Government laws and policies	27	2	3	6	7.41	44.44	16
Local body laws and regulations	27	2	2	4	3.7	14.81	17

Score: Impact: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high
Likelihood: 1 = very unlikely; 2 = unlikely; 3 = about as likely as not; 4 = likely; 5 = very likely
* proportion of respondents with risk score of 15 and higher

Table 6. Typical risk scores for strategic uncertainty that create threats within season as rated by the respondent dairy farmers

Sources of uncertainty	N	Potential	Likelihood	Risk Score	Proportion of Respondents	Importance	
		Score	*Score*		*(%)**	*Index*	*Rank*
Product prices	26	4	3	12	62.96	755.56	1
Unexpected weather conditions	27	4	3	12	51.85	622.22	2
Input costs	26	4	3	12	51.85	622.22	2
Global demand for dairy products	26	4	3	12	48.15	577.78	4
Local body laws and regulations	27	4	3	12	44.44	533.33	5
Government laws and policies	27	3	3	9	33.33	300	6
Pasture/crop/animal health	24	3	3	9	19.23	173.08	7
Skills and knowledge of those in or associated with the business	27	3	2	6	18.52	111.11	8
Interest rates	27	3	3	9	11.11	100	9
Credit availability	27	3	3	9	11.11	100	9
Availability of labor (self, family, employees, contractors)	27	3	2	6	14.81	88.89	11
Cooperative policies and producer requirements	27	3	2	6	14.81	88.89	11
Land prices	27	2	2	4	11.11	44.44	13
Business relationships	27	3	2	6	7.41	44.44	13
Purchased feed availability	27	2	2	4	7.41	29.63	15
Family relationships	27	2	2	4	7.41	29.63	15
On-farm technology (incl. Breeding)	26	2	2	4	3.7	14.81	17

Score: Impact: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high
Likelihood: 1 = very unlikely; 2 = unlikely; 3 = about as likely as not; 4 = likely; 5 = very likely
* proportion of respondents with risk score of 15 and higher

benefit. However, considering the proportion of respondents that ranked it with an uncertainty score of 15 or more, skills and knowledge of those in or associated with business has the highest relative importance or potential to gain benefit from. This is followed by global demand for dairy products, interest rates and business relationships in that order.

Interestingly none of the sources of uncertainty are typically assessed to create threats at a level requiring management attention as they all have average uncertainty scores of less than 15. It is worth noting that about 63% of the respondents individually assessed uncertainty related to product prices at a level of 15 and above, the point at which they should require management attention. This is followed by uncertainties associated with unexpected weather conditions and input costs and global demand for dairy products.

Over the long-term (Tables 7 and 8), although none of the sources of uncertainty generated high indices with regard to creating opportunities, it is equally worth noting that about 60% of the respondents individually assessed global demand for dairy products and skills and knowledge of people in or associated with business as sources of uncertainty that can create benefits. Similarly few of these sources of uncertainty generated high index values as threats to the business, but about 55% of the respondents assessed input costs as a concern. The source of uncertainty causing the most concern long-term is the local body laws and regulations. This has a risk score of 16 with an index value far exceeding other uncertainties.

Table 7. Typical assessment scorecards and risk scores for strategic uncertainty that create opportunities over the long term as rated by the respondent dairy farmers

Sources of uncertainty	N	Potential	Likelihood	Risk Score	Proportion of Respondents	Importance	
		Score	*Score*		*(%)**	*Index*	*Rank*
Global demand for dairy products	27	4	3	12	59.26	948.15	1
Skills and knowledge of those in or associated with the business	27	3	2	6	59.26	948.15	1
Product prices	27	4	3	12	51.85	829.63	3
Business relationships	27	3	2	6	44.44	711.11	4
Availability of labor (self, family, employees, contractors)	27	3	2	6	44.44	711.11	4
On-farm technology (incl. Breeding)	26	2	2	4	38.46	461.54	6
Interest rates	27	3	3	9	37.04	444.44	7
Credit availability	27	3	3	9	37.04	444.44	7
Pasture/crop/animal health	27	3	3	9	25.93	311.11	9
Purchased feed availability	27	2	2	4	22.22	266.67	10
Land prices	27	2	2	4	22.22	266.67	10
Family relationships	27	2	2	4	29.63	266.67	10
Unexpected weather conditions	27	4	3	12	18.52	222.22	13
Input costs	27	4	3	12	18.52	222.22	13
Cooperative policies and producer requirements	27	3	2	6	22.22	200.00	15
Government laws and policies	27	3	3	9	18.52	111.11	16
Local body laws and regulations	27	4	3	12	18.52	111.11	16

Score: Impact: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high
Likelihood: 1 = very unlikely; 2 = unlikely; 3 = about as likely as not; 4 = likely; 5 = very likely
* proportion of respondents with risk score of 15 and higher

Table 8. Typical assessment scorecards and risk scores for strategic uncertainty that create threats over the long term as rated by the respondent dairy farmers

Sources of uncertainty	N	Potential	Likelihood	Risk Score	Proportion of Respondents	Importance	
		Score	*Score*		*(%)**	*Index*	*Rank*
Local body laws and regulations	27	4	4	16	51.85	829.63	1
Input costs	27	4	3	12	55.56	666.67	2
Unexpected weather conditions	27	4	3	12	40.74	488.89	3
Government laws and policies	27	4	3	12	40.74	488.89	3
Product prices	27	3	3	9	33.33	333.33	5
Interest rates	26	3	3	9	29.63	266.67	6
Purchased feed availability	27	3	3	9	25.93	233.33	7
Global demand for dairy products	27	3	3	9	25.93	233.33	7
Credit availability	27	3	3	9	22.22	200	9
Cooperative policies and producer requirements	27	3	3	9	22.22	200	9
Pasture/crop/animal health	27	3	3	9	15.38	138.46	11
Land prices	27	3	3	9	14.81	133.33	12
Availability of labor (self, family, employees, contractors)	27	3	2	6	14.81	88.89	13
Skills and knowledge of those in or associated with the business	27	2	3	6	11.54	69.23	14
Family relationships	27	2	2	4	11.11	44.44	15
On-farm technology (incl. Breeding)	27	2	2	4	7.41	29.63	16
Business relationships	27	2	2	4	3.7	14.81	17

Score: Impact: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high

Likelihood: 1 = very unlikely; 2 = unlikely; 3 = about as likely as not; 4 = likely; 5 = very likely

* proportion of respondents with risk score of 15 and higher

The risk importance index is an improvement on the risk scores as it ranks the sources of uncertainty and therefore provides a clearer direction on where to focus for a group, or population of farmers.

Conclusion, Recommendations and Limitations

The uncertainties of the business world provide as much opportunity for success as threat of failure. As such, when assessing farmers' risk perceptions, it is useful to enquire about both the positive and the negative implications from each source of uncertainty. It is acknowledged that various aspects of the business (including production, finance, marketing, R&D/technology, human relationships and policy and regulations) contribute to the success of the business as well as being part of the uncertainty factors that contribute to the failure of the business.

The methodology developed was able to illustrate differences in these entrepreneurial farmers' perceptions of risk both with respect to time horizon and whether the risk created opportunities or threats to their business. The time horizon effect on farmers' perception of risk provides a useful distinction between management and mitigation measures at the strategic level and the within season, tactical, level in a dairy farm business.

Of particular interest is the assessment by the respondents that there are more opportunities created by uncertainty within a season than threats. In the longer-term, there was more of a balance between the threats and the opportunities but, as the RiskChoice matrix illustrated well, the sources of uncertainty created more opportunities than threats for this sample of farmers. Although while acknowledging that the respondents are identified as entrepreneurial farmers given their perceptions of risk this provides a useful lead for further research and certainly questions the efficacy of focusing only on the negative aspect of uncertainty. Of interest would be to use the tools that have been developed to explore differences between farmers' ability to see risk as not just a threat. It would be useful to survey a larger number of farmers and then segment them according to physical and financial performance as well as personal characteristics. If and why differences in the respective segments ability to see risk as an opportunity, and not just a threat, were identified it would help determine what it takes to have that ability.

This conclusion was further reinforced by the risk index that not only ranked the sources of uncertainty, but also identified, for these farmers, more sources of risk providing opportunities than threats, particularly within the season. The index is designed to be of use in guiding industry and policy makers in their understanding of how farmers perceive risk. The next step in this research would be to calculate the index from a larger sample of farmers to determine the balance of perceptions between positive and negative impacts. The results will be able to guide the application of funds to extension and development of risk management strategies for the industry. The extent to which the results of the wider sample are similar to the selected group would shift funds from a focus on risk mitigation to one of working with farmers to develop strategies that capture opportunities. It would also guide extension work to better identify those with the ability to identify opportunities and determine what knowledge, information and skills are required by those who see mostly threats.

The limitations of this study were, firstly the sample size and its biased nature. This was an exploratory exercise that was initially designed to identify suitable case study farmers. The next step in this research is to further refine the technique and extend it to the wider population. The biased nature of this sample, where the majority of farmers were entrepreneurial, may have resulted in a much greater focus on opportunities than would have been found if the sample had been from a broad cross-section of the dairy farming population. The second limitation of the study was the limited assessment of the farmers' attitude to risk. This requires more research, particularly in regards to the link between attitudes and how risk is perceived.

Dairy farmers in New Zealand will assess the sources of uncertainty facing them, identify both opportunities to exploit and hazards to minimize, and respond as they see fit. The success or failure of their individual responses will not be observed for some time. The literature suggests that those who are more aware of both immediate and wider, long-term issues will make the most robust responses.

References

Alimi, T., O.C. Ajewole, O.O. Olubode-Awosola, and E.O. Idowu. 2006. "Economic rationale of commercial organic fertilizer technology in vegetable production in Osun State of Nigeria" *Journal of Applied Horticulture* 8(2):159-164.

Alsos, G. A., A. Ljunggren, and L.V. Pettersen. 2003. Farm - based entrepreneurs: what triggers the start - up of new business activities. *Journal of Small Business and Enterprise Development, 10*(4).

Anderson J.R, J.L. Dillon, and B. Hardaker.1977. Agricultural Decision Analysis. Ames:Iowa State University Press.

Boehlje, M, A.W. Gray and J.D. Detre. 2005. "Strategy Development in a Turbulent Business Climate: Concepts and Methods," *International Food and Agribusiness Management Review*, 8(2):21-40.

Chavas, J.P. 2004. Risk Analysis in Theory and in Practice, Amsterdam: Elsevier.

DairyNZ. 2009. *DairyNZ Economic Survey 2007-2008.* DairyNZ Limited.
http://www.dairynz.co.nz/

Detre, J., B. Briggeman, M. Boehlje, and A.W. Gray. 2006. "Scorecarding and heat mapping: tools and concepts for assessing strategic uncertainty" *International Food and Agribusiness Management Review* 9(1):71-92.

Hardaker, J.B., R.B.M. Huirne, and J.R. Anderson. 1997. Coping with risk in agriculture. CAB International, Wallingford, U.K.

Hardaker, J.B., R.B.M. Huirne, J.R. Anderson, and G. Lien. 2004. Coping with risk in agriculture. Second edition. CAB International, Wallingford, U.K.

Harvard Business Review 2009. "Managing risk in the new world". D. Chapman (ed). *Harvard Business Review* (October):69-75

Jose, H.D. and R.S.K. Valluru. 1997. Insights from the Crop Insurance Reform Act of 1994." *Agribusiness*, 13(6):587-598

de Lauwere, C. C. 2005. The role of agricultural entrepreneurship in Dutch agriculture of today. *Agricultural Economics 33*:229-238.

Martin, S.K. 1994. Risk perceptions and management responses to risk in pastoral farming in New Zealand. *Proceedings of the New Zealand Society of Animal Production* 54:363-368.

McLean-Meyinsse, P., J. Hui and Meyinsse. 1994. "Consumer perceptions of, and attitudes towards rabbit meat." *Journal of Agribusiness*, 12(1):55.

Millang J., B. Viney and M. Muchka. 2009. Risk Choices Matrix; Government of Alberta, Department of Agriculture and Rural Development. http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/bmi12491

Newbury D.M.G. and J. E. Stiglitz. 1981. The Theory of Commodity Price Stabilization, Oxford: Clarendon Press.

OECD . 2008. An Assessment of Risk Exposure in Agriculture. A Literature Review. Organisation for Economic Co-operation and Development, Trade and Agriculture Directorate. Working Party on Agricultural policies and Markets. TAD/CA/APM/WP(2008)23/FINAL

Pascale, R.T., M. Millemann and L. Gioja. 2000. Surfing the edge of Chaos, Three Rivers Press, New York.

Payne T., D. Gray, J. Walcroft, and J. Dotterer. 2010. On-farm risk in the dairy industry: case study report. Report prepared for DairyNZ February 2010 by AgResearch and Massey University.

Pinochet-Chateau, R., N. M. Shadbolt, C. Holmes and N. Lopez-Villalobos. 2005. Differences in risk perceptions and risk management strategies used by New Zealand dairy farmers. Conference Proceedings from the International Food and Agribusiness Forum: https://www.ifama.org/events/conferences/2005/Symposium.aspx

Rabobank. 2010. Primary producers to prepare for the bumpy road to recovery. Press Release http://www.rabobank.com.au/News-and-Events/Media-Releases/2010-News-Archive/Pages/media-release-20100302.aspx

Robison L.J. and P.J Barry. 1987. The Competitive Firm's Response to Risk. Macmillan Publishing Co.

Shadbolt, N. M., I. Kataliem, and D.A. Conforte. 2009. Entrepreneurship in Agricultural Micro Enterprises in West Pokot District, Kenya. Conference Proceedings from the International Food and Agribusiness Forum: https://www.ifama.org/events/conferences/2009/Symposium.aspx

Sonka, S.T. and G. F. Patrick. 1984. Risk management and decision making in agricultural firms. In: Risk management in agriculture. P.J. Barry (ed). Iowa State University Press, Iowa, U.S.A. 95-115.

Talavera, P.G. 2004. "Evaluate risk and plan for unforeseen", Hydrocarbon processing, (February): 87-93.

Vesala, K. M., J. Peura, and G. McElwee. 2007. The split entrepreneurial identity of the farmer. *Journal of Small Business and Enterprise Development, 14*(1): 48-63.

Appendix 1.

Table 1. Summary Statistics from Respondents

Characteristics	Number	Frequency	Percentage Frequency
Farmers' characteristics			
Number of years you have been farming	26		
Between 11 and 20		9	34.62
21 – 30		14	53.85
Above 30		3	11.54
Age	26		
Between 36 and 40		7	26.92
41 – 50		12	46.15
51 – 60		6	23.08
Above 60		1	3.85
No of staff (full time equivalents)	25		
1 – 2		5	20.00
2 – 5		6	25.00
More than 5		7	28.00
No. of family members available to assist with farm duties	24		
None		6	25.00
1 – 2		11	45.83
More than 2		7	29.17
Business characteristics			
The farmer's situation	29		
Herd owning Sharemilker/Lessee		1	3.45
Herd owning Sharemilker/Lessee with more than one herd		1	3.45
Owner Operator		10	34.48
Equity Partnership Managing partner		4	13.79
Owner Operator with multiple operations - farms, equity partnerships,		10	34.48
Other		3	10.34
Stage of farm business	30		
Growth		17	56.67
Consolidation		12	40.00
Entry of next generation		1	3.33
Total Debt as a proportion of Total Assets, June 2008	25		
0 – 30 %		5	20.00
30 – 40%		3	12.00
40 – 50%		8	32.00
50 – 60 %		5	20.00
60 – 70&		3	12.00
More than 70%		1	4.00
Debt servicing as a proportion of Gross Income, June 2008	23		
0 – 20%		7	30.43
20 - 30%		11	47.83
More than 30%		5	21.75
Perceived ability to manage risk			
Perceived ability to manage almost all uncertainty within season	27		
Strongly agree		7	25.93
Agree		11	40.74
Neutral		3	11.11
Disagree		5	18.52
Strongly disagree		1	3.73

Perceived ability to manage almost all uncertainty over a long term	26		
Strongly agree		5	19.23
Agree		11	42.30
Neutral		5	19.23
Disagree		3	11.54
Strongly disagree		2	7.69
Perceived difficulty to make a choice where there a number of solutions to a problem	26		
Strongly agree		0	0.00
Agree		3	11.54
Neutral		1	3.85
Disagree		15	57.69
Strongly disagree		7	26.92
When it comes to business, I like to play it safe	26		
Strongly agree		0	0.00
Agree		5	19.23
Neutral		11	42.31
Disagree		8	30.77
Strongly disagree		2	7.69

Consumer Preferences for Imported Kona Coffee in South India
A Latent Class Analysis

Jyotsna Krishnakumar[⊕a] and Catherine Chan-Halbrendt[b]

[a]*Graduate Student, Department of Natural Resources and Environmental Management,
University of Hawaii at Manoa, 1910 East-West Road, Sherman 101, Honolulu, Hawaii, 96822, U.S.A.*

[b]*Professor, Department of Natural Resources and Environmental Management, University of Hawaii at Manoa,
1910 East-West Road, Sherman 101, Honolulu, Hawaii, 96822, U.S.A.*

Abstract

Considering India as a potential export market for 100% Kona coffee, this study explores consumer preferences for imported, specialty, high-end Kona coffee in South India. Conjoint choice experiment with latent class analysis is used and results indicate that India offers an export market potential for Kona coffee, provided it caters to consumer preferences. Results show a significant preference for strong taste. The relative importance of price is lower than taste but majority are also adverse to higher prices. However,15% of the sample population does not care about price but does care about taste, indicating the possibility of a high-end niche market segment. Based on the results, marketing strategies and policy recommendations have been suggested.

Keywords: India, US Coffee Export, Kona Coffee, Conjoint Choice Experiment, Latent Class Analysis

[⊕]Corresponding author: Tel: + 1 808. 542. 8264
                            Email: jyotsna@hawaii.edu

Other contact information: C. Chan-Halbrendt: chanhalb@hawaii.edu

Introduction

USA-India Bilateral Trade Relationship

Historically, the U.S. and India have had bilateral trade relations and it has been increasing tremendously in recent years. India's merchandise exports to the U.S. were at $ 6.50 billion for the period January -March 2010. This is a 25.6% increase from $5.18 billion during the same period in 2009. Similarly, the U.S. exports of merchandise to India increased 20.4% from $3.31 billion to $3.99 billion for the same period (January – March) in 2009 and 2010 respectively. (India-US Trade, Embassy of India, in Washington DC). This is also the case with U.S. –India bilateral agricultural trade which has expanded about 9 %annually since 1990, reaching $1.7 billion in 2007. U.S. agricultural exports to India grew 9.1 % per year during 1990-2007 with a total value of $475 million in 2007, while U.S. imports from India grew 8.6% annually with a total value of $1.2 billion in 2007 (USDA Economic Research Service). The main agricultural exports from U.S. to India include edible tree nuts (mainly almonds), raw cotton, fresh fruit (mainly apples), and pulses that has accelerated to 12% annually since 2000. A faster growth in "many categories of agricultural trade, including fruit and preparations, pulses, vegetables and preparations, and animals and animal products is also predicted."

However, the export of grains and edible oil from the U.S. to India have declined mainly due to competition from other global suppliers. President Clinton, in 2000, announced the easing of economic sanctions against India and the restarting of the $25 million Financial Institutions Reform and Expansion (FIRE) program to modernize Indian financial markets and also signed $4 billion worth of business agreements. Cooperation in the small-scale sector was also reached between US and India during a visit to Washington DC in 2000, by the Indian Minister of State for Small Scale Industries and Agro & Rural Industries, along with a delegation representing the small and medium industry sector of India. During the visit, future cooperation between US Small Business Administration (SBA) and the Ministry of Small Scale Industries were also discussed and agreements were reached (India-US Trade, Embassy of India, in Washington DC). Thus, with India's fast rising income per capita (Business Line Report, The Hindu 2009), investment friendly policies, relaxed import regulations, and strengthened trade agreements between U.S. and India, there is a greater potential for importing more U.S. goods to India for trade. This paper explores if Kona coffee offers an export potential from U.S. to India.

Coffee Consumption Trends in India

Coffee is one of the most traded commodities in the world and India is the world's sixth largest producer, accounting for over 4% of world coffee production (Coffee Consumption in India, 2008). As far as domestic demand for coffee is concerned, it is largely confined to the southern regions particularly the states of Karnataka and Tamil Nadu (Coffee Consumption in India on the Rise, 2005; Radhakrishnan and Reddy 2007). However, new trends are emerging with coffee being just a traditional South Indian drink to becoming a trendier beverage in India as a whole (Coffee Consumption in India, 2008). According to the chairman of the Coffee Board of India, Mr. G.V. Krishna Rao, coffee consumption in India is expected to increase 18% from 102,000 metric tons in 2010 to a projected 120,000 metric tons by 2012. In addition, industry sources say that the niche coffee market is growing at 10-12% a year, with branded coffee accounting for

53% of the sales (Bharadwaj 2006). Also, according to Mr. Siddartha, Chairman of Amalgamated Coffee Bean Trading Co. Ltd. (ABTCL), one of the largest growers and exporters of coffee, "there is a shift in consumer preference towards pure coffees on the back of growing affluence and income levels" adding that the country could transition from a net exporter to a net importer. In fact "good quality imported coffee will get recognition in the country with an increased demand" (Business Line Report, The Hindu, 2009). In other words, India offers niche market opportunities for high-end exclusive coffee, value added in terms of the flavor, the type of coffee (especially the highly priced *Coffea arabica* species), its place of origin, and the exclusivity in terms of high quality and limited production associated with it.

The U.S. Coffee Industry-Hawaiian Kona Coffee

Hawaiian Kona coffee is one of the main suppliers for *Coffea arabica* and they are grown on the slopes of North and South Kona district of Big Island, Hawaii. It has a reputation for being one of the most expensive and sought after coffee in the world. The coffee production in Kona for 2007-2008 was approximately three million pounds (Hawaii Department of Agriculture, 2009) with average exports of over 200,000 pounds per year at an estimated value of $6 million. (Instant Hawaii, http://www.instanthawaii.com/cgi-bin/hawaii?Plants.coffee). However, in the past decade, the reputation of Kona coffee has suffered due to issues with blending. Much of the coffee sold in commercial markets by large companies contains only 10% Kona beans but carry the "Kona coffee" label. According to the Hawaii State Legislature, "existing labeling requirements for Kona coffee causes consumer fraud and confusion and degrades the 'Kona coffee' name" (Senate Concurrent Resolution No. 102, 2007). Initiatives have been undertaken by the Kona Coffee Farmers Association to seek greater legal protection of the Kona coffee name. In fact, they prefer to market 100% pure Kona coffee for its high quality and the high value it can demand (Feldman 2010). However, this also implies the need to explore new markets for 100% Kona coffee. Currently, 93% of the export market for Kona coffee is in Japan for all coffee types–green, roasted beans of regular and decaffeinated coffees. The remaining portion of exports is to other parts of Asia, especially South Korea and Taiwan, and also to Europe. With the expected higher per capita income in other parts of Asia such as India, a greater export market potential for 100% Kona coffee to these regions is perceived (Felming and Nakamoto, 2003). Unfortunately, lack of awareness and knowledge of new and expanding markets, or the inability to find them pose challenges to the Kona farmers. Studies indicate key factors that can positively affect the demand for Hawaiian grown Kona coffee and they are: 1. Consumers are willing to pay high price for a product known for its high quality and brand image; 2. Changes in the economic conditions of the regions where it is marketed (Southichack 2004).

The current coffee exports from U.S. to India are only 23 metric tons (46,552lbs) for 2007-08 and these exports are mainly classified as "roasted non-decaf, extract essence and concentrates and other coffee" (Coffee Consumption in India, 2008). Based on earlier discussions it is obvious that there is a benefit for Kona coffee growers to explore new export markets for their high quality 100% Kona coffee. As mentioned earlier, with the changing economic scenario in India and a predicted increase in demand for imported coffee, India can be a potential export market for 100% Kona coffee positioned as a high-end specialty product and sold at profitable returns that the Kona coffee producers can target.

Studies indicate that one reason why Kona coffee has been able to capture the Japanese market is due to innovative marketing strategies, mainly through niche marketing. Hawaiian exporters successfully established close ties with the Japanese consumers as they understood the culture, their preferences and tastes. This is because a better understanding of the consumers' preferences and needs would provide the growers a competitive edge over others (Fleming and Nakamoto 2003). Considering this, market study for exploring consumer preferences for Kona coffee in India, particularly South India and its niche market potential as a high-end specialty coffee needs to be undertaken.

Objectives of the Study

The main objective of the study is to explore consumer preferences for imported, specialty, high-end Kona coffee in South India. Two specific objectives to meet the overall objective are: 1) Explore South Indian coffee consumers' buying habits and knowledge of imported specialty coffee; 2) Find out South Indian consumers' preferences for Hawaiian specialty Kona coffee and explore potential for niche markets.

Review of Literature

The main focus of this study is exploring consumer preferences for Kona coffee in South India. Consumer purchasing decisions of a product are usually based on the importance of product attributes along with the socio-demographics of the consumers. This applies to the case of coffee as well. Various coffee studies have been conducted with a focus on consumer behavior, coffee preferences and consumption characteristics. They include exploring consumption preferences among young consumers for instant coffee; the influence of branding and advertisements on coffee choices; the influence of price, volume, packaging, place of origin, and product image on coffee choices (Tseng 1991; Lu and Hung 2000; Su and You 1999).

A study in Singapore hypothesized that, for international consumers, country of origin could be important for making purchasing decisions. The study examined the influence of country of origin of a product relative to other product attributes on preferences for food staples such as bread and coffee. Results revealed, in addition to country of origin, price and brand are important attributes (Ahmed et al. 2004; Chung and Jay 1997). A study on instant coffee preferences among consumers in Taiwan using conjoint analysis concluded that market potential for coffee products improve when important coffee attributes preferred by consumers are considered. The study explored the preferences for instant coffee by regional consumers of Taiwan and found that the price was most important followed by brand, packaging material and taste (Shih et al. 2008). Another study conducted in Belgium on coffee preferences for fair-trade coffee, also using conjoint analysis, explored how consumers trade-off between different coffee attributes and making ethical choices. The key questions raised focused on investigating the relative importance attached to the coffee being fair-trade coffee compared to other coffee attributes such as blend, brand, flavor, and packaging, and determining what was the willingness to pay for fair-trade coffee. The study also determined the socio-demographic differences influencing purchasing preferences. The results indicated brand attribute to be of highest relative importance followed by the fair-trade label and flavor. Packaging and blending were of the least importance. (Pelsmacker et al. 2005). The results of another study on the consumer preferences for fair-trade

coffee in Toronto, Canada, using conjoint choice analysis, show that, regardless of location, consumers place a strong preference for price and labeling claims (Cranfield et al. 2010). Studies exploring socio-demographic influence on coffee preferences in Europe showed consistent variations in terms of nationality, gender and age, with gender and age showing significant effects on coffee preferences and coffee brands (Cristovam et al. 2000; Heidema and Jong 1998). Last but not the least, studies also show that the reputation of the quality of a country's product varies based on the type of product. In other words, if a country is perceived to have a good reputation for a specific product, consumers are more willing to buy the product from that country (Ahmed et al. 2004; Roth and Romea 1992). This is highly applicable in the case of commodities such as coffee. For example, Colombian coffee (Ahmed et al 2004) or Kona coffee has a reputation attached to it mainly due to the perception of high quality associated with coffee from these regions.

The afore-mentioned studies clearly indicate that consumer purchase preferences of coffee is a function of the product attributes rather than a function of the product alone. The key product attributes in the case of coffee were identified as price, place of origin, taste and flavor/blend/ grind preferences. Therefore drawing from the conclusions of these preference studies on consumer goods, this study attempts to explore South Indian coffee consumers preferences for Hawaiian specialty Kona coffee using conjoint choice experiment.

Why Choose the Conjoint Choice Experiment (CCE) with Latent Class Analysis?

Since the early 1970's, conjoint analysis has received considerable academic and industry attention as a powerful technique to measure and understand buyer preferences for consumer products (Green and Rao 1971; Johnson 1974; Srinivasan and Shocker 1973b;Wittink and Cattin 1989). Usually a marketable product has multiple attributes and when consumers are asked their preferences, it can be difficult to state their trade-offs and relative importance for each of the product attribute. Also, it is said that product attributes in isolation are perceived differently than in combination which is how normally products are available in the market.

Although there are different methods that can help determine which attributes will have the biggest impact in customer satisfaction or how customer satisfaction will be affected by changing a product attribute, there are limitations to these approaches. The advantage of using conjoint analysis method over other methods is that the former is a decompositional model, where products are decomposed into different attributes with different levels and consumer preferences for the products measured by the partial contribution ("partworth") of product features (Hauser and Rao 2004). Later, in the 1980s, conjoint analysis was improved to choice based experiments known as conjoint choice experiment (CCE) (Louviere and Woodworth, 1983).

The main advantage of using CCE over conventional conjoint analysis as pointed out by Louviere 1988; Elrod et al. 1992; DeSarbo, Ramaswamy and Cohen 1995; Cohen 1997; Chran and Orme 2000; and, Haaijer 1999) is that in the conventional approach, a set of profiles is presented to the respondent, while in the choice approach several sets of profiles with each divided into several choice sets is presented and respondent have to choose their most preferred

alternative from each choice set. This is far less tedious compared to conventional conjoint approaches.

The profiles are designed in such a way that it mimics the changes in the environment based on which trade off can be measured through the respondents weight in choosing one attribute over another. The CCE and analysis comprises of six design stages (Cattin and Wittink 1982; Green and Wind 1975; Louviere and Woodworth 1983; Hanley , Mourato and Wright 2001; Halbrendt et al. 1991; Chan-Halbrendt et al. 2007) and involves surveys for hypothetical or real products with different attributes or characteristics. The potential impact from changing these attributes is that it might impact purchasing decisions. Once the attributes have been identified, the outputs of CCE indicate which attributes are significant determinants of the values people place when purchasing a product the relative importance of key attributes of the product and market simulation.. This is the other advantage of using CCE.
While CCE is useful in capturing the consumers' preferences for the observable attributes of the products and its relative importance, it is also important to understand that these preferences are influenced by the unobservable factors as well which are basically the heterogeneity of individual behavior defined by their socio-demographic background.

Conjoint choice method using latent class analysis (LCA) provides additional information on the traditional aggregated or one class model. The standard aggregate model can be affected due to violations of the independence of irrelevant alternatives (IIA) problem, which distorts the predictions of market niches. With latent classes, the different segments that have different utility preferences are accounted for, (and IIA holds true within each segment), which is a way of resolving this problem and improving niche market predictions (Vermunt and Magidson 2005). Thus, CCE with LCA is more powerful as it evaluates respondent choice behavior by capturing both observable attributes of choice and unobservable factors found in the heterogeneity of individual's behavior (Greene and Hensher 2003; Milon and Scrogin 2006). In other words, respondents are placed into distinct classes (groups) based on their choices when answering the conjoint choice experiment questions. In LCA studies, the probability of making a specific choice is based on the perceived value of product attributes and covariates of respondents (such as respondent's age and income) (McFadden 1973). This method therefore helps in identifying specific niche market segments based on the "distinct classes" the respondents fall into and design appropriate marketing strategies based on the preferences of the "distinct classes". Considering these advantages, Conjoint Choice Experiment (CCE) with Latent Class Analysis (LCA) was used for evaluating Indian consumer preferences for Kona coffee. The most important coffee attributes were chosen based on previous studies and in consultation with Kona coffee experts in order to make more accurate niche market predictions for Kona coffee in South India.

Method

In this study, we used Conjoint Choice Experiment (CCE) to find South Indian consumer's preferences for specialty imported Kona coffee. The following paragraphs describe how the CCE was designed and the data analyzed. This study was conducted through a survey of Bangalore residents (the city of Bangalore has approximate population of five million) using a conjoint choice experiment method. A conjoint choice experiment approach directly asks for respondents' preferences based on a set of structured survey questions. The approach measures the value of

the most important coffee attributes by asking about different market scenarios based on the product characteristics or attributes. In conjoint choice experiment models respondents typically are asked to evaluate two profiles from each choice set. Respondents are then required to pick the profile that they would most prefer from that set.

There are six stages of a CCE design and analysis (Cattin and Wittink 1982; Green and Wind 1975; Louviere and Woodworth 1983; Hanley et al. 2001; Halbrendt et al. 1991; Chan-Halbrendt et al. 2007).

First and Second Design Stage

Finding Product Attributes and their Levels

The first and second stage of CCE design comprised of finding the product attributes and their levels respectively. This is done through an extensive literature survey and consultation with experts. The levels should be realistic, practically achievable, and span the range over which we expect respondents to have preferences. In order to come up with the important attributes and the corresponding levels which consumers will consider when purchasing specialty coffee, experts in the field were consulted along with literature review. Based on expert opinions as well as previous studies by Tseng (1991), Su and You (1999), Lu and Hung (2000), Pelsmacker et al.(2005) and Shih et al. (2008). Four important attributes were selected for this study - Price, Grind Preferences, Taste and Place of Origin. Each of these attributes had varying levels (see Table 1). Price had three levels— U.S. $ 60, $75, $90 per gift box of 500 gms. This is based on the estimated cost of imported specialty coffees) which falls in the range of $60 (2900 INR) to $90 (4400 INR) for 500 gms. Grind Preferences had three levels— Fine Grind, Ground Regular, and Whole Bean. Taste had three levels- Light, Medium, and Strong and; Place of Origin had four levels- Kona Coffee, South American Coffee, South-East Asian Coffee and African Coffee (See Table 1).

Table 1. Coffee Attributes and Their Levels

Attributes	Levels			
Price	$ 60/ 500gms	$75/ 500gms	$90/500gms	
Grind Preference	Whole Bean	Ground Regular	Fine Ground	
Taste	Light	Medium	Strong	
Place of Origin	Kona, U.S.A.	S.E. Asian	South America	African

Third and Fourth Design Stage

Choice of Experimental Design and Construction of Choice Sets

The third and fourth stages of designing the CCE involve choice of experimental design and construction of interview questions (or construction of choice sets or product profiles) to be presented to survey respondents. Statistical design theory is used to combine the levels of the attributes into a number of alternative product profiles to be presented to respondents. Depending on how many choice sets and/or profiles are included in the experiment, one can have either a complete or fractional factorial design. Product profiles are constructed by selecting one level from each attribute and combining across all attributes. In this study, there are four attributes, of which Place of Origin has four levels and the rest have three levels each, bringing the total

number of profiles to 108 (i.e. 4*3*3*3). Based on a complete factorial design, all 108 profiles would have to be presented to the respondents, which could be tedious and difficult. Therefore, a fractional factorial design was utilized where a sample of the design is selected from the full factorial design. Using this approach minimizes loss of information and also efficiently tests the main effects of the attributes on respondent's preference (Chan-Halbrendt et al. 2007). The most commonly used method of constructing fractional factorial design in conjoint measurement is the orthogonal array. Orthogonal arrays build on Graeco-Latin squares by developing highly fractionated designs in which the scenario profiles are selected so that the independent contributions of all main effects are balanced, assuming negligible interactions (Green and Wind 1975). From all possible profiles, pairs of profiles were randomly developed and separated into seven versions with 12 pairs each using software developed by Sawtooth Software, Inc. Having only 12 pairs per respondent to evaluate from ensures that the duration of the surveying exercise does not adversely impact a respondent's responses.

For data collection, all seven versions were administered in approximately equal proportion (i.e. each set to about 30 of the 200 respondents). Respondents were then presented with one set of 12 pairs of profiles from which to make their choices. The experiment requires respondents to choose one product profile from each pair. Table 2 shows an example of a pair of product profile scenarios from which the respondents chose.

Table 2. Example of a pair of product profile scenarios

If these were your product options, which would you choose?		
Attribute	**Profile A**	**Profile B**
Price	$60 / 500gms	$90 /500gms
Grind Preference	Whole Bean	Ground Regular
Taste	Light	Strong
Place of Origin	Kona, U.S.A.	South America

Fifth Design Stage

Data Collection- Survey Location, Sample Size and Survey Technique

A face-to-face survey was conducted to ascertain consumer awareness and preferences for imported specialty Kona coffee. Bangalore, Karnataka was chosen as the representative study site for South India based on meetings with the local coffee experts and professionals working at the U.S. Foreign Agricultural Service, Office of Agriculture Attaché, New Dehli, India. Also, the Coffee Board of India's head office is located in Bangalore. Bangalore also has the largest number of coffee outlets and is one of the highest coffee consuming urban cities in South India. 200 surveys were collected, mainly focusing on high-income professionals in Bangalore as they match the profile of the consumers who are representative of the changing coffee trends based on expert opinions and previous studies (Business Line Report, The Hindu, 2009; Bharadwaj 2006; Coffee Consumption Study in India, 2008). The sample size was based on the Sawtooth Software recommendation for such a study (i.e. Conjoint Choice Experiment) where a sample size ranging from 150 to 1,200 respondents is recommended (Orme 2006).The following formula was also used to validate the sample size for the latent class analysis (Johnson and Orme 2003).

(1) $nta / c \geq 500$

Where n is the number of respondents, t is number of tasks per respondent, a is the profiles per task, and c is the maximum number of attribute levels.

Since the product is imported high-end specialty coffee, we were targeting high-income professionals and data was collected from the following locations: outlets of India's biggest coffee retail chain- Café Coffee Day; a multinational company; two international banks; and a five-star hotel. The surveying was accomplished over 7 days in the last week of May, 2009. The response rate was 86%.

The survey questionnaire consisted of two sections. Section one was comprised of 12 pairs of specialty coffee profiles from which respondents choose. Section two consisted of questions regarding the socio-demographic and economic background of the respondents such as age, income, education and other characteristics. Section one data provided the attribute-specific preferences. The data was analyzed using latent class analysis software Latent Gold Choice, Version 4.0 developed by Statistical Innovations Inc. To establish a minimal level of knowledge on the issue prior to completing the survey, a brief description of the study was explained to respondents regardless of their knowledge of the topic. Then, each respondent was shown 12 pairs of product profiles with differing levels of attributes and asked to select one from each pair. Section two provided the socio-demographic profile of the respondents which was used to confirm if the respondent profiles were consistent with the target population of key coffee drinkers in Bangalore as identified by the Coffee Board of India survey.

Sixth Design Stage

Data Analysis: Conjoint Choice Model Using Latent Class Analysis (LCA) Approach

This is the final stage of a CCE. As discussed in the literature review, conjoint choice method using latent class analysis is an improvement on the traditional aggregated or one class model. In latent class analysis, the different segments that have different utility preferences are accounted for, (and IIA holds true within each segment), and by this better market predictions can be made.

The model used in this study is a conditional logit model where, the probability (P_{ni}) that individual n chooses profile i can be represented by the following equation (2) (McFadden 1973).

$$(2) \qquad P_{ni} = \frac{\exp(\eta X_{ni})}{\sum_{h=1}^{I} \exp(\eta X_{nh})}$$

Where η denotes a scale parameter, usually normalized as 1.0. X_{ni} is the deterministic component that is assumed to be a linear function of explanatory variables. Equation (2) can be represented as equation (3) for LCA:

$$(3) \qquad P_{ni} = \frac{\exp(\eta \beta Z_{ni})}{\sum_{h=1}^{I} \exp(\eta \beta Z_{nh})}$$

Where Z_{ni} are explanatory variables of X_{ni}, including a profile-specific constant, product attribute of profile i, and socio-demographic factors of respondent n. β is a vector of estimated parameter coefficients.

In a latent class analysis, respondents are sorted into M classes (groups) in terms of individuals' choice of observable product attributes, and the unobservable heterogeneity among the respondents. The value of estimated parameter coefficient β is different from class to class because this parameter coefficient is expected to capture the unobservable heterogeneity among individuals (Greene and Hensher 2003). Then, the choice probability of individual n belong to class m (m = 1, …, M) can be expressed as equation (4):

$$(4) \qquad P_{ni \mid m} = \frac{\exp\left(\eta_m \beta_m Z_{ni}\right)}{\displaystyle\sum_{h=1}^{I} \exp\left(\eta_m \beta_m Z_{nk}\right)}$$

Where η_m is the class-specific scale parameter and β_m is the class-specific estimated utility parameter.

The first step of the latent class analysis was to determine the optimal number of distinct classes for the dataset. Using the Bayesian Information Criterion (lowest BIC value for best results), which was first proposed by Schwartz (1978), a three-class model for this study was decided as it was the class with the lowest BIC value.

Therefore, in summary, the probability for individual *n* in class *m* choosing control program *i*, P(*i*), is measured by two types of characteristics: (1) product attributes, including grind preference (G), Taste (Tt), Place of Origin (O), and price (C); and (2) individual socio-demographic factors, including gender (GE), age (A), education (E), income (I), and household size (H). The preference model is specified in equation (5).

(5)   P (*i*) = f (G, Tt, O, C, GE, A, E, I, H)
       P (*i*) = Probability of choosing product profile A vs. B;
       C = Price of imported coffee- U.S. $60, $75 and $ 90/500 gms;
       G= Grind Preference -Whole Bean, Ground regular and Fine ground;
       Tt = Taste - Light, Medium and Strong;
       O= Place of Origin of Imported Coffee- Kona/Hawaii, South East Asia, South
           America and Africa;
       A= Age18 and above;
       GE= Gender- Male or Female;
       I= Household income group (U.S. $/month)- < $1001; $1001-1500; $1501-2000;
           $ 2001-2500; > $ 2500;
       E= Educational Background- High School, Higher Secondary (11th and 12th grade),
           Undergraduate, Post-Graduate, Others;
       H= Household Size- Number of people in the household;

Results

Sample Population Profile and Product Awareness

The socio-demographic profile of the respondents indicated the average age of the respondents was 31 years with the majority (67%) holding a postgraduate degree. 43% of the respondents belonged to the higher monthly income category of INR 110,000 (U.S. $ 2500) and above. The gender distribution among the respondents was fairly equal with 55% males and 45% female. According to Bidisha Nagaraj, president of marketing at Cafe Coffee Day, India's largest retail cafe chain, "modern coffee shops are positioned as a social hub and aimed at consumers who are young and young at heart". And so, coffee chains are aggressively targeting young, urbanized Indians between the age groups of 15-35 who are brand conscious and can afford to splurge on high-priced lattes and espressos (AFP Asian Edition, June 2009). Clearly the respondent profiles are consistent with the profile of the major coffee consumers in the city as indicated by reports (Coffee Consumption in India, 2008).

According to the survey, not surprisingly, the majority of consumers are aware of Indian origin coffee (91%) followed by 47% are aware of South American Coffee, 42% aware of South East Asian Coffee, 37% are aware of African coffee and only 20% are aware of Hawaiian Kona Coffee. The comparative lack of knowledge of Hawaiian Kona Coffee is expected considering the almost non-existent export marketing campaigns by Kona Coffee growers in these regions. South American and South East Asian brands are available at leading Coffee outlets such as Café Day, particularly through their new café concept of high-end Café Day Squares thus explaining awareness regarding these brands. In terms of purchasing coffee from the main coffee producing regions, the majority have purchased coffee from India, which is again expected. As far as imported specialty coffee is concerned the majority have purchased South American (39%) coffee, closely followed by South East Asian Coffee (34%) with only 2% of respondents having purchased Kona Coffee.

Kona coffee is a high end consumer product. It is also currently being exported and marketed to countries such as Japan, as a high-end niche market product and high-end gifts. Also, as mentioned earlier, increase in the availability of disposable income is an indication of improved economic conditions of a region which in turn influences the demand for high-end products. Considering this, it was important to explore the respondents' spending behavior such as- their awareness on the price of specialty imported coffee, their willingness to pay for high-end Kona coffee and the average spending on gifts the previous year. Results indicated that the average amount spent on gift was approximately $345 annually. This is an indication of the average disposable income that the respondents have available to spend on gifts. On the other hand, their willingness to pay for a box of imported specialty coffee was only about $19 much less than the actual cost of importing. This can be attributed to the lack of awareness of imported specialty Kona coffee among the target population sample. On average it was estimated that the total cost of imported Hawaiian Kona Coffee, including import taxes is somewhere in the range of $60 to $90 for 500 gms. This is much more than their indicated willingness to pay but within their average gift expenditure. This is key information from a niche marketing perspective. Being a culturally diverse place and the number of festivals celebrated annually, there is ample opportunity for purchasing high end gifts. However, to explore the potential for niche market for high-end Kona coffee, a detailed understanding of the respondent's preferences of imported

specialty Kona coffee, their willingness to pay as well as their product attribute preferences and knowledge is needed. Conjoint Choice Experiments (CCE) with Latent Class Analysis (LCA) was used to gather these information and the results are discussed in the following section.

Latent Class Analysis: Results

Table 3 shows the results of the latent class analysis with the estimated parameters, the nature of the relationship between the dependent and independent variables and their significance levels for each class. The model is specified as probability of choosing a particular product profile as a function of coffee attributes with different attribute levels. Three class models was the best fit for the data set based on the BIC criterion (lowest BIC value).

Table 3. Results of the Latent Class Analysis with the Estimated Parameters by z-values

	Class1	z-value	Class2	z-value	Class3	z-value
Class Size	**60%**		**25%**		**15%**	
Attributes						
Price/500gms	-0.66**	-4.37	-0.68*	-2.07	-0.09	-0.12
Grind Preference						
Fine Ground	0.11*	1.95	0.10	0.95	0.24	0.77
Ground Regular	-0.07	-1.34	0.28*	2.58	-0.02	-0.08
Whole Bean	-0.03	-0.58	-0.39**	-3.19	-0.21	-0.67
Taste						
Light	-0.34**	-4.76	0.68**	4.97	-3.18**	-5.35
Medium	0.04	0.69	0.45**	4.45	0.36	1.32
Strong	0.30**	3.82	-1.13**	-6.41	2.82**	5.59
Origin						
Africa	-0.31**	-4.35	-0.15	-1.04	0.31	0.67
Kona	0.19*	2.83	0.14	1.05	0.02	0.05
South America	-0.03	-0.44	0.04	0.32	-0.00	-0.01
South East Asia	0.14*	2.07	-0.03	-0.23	-0.33	-0.83
Intercept	Class1	z-value	Class2	z-value	Class3	z-value
* p<.1 and ** p<.05	0.74	5.21	-0.12	-0.66	-0.62	-3.65

Class 1 respondents prefer to buy coffee from Kona and South East Asia that are strong tasting and fine ground and not African. The price parameter is negative such that their demand decreases as price increases. These signs are expected and significant at the <0.05 level. Class 2 respondents prefer coffee that is ground regular, not whole bean and more light than medium in taste, but not strong. Their demand decreases as price increases. Place of origin is not important. Again, the signs are expected and they are all significant at the <0.05 level. Of particular interest, price has the expected significant negative correlation in this class. For Class 3, only taste is statistically significant with a preference for strong coffee and respondents do not like light coffee at all. These parameters are all significant at the <0.05 level. The majority of the respondents, 60%, belong to Class 1, followed by Class 2 (25%) and Class 3 (15%) (See Table 3).

An important aspect that also needs to be considered is the relative importance and magnitude of each attribute by class places on the key attributes. This is important from a marketing

perspective as the product can be made available to the consumers incorporating and highlighting the most preferred attribute, thereby leading to customer satisfaction. The results indicate (Table 4) that Class 1, to which the majority of the respondents belong, consider taste as the most important factor, followed by place of origin, then price and finally grind. Class 2 also considers taste as the most important factor, followed by grind, then price and finally place of origin. Class 3 considers taste as the most important factor, followed by place of origin, grind preference and price is least important to them**.**

Table 4. Relative Importance of Attributes by Three Classes of Respondents

Relative Importance	Class 1	Class 2	Class 3
Price/500gms	25%	14%	1%
Grind Preference	9%	20%	6%
Taste	37%	56%	84%
Origin	29%	10%	9%

As mentioned earlier a latent class approach is a more appropriate estimation tool when dealing with people of generally heterogeneous backgrounds such as different income levels, gender and other socio-demographic variables. The Latent Class approach helps not only in identifying niche groups with their specific product preferences within the sample population but also identify the type of population on the basis of their socio-economic characteristics. In the case of this study, the respondents were fairly homogenous in terms of socio-demographic variables such as age, education, income and employment as these groups were specifically targeted for the study. As a result, none of the socio-demographic variables showed significance in the latent class analysis and, therefore, differences among consumers based on socio-demographics, for each of three classes, could not be found.

Conclusions and Marketing Implications

The main goal of this study is to enhance the economic viability of small Kona coffee growers' income through exporting to emerging markets such as India. The overall objective of the study was to explore consumer preferences for imported, specialty, high-end Kona coffee in South India. Based on previous studies and local Kona coffee experts, four key product attributes with different levels were chosen to explore consumer preferences for Kona coffee among South Indian respondents. These attributes include—Price, Taste, Grind Preference and Place of Origin. Majority of the respondents (60%) belong to Class 1 and they show a preference for Kona Coffee along with coffee from South East Asia. A significant importance is placed on taste with a preference for strong coffee. In other words there is a preference for dark roasted coffee (for strong taste) as indicated by respondents in both class I and class III. There is also a segment of respondents (class II) who has preference for light than medium roasted coffee. The bottom line is taste is an important factor and marketing strategies that target consumers with different tastes is suggested. Results also indicate specific ground preferences for coffee, mainly fine ground and regular ground but not whole beans. Therefore, it is imperative to launch the product, highlighting these preferences.

The relative importance of price is not as high as taste but the result indicates it as a negatively significant attribute which means that the willingness to buy decreases with increasing price. This information is valuable from a marketing perspective and it can be inferred that India offers an export market potential for Kona coffee, provided it is offered at competitive prices. Besides Kona coffee, there is also a preference for coffee from South East Asia among majority of respondents. Currently the biggest coffee imports to India are from South East Asia, primarily Indonesia with approximately 15,000 million tons imported in 2007-2008. This coffee is readily available with greater market visibility and at cheaper prices. The cost is almost three times less than coffee from USA (Coffee Consumption in India, 2008). Also, recent reports state that competition, notably from Vietnam is likely to rise in the wake of the recently signed Free Trade Agreement (FTA) between India and the Association of South East Asian Nations (ASEAN) (August13[th] 2008, Indian Express News Report). This means that in order to increase demand for Kona coffee in India, it must be competitive compared to South-East Asian coffee in terms of taste and price.

As discussed in a study on Instant coffee in Taiwan, the price needs to remain flexible until the consumers' perception regarding the product matches with the suggested price (Shih et al. 2008), which may be possible only through rigorous marketing campaigns. There is also the danger of a very high price obscuring the true quality of the product and its purchasability (Wall et al. 1991) and therefore appropriate pricing is something that needs to be strongly considered. Under the circumstances, one possibility is to use high quality Kona coffee blends (more than the current 10% Kona coffee blends available in the U.S. markets) with the preferred taste and grind preferences, offered at competitive prices. However, the acceptability of this arrangement by Kona farmers needs to be explored. According to the Hawaii State Legislature, "existing labeling requirements for Kona coffee causes consumer fraud and confusion and degrades the 'Kona coffee' name" (Senate Concurrent Resolution No. 102, 2007). In fact, a recent study on the economic impact of blending shows that while the Kona farmers received an estimated $1.4 million from the sale of "prime grade" Kona coffee to the blenders, the blenders made a profit of $14.4 million through the sale of coffee containing only 10% Kona Coffee. This is because the buyers are "deceived" by the "Kona Coffee" label. This also in turn impacts the consumers' willingness to pay a premium price for 100% Kona coffee which lowers as it is not well differentiated from the non-specialty coffee (Feldman, 2010; Aaker and Killer 1990). In fact, the Hawaii coffee growers association is demanding the State to protect the economic interest of its coffee farmers by protecting the "Kona Coffee" brand (Feldman, 2010).

Also, it is important that exporters be aware of import regulations and shipping options in India. Currently there is a 100% import tax on coffee, which will create additional costs to selling the product in India, further driving up its price. Under the circumstances, competing with South Asian coffees in terms of price can be challenging. Therefore, unless alternative marketing approaches are considered, pure Kona coffee will remain a high-end specialty product and not price competitive with lower quality South East Asian coffee.

An alternative approach for marketing 100% Kona coffee could be through creating niche markets for Kona Coffee as exclusive high-end gifts. This study's survey indicated that on an average the respondents spent U.S. $354 on gifts in 2008. This basically gives an indication of the average disposable income that the respondents are willing to spend on gifts. The study results also indicated that there is a section of the population (about 15%) who are indifferent

about prices. Their choice is purely driven by taste, preferably strong taste. This offers an opportunity to tap into this niche market segment for 100% pure Kona coffee. With the rate at which the coffee industry is expanding in India and the change in the coffee consumption trends along with a rich and expanding middle class, this region cannot be disregarded as a potential market for Kona. Marketing of Kona Coffee as exclusive high-end gifts might offer some opportunities for Kona Coffee to enter into the Indian markets. Culturally, with the number of festivals celebrated in India, gift giving is an important aspect of any festival or other family events such as marriages and anniversaries. The advantage of selling it as gifts is the exemption from import taxes, which can bring down the cost as well. In this context, it is also important to note that cultural preferences must be considered for packaging in terms of color and pattern. For instance, culturally, certain colors are considered auspicious for occasions such as festivals and family functions. But colors such as black or white are not and these cultural nuances must be taken into account for gifting option.

Recent reports also indicate large expansions by some of the biggest café chains in India such as Cafe Coffee Day. Café Coffee Day with its recent concept of Café Coffee Day Square is offering many international brands on its menu, although at present Kona coffee is not one among them. Besides Café Coffee Day, there are also increasing expansions by other competitors. According to Mr. Vishal Kapoor, head of marketing and product development at Barista, a Netherlands based company with a large number of café chains in India, "the sector shows no signs of saturation or slowing demand" (AFP Asian Edition, 2009). Also, five star hotels such as the Taj group of hotels is already featuring high priced Kona coffee in their menu. But, according to Mr. Vinod Pandey, the Food and Beverage Manager of Taj West End in Bangalore, awareness on Kona coffee is very minimal and hence not frequently in demand in their cafes or restaurants. According to Mr. Pandey, the product should be made more visible with more emphasis placed on its uniqueness, limited production and high quality.

Under the above mentioned circumstances, it becomes imperative that measures be taken to assist local Kona farmers in creating business linkages with the Indian market. More visibility for Kona coffee is also essential to improve awareness among coffee consumers. Steps must be taken to launch the product in the Indian market through possible collaborations with café chains like Café Day. The majority of the population that frequents these cafes is high-income, highly educated professionals with an average age of 31 years. Marketing campaigns must cater to this population for both blended and 100% pure Kona coffee. Partnering with high-end restaurants and five-star hotels such as the Taj Hotel is also recommended. Keeping in mind the limited production and exclusivity of Kona coffee, efforts need to be made to launch and market it as a specialty, high-end product. Results clearly indicate that taste is a very important attribute and opportunities need to be created for South Indian consumers to experience the taste of Kona coffee.

Furthermore, policy level and other support must be provided to local Kona coffee growers in order to expand their export market and bring in the much-needed revenue to both the farmers and the State of Hawai'i. To begin with, support should be extended to the local coffee farmers to protect the Hawaiian grown identity as well as the "100% Kona Coffee" trade mark. The well functioning Kona Coffee Cooperative in Hawaii, in collaboration with the Department of Agriculture and with the support of the University of Hawaii's extension services have a key role

in assisting farmers to establish business linkages with potential markets in Bangalore and South India. Representation of Kona coffee growers at the Indian International Coffee Festival, 2009 can be considered an important initial step towards establishing these linkages. Educating farmers on maintaining the high quality of Kona coffee by making appropriate farming, harvesting and packaging decisions, disseminating useful information on potential export markets such as India and the associated rules and regulations is important. And last but not the least providing assistance to launch the product in emerging markets such as India and expanding awareness on the product among potential consumers and buyers are some of the strategic steps to be undertaken. Increasing the visibility of the product, the value of its trademark and significance of the place of origin are all key aspects that need to be seriously considered.

The reputation of the quality of a country's product varies based on the product type and consumers are more willing to buy the product from the country perceived to have a good reputation for a specific product. Therefore the key is to initiate efforts to increase the visibility of specialty 100% pure Kona coffee and educate consumers on the significance of its quality, exclusivity, aroma and taste, thereby strengthening the "fit between the product category and country image" (Ahmed et al. 2004; Roth and Romea 1992). Increased familiarity, along with promoting the reputation, prestige and favorable image Kona coffee represents in the international market, will increase the chances of a successful market entry and also increase the willingness to pay. Overall, an emphasis should be placed on strengthening the brand image of the product in South India. Clearly there is niche market potential for Kona coffee in South India, and rigorous marketing campaigns along with establishing strategic alliances with the host country businesses are the key to potential import success for Kona Coffee as a high-end specialty product.

Acknowledgements

References

Aaker, D.P.A. and K.L. Keller. 1990. Consumer Evaluations of Brand Extensions, *Journal of Marketing,* 54(1): 27-41.

AFP Asian Edition. June 2009, Retail chains leave India's coffee houses in peril(accessed December 2009) http://www.thefreelibrary.com/

Ahmed, Z. U., J. P.Johnson, X.Yang, and K. F.Chen. 2004. Does Country of Origin Matter for Low-Involvement Products? *International Marketing Review*. 21:102.

Bhardwaj, P. 2006. India develops a taste for coffee (accessed December 2008) http://www.atimes.com/atimes/South_Asia/HE12Df04.html

Business Line Report. 2009. Arabica coffee imports likely in next 7-8 years. The Hindu (accessed December 2009). http://www.thehindubusinessline.com/2009/08/14/stories/2009081450871600.htm

Cattin, P. and D.R.Wittink. 1982. Commercial Use of Conjoint Analysis. *Journal of Marketing* 46(Summer):44-53.

Cohen, S.H. 1997. "Perfect Union: CBCA Marries the Best of Conjoint and Discrete Choice Models," *Marketing Research* 9(1):12-17.

Chan-Halbrendt, C., F.Yang, L.Thomas, and A. Pant. 2007. Analysis of Farming Household's Preferences on Invasive Species Management: The Case of Miconia. *International Food and Agribusiness Management Review*. 10(2):117-140.

Chran,K. and B. Orme. 2000. An Overview and Comparison of Design Strategies for Choice-Based Conjoint Analysis, Research Paper Series, Sawtooth Software, Inc (accessed on June 2010). http://www.sawtoothsoftware.com/download/techpap/desgncbc.pdf

Chung, K.K. and Y.C.Jay.1997. Brand popularity, country image and market share. *Journal of International Business Studies* 28: 361-86.

Coffee Consumption in India on the Rise. 2005. Tea &Coffee Trade Journal, Coffee Board of India.[accessed December 2008] http://www.allbusiness.com/manufacturing/food-manufacturing-food-coffee-tea/408540-1.html

Coffee Consumption in India. 2008. *Economic & Market Intelligence Unit*, Coffee Board, Bangalore. Coffee Board of India Publication, No. 1 Ambedkar Veedhi, Bangalore-560001. INDIA http://www.indiacoffee.org/publications/consumption2008.html

Cranfield, J., S. Hensen, J. Northey and O. Masakure. 2010. An Assessment of Consumer Preference for Fair Trade Coffee in Toronto and Vancouver. *Agribusiness,* 26(2): 307-325.

Cristovam, E., C. Russell, A. Paterson, and E. Reid. 2000. Gender Preference in Hedonic Rations for Espresso and Espresso-milk Coffees. *Food Quality and Preference* 11(6):437-444.

DeSarbo, W.S., V. Ramaswamy, and S.H. Cohen. 1995. "Market Segmentation with Choice-Based Conjoint Analysis," *Marketing Letters* 6(2): 137-148.

Elrod, T., J.J. Louviere and K.S. Davey. 1992. "An Empirical Comparison of Rating-Based and Choice-Based Conjoint Models," *Journal of Marketing Research*, 29(3), 368-377.

Feldman, M.2010. Kona coffee blends take profits from growers, Resource Decisions. http://konacoffeefarmers.org/Economic%20Efforts%20of%20Blending%20Kona.pdf

Fleming, K., and S. Nakamoto. 2003. "Kona Coffee for the Japanese Market," Western Profiles of Innovative Agricultural Marketing: Examples from Direct Farm Marketing and Agri-Tourism Enterprises. Western Extension Marketing Committee.

FTA with ASEAN, August 13th. 2008. Indian Express News Report, (accessed November 2009). http://www.indianexpress.com/news/fta-with-asean/501716/

Greene, W.H. and D.A. Hensher. 2003. A latent class model for discrete choice analysis: contracts with mixed logit. *Transportation Research Part B: Methodological* 37(8): 681-698.

Green, P.E. and V. R. Rao. 1971. Conjoint Measurement for Quantifying Judgmental Data. *Journal of Marketing Research,* 8: 355-63.

Green, P.E. and Y. Wind. 1975. New Ways to Measure Consumers' Judgments. *Harvard Business Review*: 89-108.

Green, P. E. and V.Srinivasan. 1978. Conjoint Analysis in Consumer Research: Issues and Outlook. *Journal of Consumer Research* 5:103-123.

Haaijer, M., 1999. Modeling conjoint choice experiments with the probit model. Ph.D. Thesis, University of Groningen, Labyrint Publications, The Netherlands [accessed June 2010]. http://dissertations.ub.rug.nl/faculties/eco/1999/m.e.haaijer/?pLanguage=en

Halbrendt, C., C. Gempesaw II, J. R. Bacon and L. Sterling. 1991. Public Perception of Food Safety in Animal-Food Products. *Journal of Agribusiness.* 9(1):85-96.

Hanley, N., S. Mourato, and R.E. Wright. 2001. Choice Modelling Approaches: A Superior Alternative for Environmental Valuation? *Journal of Economic Surveys* 15(3): 435-462.

Hawaii Department of Agriculture, 2009. "Report on Hawaii-Grown Coffee Labeling & Inspection and Economic Impact of Potential Changes to Minimum Content Requirements", (accessed October 2010). http://hawaii.gov/hdoa/meetings_reports/legislative-reports/2009legreports/Coffee%20Report.PDF

Heidema, J. and S.de Jong. 1998. Consumer Preferences of Coffees in Relation to Sensory Parameters as Studied by Analysis of Covariance. *Food Quality and Preference* 9(3):115-118.

Hauser, R.J., and V. Rao. 2004. Conjoint Analysis, Related Modeling and Applications. *Market Research and Modeling: Progress and Prospects, A Tribute to Paul E. Green.* Eds.Yoram j. Wind and Paul E. Green, Kluwer Academic Publishers, Massachusetts.

India-US Trade, Embassy of India,Washington DC. 2008. (accessed December 2009) Available from http://indianembassy.org/newsite/indoustrade1.asp; (accessed May 2010).

Instant Hawaii. (accessed December 2008). http://www.instanthawaii.com/cgi-bin/hawaii?Plants.coffee.

Johnson, R. M. 1974. Trade-off Analysis of Consumer Values, *Journal of Marketing Research,* 11: 121-7.

Johnson, R. and B.Orme.2003. Getting the most from CBC. Sawtooth Software Research Paper Series. (accessed January 2010). http://www.sawtoothsoftware.com/education/techpap.shtml.

Louviere, Jordan J. and G.Woodworth. 1983. "Design and Analysis of Simulated Consumer Choice or Allocation Experiments: An Approach Based on Aggregate Data," *Journal of Marketing Research,* 20 (November): 350-67.

Louviere, J.J. 1988. "Conjoint Analysis Modeling of Stated Preferences. A Review of Theory, Methods, Recent Developments and External Validity*," Journal of Transport Economics and Policy*, January: 93-119.

Lu, C., and W. C. Hung. 2000. Young consumers' preference for canned coffee. In Proceedings of *Symposium of Science. Technology and Management* 321-327.

McFadden, D.S. 1973. Conditional Logit Analysis of Qualitative Choice Behavior, In *Frontiers in Econometrics*, Edited by Zarembka P. Academic Press, New York, NY.

Milon, J.W., and D. Scrogin. 2006. Latent preferences and valuation of wetland ecosystem restoration. *Ecological Economics* 56(2): 162-175.

Orme, B. K. 2006. Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research, Research Publishers LLC, Madison, U.S.A.

Pelsmacker, P. D., L.Driesen, and G.Rayp. 2005. Do Consumers Care about Ethics? Willingness to Pay for Fair-Trade Coffee. *The Journal of Consumer Affairs* 39: 363-385.

Rdahakrishnan,S. and B.D.R. Reddy. 2007. Attitude towards coffee drinking by coffee consumers and non-consumers in India. (accessed April 2008). http://www.indiacoffee.org/newsletter/2007/april/cover-story-1.html.

Roth, M.S., and J.B.Romea. 1992. Matching product and country image perceptions: a framework for managing country-of-origin effects. *Journal of International Business Studies* 23(3): 477-497.

Schwarz, G.1978. Estimating the dimension of a model. *Annuals of Statistics* 6:461-464.

Shih, M.L., C.Y. Liu, B.W. Huang, S. Lin, and K.C. Peng. 2008. Conjoint Analysis: A Study of Canned Coffee in Taiwan. *International Journal of Computer Science and Network Security*. 8(8): 238-246.

Southichack, K.M. 2004. Market Outlook Report- Hawaii Coffee Industry, Agriculture Development Davison, Hawaii Department of Agriculture.

Srinivasan,V., and A.D. Shocker. 1973b.'Estimating the Weights for Multiple Attributes in a Composite Criterion Using Pair wise Judgments. *Psychometrika* 38: 473-93.

Su, C. Y., and C.W. You. 1999. A study of purchasing behaviors of college students over brandname products in Metro-Taipei—a case study of Unipresident's La gauche de la Seine coffee. *Journal of Printing Art* 11:134-157.

Tseng, R. H. 1991. Canned Coffees. *Logistic World Magazine* 1: 32-34.

USDA Economic Research Service, (accessed May 2010). http://www.ers.usda.gov/briefing/India/trade.htm

Vermunt, J.K., and J. Magidson. 2005. *Technical Guide for Latent GOLD 4.0: Basic and Advanced.* Statistical Innovations Inc. Belmont, Massachusetts.

Wall, M., J. Liefeld, and L.A. Heslop. 1991. Impact of country-of-origin cues on consumer judgments in multi-cue situations: a covariance analysis. *Journal of the Academy of Marketing Science* 19(2): 105-13.

Wittink, Dick R., and P. Cattin. 1989. Commercial Use of Conjoint Analysis: An Update. *Journal of Marketing* 53(July): 91-6.

Global Food Production under Alternative Scenarios

Ellen Huan-Niemi[⊕][a] Janne Niemi[b] and Jyrki Niemi[c]

[a]*Researcher, Economic Research, MTT Agrifood Research Finland, Latokartanonkaari 9, 00790, Helsinki, Finland*

[b] *Researcher, Government Institute for Economic Research (VATT), Arkadiankatu 7, 00101, Helsinki, Finland*

[c]*Professor, Economic Research, MTT Agrifood Research Finland, Latokartanonkaari 9, 00790, Helsinki, Finland*

Abstract

The aim of this study is to compare the conceivable baseline or "business as usual" scenario to four extreme alternative scenarios over the next two decades. The alternative extreme scenarios present the question of "what if" an extreme policy is implemented, what would be the forecasted impact on global food production and how the impact would differ from the plausible scenario. The baseline scenario includes the WTO draft proposal for the Doha Round, the Kyoto Protocol targets to reduce greenhouse gases emissions, and the scheduled reforms on the EU Common Agricultural Policy. The alternative scenarios are prolonged world economic recession, climate change mitigation policies with higher targets, complete removal of only EU agricultural subsidies, and total trade liberalisation for agriculture worldwide. The goal is to foresee the future under plausible and extreme circumstances or policy implementations in a rapidly changing environment for decision makers, interest groups, agribusiness firms and managers in order to support the process of policy and strategy planning.

Keywords: global food production, agriculture trade liberalisation, climate policy, EU agricultural subsidies, economic recession.

  [⊕]Corresponding author: Tel: + 358.40.8613274
                            Email: ellen.huan-niemi@mtt.fi

  Other contact information: Janne Niemi: janne.niemi@vatt.fi
                             Jyrki Niemi: jyrki.niemi@mtt.fi

Introduction

Food is vital in our lives, but it is more than just survival. Our relationship with food is intertwined with trade policies, politics, economics, and environmental concerns, in addition to culture and science. The future of food production is in a path filled with dilemmas. Infectious animal diseases that lead to food safety concerns, energy crisis, declining biodiversity, natural resources depletion, pollution, and global climate change are all intervening in the path in different ways at different levels. The use of arable land for food production will compete with biofuel production. Migration from rural to urban areas continues worldwide, and population growth soars over the next decades. Demand for food will rise in the coming decades as a result of population growth as well as increasing affluence due rising income. Growing affluence in population rich countries such as China and India will prompt more people to eat a resource intensive diet, rich in meat and dairy products. This increases demand for crops used as animal feedstock instead of food straight for human consumption. We will have to confront the paradox of the coexistence of obesity and malnutrition, as inequality grows between the rich and poor.

Food-price and economic shocks have further jeopardized the food security of developing countries and poor people, pushing the estimated number of malnourished people over one billion. Food security risks appear to be on the rise and governments are paying more attention to this issue. Increasing uncertainties raise critical questions on how to manage these risks. The poor, particularly those who depend on food purchases, both in rural and urban areas, are highly vulnerable to market risks such as the rapid escalation of food commodity prices from 2006 to 2008.

The global financial crisis and economic recession have placed additional stresses on the impoverished countries, where the result is decreased economic growth, reduced inflow of foreign direct investment, and reduced remittances. The global and national food systems are complex systems, which are vulnerable to sudden disruptions and changes that are difficult to predict. Policy shocks, such as trade policies and climate change mitigation policies, have serious impacts on the poor and the rich as well. Therefore, the impacts of four policy shocks on global food production are explored:

1) Economic recession will lead to the loss of employment and will have an impact on the demand for agricultural commodities. The economic crisis policy shock is to mimic the impact of a prolonged economic recession worldwide.
2) Global climate change will affect food production and aggravate food security risks due to the increase in extreme weather events such as droughts and floods combined with the possibility of declining yields in developing countries. Carbon dioxide is the main gas believed to contribute to global warming. The climate change mitigation policy shock is to limit the emissions of greenhouse gases such as carbon dioxide (CO_2) due to fossil fuels usage.
3) Agricultural subsidies have been a thorny issue in the World Trade Organisation (WTO). The policy shock involving the elimination of all agricultural subsidies in the European Union (EU) is to apply the concept of a unilateral removal of agricultural subsidies from a major agricultural producer and subsidiser.

4) Trade liberalisation in agriculture is one of the major issues in the WTO. The policy shock concerning the global removal of all agricultural subsidies and tariffs is to apply the notion of a multilateral trade liberalisation for agriculture.

The aim of this study is to compare the conceivable baseline or "business as usual" scenario to four extreme alternative scenarios over the next two decades. The alternative extreme scenarios present the question of "what if" an extreme policy is implemented, what would be the forecasted impact on global food production and how the impact would differ from the plausible scenario. The alternative extreme scenarios are prolonged world economic recession, climate change mitigation policies with higher targets, complete removal of only EU agricultural subsidies, and total trade liberalisation for agriculture worldwide. Food production in different countries and regions are projected until 2030 whereby three groups of food products are analysed in this study -- bovine meat, poultry & pigmeat, and coarse grains.

Methodological Framework of the Study

The GTAP Model and Database

The simulations in this study employ the Global Trade Analysis Project (GTAP) model and database. The model is a recursive-dynamic applied general equilibrium model extended to better analyse energy and environment issues and take into account the various forms of agricultural subsidies.

The standard GTAP model (Hertel and Tsigas 1997) is a comparative-static, multi-region, multi-sector, computable general equilibrium model, with perfect competition and constant returns to scale. Bilateral trade is handled via the Armington (1969) assumption. Model results are derived from assumptions of firms and consumers optimising their behaviour within constraints given by endowments (land, labour, capital, natural resources) and policies (e.g. taxes). In the equilibrium solution, all markets are in equilibrium, i.e. demand equals supply.

The modified model used in this study is based on GTAP-Dyn model (Ianchovichina and McDougall 2001) and GTAP-E model (Burniaux and Truong 2002). The GTAP-Dyn model permits a recursive solution procedure, a feature that allows easy implementation of dynamics without imposing limitations on the model's size. Adding to the standard GTAP model, it incorporates international capital mobility, capital accumulation, and accounting that keep track of foreign capital ownership with an adaptive expectations theory of investment. The GTAP-E model includes energy substitution, which is absent from the standard GTAP model. It also incorporates carbon emissions (CO_2) from the combustion of fossil fuels and provides a mechanism to trade these emissions internationally. This allows the analysis of various climate policy measures.

Trade policy instruments are represented in the GTAP database as ad valorem taxes and subsidies. For agricultural commodities, domestic support levels are calculated from the OECD (2008) Producer Support Estimate (PSE), and components for market price support are excluded to avoid double counting with the tariffs in the database. The total PSE of a country is translated into a form that is compatible with the database and into four categories of subsidy payments:

output payments, intermediate input payments, land based payments and capital based payments. In this study, the GTAP model has been modified to consider agricultural subsidy payments in a way that allows an easy manipulation of subsidy payments in monetary terms that correspond to the policy measures of the EU Common Agricultural Policy. This allows the analysis of subsidy payments to agricultural production and trade.

GTAP model applications are widely used in research (Hertel et al. 2010, Valenzuela et al. 2009, Telleria et al. 2009, Martin et al. 2008, Walsh et al. 2007, Dimaranan et al. 2007) particularly in a broad scope of international trade. The GTAP 7 Database (Narayanan and Walmsley 2008) has been used in this study, representing the world economy for a given reference year -- 2004. The database comprises several types of data: behavioural parameters that include elasticities of substitution between domestic and imported goods, and elasticities of substitution between sources of imports (Armington elasticities). The main data file is derived from regional input-output tables, bilateral trade flows and protection data (taxes and subsidies). The database represents the world economy as flows of goods and services measured in millions of 2004 US dollars. Additional data is provided for capital stocks, population and savings. The database includes five endowments (i.e. production factors) -- land, skilled labour, unskilled labour, natural resources, and capital -- with 113 countries/regions and 57 commodities/sectors. In this study, the database is aggregated into 11 countries/regions and 20 commodities/sectors, including 12 agricultural commodities and food sectors (Table 1).

Table 1. The GTAP 7 Database is aggregated into 11 countries/regions and covering 12 agricultural commodities/sectors

Countries/Regions	Agricultural Commodities/Sectors
EU-27[1]	Wheat
EFTA[2]	Coarse grains (Other grains)
Mercosur[3]	Vegetables, fruits, nuts
Oceania[4]	Other crops
LDCs[5]	Raw milk
Developing countries[6]	Bovine animals
Developed countries[7]	Animal products n.e.c.
United States of America (USA)	Bovine meat products
Russia	Poultry and pigmeat (Other meat products)
China	Dairy products
India	Sugar
	Other food products

[1] Finland, France, Germany, Austria, Belgium, Netherlands, United Kingdom, Ireland, Denmark, Luxembourg, Sweden, Spain, Italy, Portugal, Greece, Poland, Malta, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovakia, Slovenia, Bulgaria, Romania.
[2] Switzerland, Norway, Iceland.
[3] Brazil, Argentina, Paraguay, Uruguay.
[4] Australia, New Zealand, the Pacific Islands
[5] Least developed countries in Africa.
[6] The rest of developing countries.
[7] The rest of developed countries.

The regions that are relevant in this study are the world's top agricultural producers such as the EU, USA, China, India and Mercosur. The EU and USA are not only major exporters, but also main importers of food products. On the other hand, the Mercosur region is one of the most competitive agricultural producers in the world, especially in meat production. The LDCs region

is also important to examine due its status of being a net food importer and as the poorest region in the world. Russia being a key food importer is interesting due to its energy intensive agricultural and food industry. Population rich and increasingly affluent countries such as China and India will be major forces in the international agricultural trade. These emerging superpowers are currently major forces in the WTO negotiations.

Assumptions for the Baseline (business as usual) and Four Scenarios

The baseline or "business as usual" scenario is a hybrid scenario that cuts across conceivable scenarios based on the projected changes in the macro indicators, the Kyoto Protocol targets to reduce greenhouse gases emissions, the scheduled reforms in the EU Common Agricultural Policy (CAP), and the draft proposal for the Doha Round agreement under the WTO.

Assumptions for the baseline under "business as usual":

i) Macro indicators:
    World population growth follows the United Nations (2008) medium variant projection, and labour force growth corresponds to the International Labour Organization (ILO 2008) projection. For the European countries, the growth projections have been adjusted according to EUROSTAT (2008) for population projection and Carone (2005) for labour force projection. The medium-term gross domestic product (GDP) growth for the baseline follows the International Monetary Fund (IMF 2009) projection, and longer term productivity growth corresponds to the calibrated estimates based on Carone et al. (2006) and Poncet (2006).

ii) Greenhouse gases emissions:
    CO_2 emissions in the EU-27 and EFTA regions are constrained to Kyoto targets (8% reduction by 2012 from the benchmark 1990 emission levels and zero reduction after 2012). The regional CO_2 tax levels correspond to partial emissions trading in the EU and EFTA regions. The other regions have no limits to CO_2 emissions growth. The CO_2 emissions in the model are exaggerated because the development and improvement in energy efficient technology is not taken into account. Only carbon emissions (CO_2) from the usage of fossil fuels are taken into account; emission of other greenhouse gases are not included in the model.

iii) Domestic support in the EU:
    The EU subsidy payments are kept constant in Euro terms, leading to a slight decrease in subsidy rates. Simulation of the CAP reforms from 2005 to 2007 -- decoupling of land and capital based subsidy payments by introducing the Single Farm Payment as generic land subsidy. Subsequently, the "Health Check" reforms of the CAP are implemented in 2010.

iv) Trade policies:
    Removal of all tariffs between the EU-15 old member states and the EU-12 new member states. Furthermore, worldwide agricultural tariffs are gradually cut according to the WTO draft proposal for the Doha Round (WTO 2008). The Doha Round is assumed to begin in December 2011 and export subsidies are eliminated at the same time.

After the details are tested on the GTAP model for the baseline or "business as usual" scenario, the conceivable baseline scenario is compared to the extreme alternative scenarios. The four alternative scenarios present the question of "what if" an extreme policy is implemented, what would be the forecasted impact on global food production and how the impact would differ from the plausible scenario (baseline/business as usual).

Assumptions for the four alternative scenarios:

i) Economic crisis:
    During the 5-year period from 2009 to 2014, worldwide unemployment grows by 2% annually and worldwide investments are reduced by half. In the subsequent 5 years from 2015 to 2019, unemployment is decreased back to the original levels and investments are increased back to the initial levels.

ii) Climate change mitigation policy:
    A more ambitious climate policy will take over from the Kyoto Protocol after 2012. The EU-27 emission target is to reduce CO_2 emission by 40% in 2030 from the 2012 emission level. The whole world including the EU reduces CO_2 emissions by 10% in 2030 from the benchmark 2012 levels. This corresponds to the rest of the world keeping their CO_2 emissions at 2012 levels. The model does not take into account improvement in technology through global funding allocated to the development of clean technologies, thus the predictions may be overestimated.

iii) Unilateral removal of domestic subsidy in the EU:
    Removal of all agricultural subsidies in the EU-27 region, implemented in 3 years from 2018 to 2020 and structured as domestic agricultural policy reform.

iv) Multilateral removal of tariff and subsidy for agriculture globally:
    Removal of all import duties for agricultural products and agricultural subsidies in all regions, implemented in 3 years from 2018 to 2020 and structured as global trade liberalisation for agriculture.

Impact on Global Food Production

Bovine Meat Production

Who will gain and who will lose from the possible outcome of trade liberalization? Projections for bovine meat production in different countries and regions (EU-27, China, India, USA, LDCs, and Mercosur) are shown in Appendix 1. Total trade liberalisation for agriculture has the largest impact on the production of bovine meat in the EU -- bovine meat production in the EU would decrease dramatically compared to the baseline (business as usual) and other scenarios. The current trend in EU beef production can justify the projected decline in EU bovine meat production. The major factors influencing the medium to longer term projections for the EU beef sector are the gradual decrease in the EU dairy herd, the origin for two thirds of EU beef, and the

continued impact of decoupling domestic support payments to EU beef producers[1]. These factors combined with rising cereal or feedstock prices will reduce the incentives for intensive beef production systems and unprofitable production, thus the overall EU beef production will decline. The EU cattle herd is predicted to contract in the medium and long term (EU Commission 2009, USDA 2009a). The EU self sufficiency rate has decreased to 96 percent and total EU beef imports have increased 14 percent year-on-year in 2009 (TheBeefSite 2009). Furthermore, the competitiveness of the EU beef industry is weak. EU beef is highly sensitive to tariff reductions (Huan-Niemi et al. 2009). Presently, the EU is able to control its beef imports through prohibitive tariffs imposed on the imports of bovine meat products and import quotas with considerably lower tariff rates. However, an increasing volume of beef is imported outside the quotas by paying the full tariff rate. Consequently, the elimination of tariffs for EU beef would force the least competitive EU beef producers to stop cattle-raising for beef. The removal of border protection for EU beef would give a strong advantage to the exports of low cost beef producers in the world, and the growth in beef imports would directly have a substantial impact on EU domestic prices for beef. Brazil, Argentina, and Uruguay have been the main supplier to the EU beef market.

In contrast, bovine meat production in India would increase tremendously under total trade liberalisation. The projected striking increase in Indian bovine meat production can be debated. How India can meet the challenges arising out of growing requirements of other countries due to deficit in their beef production levels would depend on India's export capabilities and available surpluses for exports. There is no doubt that the total bovine meat production in India has increased tremendously in the past decade. India has a large population of livestock. Animal rearing has remained traditionally a small scale undertaking for the production of milk. So far a very small percentage of the total Indian cattle herd is slaughtered since the majority of the Indian population does not eat beef due to religious bias. Hinduism, a religion that constitutes a majority of the Indian population, considers cows as sacred and regards slaughtering of cows as offensive. On the other hand, slaughtering of buffaloes is allowed in India unlike slaughtering of cows. Therefore, most of the Indian bovine meat supply is from the water buffalo. Meat from buffaloes is primarily processed for exports. Buffalo meat is the largest meat segment exported out of India and international demand for buffalo meat is growing. Buffalo carcases have less fat and bone, but a higher proportion of muscle. There is favourable export demand due to the lower cost and lean meat. India is cost competitive in producing buffalo meat, but further improvement is needed in India's cold chain infrastructure in order to increase competitiveness (USDA 2008). India has remained a big exporter of buffalo meat to Southeast Asia (Philippines, Malaysia, Vietnam), the Middle East (Saudi Arabia, Kuwait, Jordan), and Africa (Angola, Congo, Ghana). At the moment, certain areas in India are infested with contagious cattle and livestock diseases. The ones that are free from diseases are not certified by the World Organisation for Animal Health (formerly known as the OIE -- Office international des épizooties). Many countries resist importing bovine meat from India due to this reason. The GTAP model results have indicated

---

[1] The EU system of direct payments (domestic support payments) influences farmers' production decisions, where payments are paid on a per head basis for livestock and a per hectare basis for crops. If the current system of direct payments is decoupled, production levels would be expected to adjust downwards to reflect the underlying profitability of alternative enterprises. According to Moss et al. (2002), a greater decline in projected livestock numbers is observed in the United Kingdom compared to projections for the EU, when decoupling occurs. In this study, all the EU direct payments are decoupled in the baseline; hence the simulations indicate a declining EU beef production.

that most of the growth in Indian bovine meat exports is flowing into the EU market. This can be questioned because the model can only estimate the impact of tariff elimination. The impact of tariff barriers can be measured by the model but not the impact of non-trade barriers in the EU such as food safety, guaranteed quality, labelling & traceability, and animal welfare. Labelling and tracking the meat through the food chain and control of animal diseases would be the most daunting challenges. In addition, EU consumers must acquire a preference for buffalo meat compared to the consumption of cattle meat.

Concerning the least developed countries (LDCs), bovine meat production would decline the most under total trade liberalisation compared to the baseline. The drop in production is caused by the escalating and huge amount of imports competing with domestic production due to the loss of border protection. Furthermore, there is a considerable decrease in exports due to preference erosion and the end of preferential treatment from the highly protected markets of developed countries. Compared to the baseline, the economic crisis scenario in the LDCs has a short term impact in reducing production due to lower domestic consumption; the scenario for climate change mitigation policy in the LDCs has a positive impact by boosting domestic production due to decreasing imports; and the EU subsidy removal scenario has no impact on production in the LDCs.

Bovine meat production in the Mercosur would be decreasing compared to the baseline due to climate policy measures that caused a substantial decline in exports. The USA and China would face only minor changes in bovine meat production for all the four scenarios compared to the baseline. Overall, the EU-27 and LDCs regions have a declining trend for bovine meat production until 2030, whereas the other countries and regions examined in this study have an upward trend. This indicates that in the long term the EU and LDCs would not be able to compete with the other countries and regions, hence producing less bovine meat in 2030 compared to 2009. The advanced developing countries that are experiencing high economic growth in recent years such as China, India, and Brazil (Mercosur) would increase bovine meat production significantly to meet rising domestic consumption and expanding export market.

Poultry and Pigmeat Production

The per capita incomes of consumers in Brazil, Russia, India, and China (BRIC countries) have risen clearly, and as a result, dietary patterns have shifted away from staple grains and starches toward animal proteins. When people move to cities or towns, they tend to consume less grain but more meat, processed foods, and restaurant meals. In 2000, China's household surveys showed that per capita red meat consumption in urban areas was 40 percent higher than in rural areas, and egg and poultry consumption was more than 2.5 times higher than in rural areas (Hsu et al. 2002). Continued urbanization, income and population growth in many developing countries will further expand meat consumption. Over two-thirds of world meat production consists of poultry and pigmeat production. China, EU, USA, and Brazil (Mercosur) are currently the world major producers of poultry and pigmeat.

Who will be the major meat producers in the future? EU-27, China, USA, and Mercosur would remain the key players in the world production for poultry and pigmeat according to the different policy scenarios shown in Appendix 2 (EU-27, India, LDCs, China, USA, and Mercosur). The

results indicate that India and the Mercosur would increase production tremendously compared to the baseline under total trade liberalisation for agriculture. However, the increase in poultry and pigmeat production is small in scale for India (from USD 50 to 350 million) compared to the growth in production for the Mercosur (from USD 12 to 25 billion) even though the rate of production growth is higher in India. The increase in production for both regions is driven by escalating exports under trade liberalisation, especially the exports of poultry and pigmeat from the Mercosur region to the EU-27 region. Consequently, poultry and pigmeat production in the EU-27 region is declining compared to the baseline because rising imports from the Mercosur region is depressing domestic production. Currently, statistics are showing similar production trend whereby EU contribution to global poultry meat production decreased from 22.6% in 1970 to only 12.4% in 2002 (Windhorst 2003). Indian poultry and pigmeat producers would gain the most and experience a higher income level due to the enlarging export market. On the contrary, the LDCs would encounter decreasing production for poultry and pigmeat because of competition from the huge amount of imports due to the loss of border protection for domestic production under trade liberalisation.

The climate change mitigation policy scenario would decrease poultry and pigmeat production in China and Mercosur compared to the baseline. The decrease is caused by the increase in production cost as a result of rising feedstock prices. Climate policies have an impact on the price level of feedstock due to the usage of fertilisers, energy and transport. Conversely, climate policies would boost domestic production in the EU and LDCs because of a reduction in imports. The economic crisis scenario compared to the baseline in the LDCs, USA, and Mercosur would affect domestic production only in the short term.

The most interesting scenario is the "business as usual" scenario depicting the baseline for China. By 2030 in the baseline, one-third of the increase in production for China is induced by exports. China's export of poultry and pigmeat is projected to increase from USD 1.5 to 41.5 billion whereas import of poultry and pigmeat is merely at USD 1.3 billion. This result showing China as the top net exporter of poultry and pigmeat in the world is a widely debated issue among the agricultural economists (Yijun Han and Hertel 2003). Some analysts believe that China will become an important net importer of livestock products, while others argue that China will become a major net exporter. A third set of estimates stresses the wide range of possible outcomes for China's net trade position, depending on the productivity growth in China's pig and poultry production and the rate of economic growth in China (Nin et al. 2004). The third set of estimates indicated that China could be a substantial net exporter owing to high livestock productivity growth and a slow-down in the economic growth of China; on the other hand, slow productivity growth in livestock production and a rapidly growing macro-economy could transform China into a major net importer for poultry and pigmeat. In the simulations, the assumed productivity growth for agriculture in China is high, thus by 2030, the model projects China as a major net exporter for poultry and pigmeat.

Certainly, according to Lohmar and Gale (2008), China has been a net food exporter for most of the last three decades. China dominates world markets in a variety of products areas, including garlic, apples, apple juice, mandarin oranges, farm-raised fish and shrimp, and vegetables. Sometimes, it seems that China has suspended the law of scarcity by raising production in many sectors without having to sacrifice production in other sectors. More recently, however, the law

of scarcity is applying mostly in the form of rising commodity and input prices, more expensive labour, restrictions on land developments, and a reversal of China's pro-export policies. Various hidden costs are beginning to emerge, including dangerous chemical residues on food and related food safety problems, falling groundwater tables, polluted water, and overall environmental degradation.

Agricultural production gains in China stemmed from gains in production efficiency rather than expansion and mobilization of additional resources. There is a decline in area sown to grain and an increase in land devoted to non-grain crops and livestock production. China's dramatic increase in animal protein consumption would not have been possible without a rapid expansion of its domestic livestock industry: China's pigmeat production has increased to over 48 million tons in 2004 compared to 24 million tons in 1990 -- over five times the level in the USA (Windhorst 2005). China is expected to increase pigmeat production and contribute more than 50% of global production. It is questionable whether China is able to produce sufficient feed for the predicted increase in meat production. According to Lohmar and Gale (2008), there is still scope to achieve further growth in meat production, despite future gains in China's agricultural production will not come as easily as in the past. In fact, developed countries such as the EU and USA have faced similar resource and environmental constraints and still maintained robust growth in agricultural production, and at the same time, production is changing into more environmental friendly practices. China, however, with very large and diverse agricultural sector is developing at a much higher speed compared to the developed countries. Therefore, China has to establish supporting institutions to facilitate this transition while increasing the efficiency of production.

Production of poultry and pigmeat in developed countries such as the EU and USA is intensive and concentrated in large-scale commercial units, and this production method is spreading in Asia and Latin America. There will be increased problems related to welfare and environmental concerns. Regulations formulated from these concerns will continue to increase the cost of production in developed countries and major exporting countries. Diseases related to human and food safety issues are the main risks of the increase in poultry and pigmeat production (swine flu and bird flu for example). The large amounts of meat that are being traded globally are increasing the dissemination of infectious diseases. Exporting countries must have excellent control of diseases because the global market has no tolerance for serious disease outbreaks.

Coarse Grains Production

Coarse grains make up a common trade category that includes corn, sorghum, barley, oats, and rye. Corn is by far the largest component traded, accounting for about three-quarters of global coarse-grain trade in recent years. Most of the corn that is traded is used for livestock feed, while smaller amounts are traded for industrial use and human consumption. The expanding use of corn for ethanol production, particularly in the USA, remains the principle driving factor behind the growth in industrial usage of coarse grains. The top coarse grain producers in the world are the USA, China, EU, Brazil, India, Russia, Mexico, and Canada. Appendix 3 is showing the course grains production in key producing countries and other regions until 2030 (EU-27, Russia, LDCs, China, USA, and Mercosur). The USA produces half of the global corn production and also dominates the global corn trade; however, exports account for only a

relatively small portion of production -- about 15 percent. This means that corn prices are largely determined by the supply and demand for corn in the USA market, and the rest of the world must adjust to prevailing prices in the USA. Subsequently, world market price for corn is greatly affected by the biofuel policies in the USA. Global population increases and rising demand for meat products will continue to support the expanding feed grain exports in the long term. The USA, Argentina, Brazil, and Ukraine are the main exporters of corn meanwhile Japan, Mexico, South Korea, and Egypt are the major importers of corn.

The climate change mitigation policy scenario would reduce coarse grains production in Russia and Mercosur by 2030 compared to the baseline because production in Russia and Mercosur is energy intensive with high usage of fertiliser and transport; also production in the LDCs would decline slightly because the higher prices for fertilisers will have an impact on production. Alternatively, if the use of coarse grains is taken into account for biofuel production, the results may be different from this simulation because the generation of energy by using biofuels is not incorporated in this simulation. The economic crisis scenario would have an influence on coarse grains production in most of the countries and regions compared to the baseline, but the decrease in production is only for short term due to the short term decline in meat consumption affecting the demand for feed grains.

China would undergo a tremendous growth in production for coarse grains by 2030 due to the need to feed its ever increasing livestock production, and all the other scenarios do not differ much from the baseline or "business as usual." According to the USDA (2009b), China has been a principal source of uncertainty in global corn trade, swinging from being the second-largest exporter in some years to occasionally importing significant quantities of corn. China's corn exports are largely a function of government export subsidies and tax rebates because corn prices in China are mostly higher than those in the world market. Large corn stocks are expensive for the government to maintain, and Chinese corn export policy has fluctuated with little relationship to its production, making China's corn trade difficult to predict. Agricultural land in China is increasingly giving way to the expanding base for industrial production. China's declining comparative advantage in grains and other land intensive crops should lead to increased grain imports in the future. Due to the fast growth in demand for meat, the shift from food to feed grains seems apparent. The simulation results indicate that by 2030 the usage of feed grains would increase by 590%, while grains for human consumption would increase by only 70%. Merely 1.5% of coarse grains production in China goes into human consumption by 2030. According to Fuller et al. (2002), the predominantly specialized households farms and commercial livestock farms will have to increasingly rely on imported corn and soybeans to feed their growing livestock numbers because arable land is scarce in China and its capacity to expand land-intensive feed grain crops is limited. Without increasing feed grains imports for its livestock, land scarcity will limit China's ability to continue increasing its livestock production to meet the growing domestic demand or become a major net exporter of meat in the world market.

Conclusions

The aim of this study is to compare the conceivable baseline or "business as usual" scenario to four extreme alternative scenarios over the next two decades. The alternative extreme scenarios

present the question of "what if" an extreme policy is implemented, what would be the forecasted impact on global food production and how the impact would differ from the plausible scenario. The baseline or "business as usual" scenario includes the WTO draft proposal for the Doha Round (the Doha Round is assumed to begin in December 2011), the Kyoto Protocol targets to reduce greenhouse gases emissions by 2012, and the scheduled reforms on the EU Common Agricultural Policy. The alternative extreme scenarios are prolonged world economic recession, climate change mitigation policies with higher targets, complete removal of only EU agricultural subsidies, and total trade liberalisation for agriculture worldwide. Food production in different countries and regions are projected until 2030 whereby three groups of food products are analysed in this study -- bovine meat, poultry & pigmeat, and coarse grains.

The impact of the economic crisis scenario on food production is only for the short term compared to the baseline. The drop in consumption for meat products is generally higher in developing countries compared to the developed countries, therefore the decline in meat production is more pronounced for example in the LDCs and Mercosur. The decrease in consumption of meat would directly affect the demand for coarse grains as feed for livestock, thus lowering the production of coarse grains worldwide only for the short term.

The climate policy measures would have a negative impact on food production that is energy intensive with high usage of fertiliser and transport such as in Russia and the Mercosur. The climate change mitigation policy scenario would decrease poultry and pigmeat production in China and Mercosur compared to the baseline due to the increase in production cost as a result of rising feedstock prices. Conversely, climate policies would boost domestic poultry and pigmeat production in the EU and meat production in the LDCs because of a reduction in imports.

The EU subsidy removal scenario has barely any impact on food production in the LDCs or other countries/regions in the world compared to the baseline. The impact on world food market is insignificant because there is no change in border protection for EU domestic production and border protection worldwide. The removal of EU subsidy is changing the production patterns within the EU-27 regions by transferring production from high cost producers to low cost producers in the EU. The elimination of EU domestic agricultural subsidies would lower the cost of land and the income of EU farmers.

Meat production in the LDCs would decline the most under total trade liberalisation compared to the baseline. The plunge in meat production in the LDCs is caused by the escalating and huge amount of imports competing with domestic production due to the loss of border protection under trade liberalisation. Furthermore, there is a considerable decrease in bovine meat exports from the LDCs due to preference erosion and the end of preferential treatment from the highly protected markets of developed countries. Total trade liberalisation for agriculture has the largest impact on the production of bovine meat in the EU -- bovine meat production in the EU would decrease dramatically compared to the baseline. The elimination of border protection for EU beef would give a strong advantage to the exports of low cost beef producers in the world, thus forcing the least competitive EU beef producers to stop cattle-raising for beef. Moreover, poultry and pigmeat production in the EU would decline without border protection compared to the baseline due to rising imports from the Mercosur. Under trade liberalisation, the increase in meat production in the Mercosur is exports driven, and other studies (for example Gomes Pereira et al.

2009) have shown similar results. The simulation results indicate that by 2030 the usage of feed grains in China would increase by 590%, while grains for human consumption in China would increase by only 70%. Merely 1.5% of coarse grains production in China goes into human consumption by 2030. The results may be different if the use of coarse grains is taken into account for biofuels production. The use of coarse grains to produce biofuels is not incorporated in this simulation because this study is showing results driven by the demand for food and not for energy. Future studies can be conducted to examine the effects of both food and energy demand on coarse grains production, and show the separate effects of food demand compared to energy demand.

The simulations demonstrate that large and highly populated countries like China and India have the potential to be large net exporter of meat products. India is projected to be a major bovine meat exporter, and China is projected to be the main poultry and pigmeat exporter under trade liberalisation. Nevertheless, the ability of these countries to increase meat production at such a rapid rate and conquer the export market can be debated due to the numerous constraints and non-trade barriers face by these countries. Further research can simulate the impact of these constraints and non-trade barriers on food production[2]. Hence, the forecasted results would be a better information kit for agribusiness firms and managers or policy and decision makers. This study is conducted to anticipate the future of the global food production in the realm of changing global agricultural, trade and climate policy and uncertain world economic growth. The goal is to foresee the future under plausible and extreme circumstances or policy implementations in a rapidly changing environment for decision makers, interest groups, agribusiness firms and managers in order to support the process of policy and strategy planning. The GTAP model is able to forecast the long term (e.g. 20 years) until 2030, but unable to provide qualitative details of the future. Future research using the Delphi method based on panels of expert opinions can significantly strengthen the results and more emphasis can be paid to the details in understanding the alternative developments of the future.

References

Armington, P. 1969. A theory of demand for products distinguished by place of production. International Monetary Fund Staff Papers 16:159-178.

Burniaux, J.M., and T. Truong. 2002. GTAP-E: An Energy-Environmental Version of the GTAP Model, GTAP Technical Paper No. 16. https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=923 (accessed January 22, 2009).

---

[2] Non-trade barriers refer to the wide range of policy interventions other than border tariffs that affect the trade of agricultural products. Non-trade barriers have gained importance as tariff levels have been reduced worldwide. Common measures of non-trade barriers are tariff-equivalents of these policy interventions (Beghin 2006). The tariff-equivalents of the non-trade barriers are subsequently used in trade models to assess the trade or welfare effects of the measured non-trade barriers. For example, Gonzalez–Mellado et al. (2010) have evaluated the role of non-trade barriers on agrifood trade between the EU and Africa by utilising the GTAP model, first by transforming the non-trade barriers into tariff-equivalents and later introducing the tariff-equivalents into a computable general equilibrium (CGE) model to study the effects of their presence and removal.


Beghin, J.C. 2006. Non-tariff Barriers. Working Paper 06-WP 438, Center for Agricultural and Rural Development, Iowa State University, December 2006. http://www.card.iastate.edu/publications/DBS/PDFFiles/06wp438.pdf (accessed June 7, 2010).

Carone, G., C. Denis, K. Mc Morrow, G. Mourre, and W. Röger. 2006. Long-term labour productivity and GDP projections for the EU 25 Member States: a production function framework. Economic Papers No. 253, Directorate General for Economic and Financial Affairs, European Commission.

Carone, G. 2005. Long-term labour force projections for the EU 25 Member States: a set of data for assessing the impact of ageing. Economic Papers No. 235, Directorate General for Economic and Financial Affairs, European Commission.

Dimaranan, B., T. Hertel, and W. Martin. 2007. Potential Gains from Post-Uruguay Round Trade Reform: Impacts on Developing Countries. Chapter 6 in Reforming Agricultural Trade for Developing Countries: Quantifying the Impacts of Multilateral Trade Reform Vol 2, A. McCalla and J. Nash (Eds.). http://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=1873 (accessed June 3, 2010).

EU Commission. 2009. Prospects for Agricultural Markets and Income in the European Union 2008 – 2015. Directorate-General for Agriculture and Rural Development, European Commission, March 2009.

Eurostat. 2008. EUROPOP 2008 - convergence scenario, population forecast 2008-2050, Eurostat Database, European Commission. http://epp.eurostat.ec.europa.eu/portal/page/portal/population/data/database (accessed January 29, 2009).

Fuller, F., F. Tuan, and E. Wailes. 2002. Rising Demand for Meat: Who Will Feed China's Hogs? China's Food and Agriculture: Issues for the 21st Century/AIB-775. Economic Research Service, United States Department of Agriculture (USDA).

Gonzalez–Mellado, A., S. H. Gay, R. M'Barek, and E. Ferrari. 2010. Evaluation of non-tariff measures for African agricultural exports to the EU in a CGE framework. Paper presented at the Thirteenth Annual Conference on Global Economic Analysis, June 9-11, in Penang, Malaysia.

Gomes Pereira, M. W., E. C. Teixeira, and S. Raszap-Skorbiansky. 2009. Impacts of the Doha Round on Brazilian, Chinese and Indian agribusiness. *China Economic Review* 21(2):256-271.

Hertel, T., M. Burke, and D. Lobell. 2010. The Poverty Implications of Climate-Induced Crop Yield Changes by 2030. GTAP Working Paper No. 59. http://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=3196 (accessed June 3, 2010).

Hertel, T., and M. Tsigas. 1997. Structure of GTAP: In *Global Trade Analysis*, ed. Thomas Hertel. Camridge University Press.

Huan-Niemi, E., L. Kerkelä, H. Lehtonen, and J. Niemi. 2009. Implications of Trade Liberalization and Domestic Reforms on EU Agricultural Markets. *International Food and Agribusiness Management Review* 12(4):29-60.

Hsu, Hsin-Hui .,Wen S. Chern, and F. Gale. 2002. How Will Rising Income Affect the Structure of Food Demand?, China's Food and Agriculture: Issues for the 21st Century/AIB-775. Economic Research Service, United States Department of Agriculture (USDA).

IMF. 2009. World Economic Outlook Database, International Monetary Fund. http://www.imf.org/external/pubs/ft/weo/2009/01/weodata/index.aspx (accessed May 5, 2009).

ILO. 2008. Labour Statistics Database, LABORSTA Internet, International Labour Organization, Geneva. http://laborsta.ilo.org (accessed January 29, 2009).

Ianchovichina, E., and R. McDougall. 2001. Theoretical Structure of Dynamic GTAP, GTAP Technical Paper No. 17. https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=480 (accessed January 22, 2009).

Lohmar, B., and F. Gale. 2008. Who Will China Feed? Amber Waves, Issue 6, Vol. 3 -June 2008, Economic Research Service, United States Department of Agriculture (USDA).

Martin, W., E. Ianchovichina, and B. Dimaranan. 2008. Economic Development in Emerging Asian Markets: Implications for Europe. *European Review of Agricultural Economics* 35(3): 303-330.

Moss, J., S. McErlean, P. Kostov, M. Patton, P. Westhoff, and J. Binfield. 2002. Analysis of the Impact of Decoupling on Agriculture in the UK. Department of Agricultural and Food Economics, Queen's University Belfast and Food and Agricultural Policy Research Institute, University of Missouri, November 2002. https://statistics.defra.gov.uk/esg/reports/decoupling/QueenUni.PDF (accessed June 2, 2010).

Narayanan, B.G., and T.L. Walmsley. 2008. Global Trade, Assistance, and Production: The GTAP 7 Data Base, Center for Global Trade Analysis, Purdue University.

Nin, A., T. Hertel, K. Foster, and A. Rae. 2004. Productivity growth, catching-up and uncertainty in China's meat trade. *Agricultural Economics* 31(1):1-16.

OECD. 2008. The PSE Manual, OECD's Producer Support Estimate and Related Indicators of Agricultural Support: Concepts, Calculations, Interpretation and Use. Trade and Agriculture Directorate, Organisation for Economic Co-operation and Development, July 2008.

Poncet, S. 2006. The Long Term Growth Prospects of the World Economy: Horizon 2050. CEPII Working Papers No 2006-16, Centre d'études prospectives et d'informations internationales, Paris.

Telleria, R., C. Ludena, B. Shankar, and R. Bennett. 2009. Would a Free Trade Agreement Between Bolivia and the United States Prove Beneficial to Bolivian Households? *Journal of International Agricultural Trade and Development* 5(1):133-170.

TheBeefSite. 2009. European Union: Beef Self Sufficiency Decreasing, Thursday, December 03, 2009. TheBeefSite Newsletter 9th December 2009. http://www.thebeefsite.com/news/29191/beef-self-sufficiency-decreasing (accessed February 3, 2010).

USDA. 2009a. EU-27 Livestock and Products Annual 2009. GAIN Report Number: NL9022, Global Agricultural Information Network, USDA Foreign Agricultural Service.

USDA. 2009b. Corn: Trade, Briefing Rooms, Economic Research Service, United States Department of Agriculture (USDA). http://www.ers.usda.gov/Briefing/Corn/trade.htm (accessed February 3, 2010).

USDA. 2008. India Livestock and Products Annual 2008. GAIN Report Number: IN8098, Global Agricultural Information Network, USDA Foreign Agricultural Service.

United Nations. 2008. World Population Prospects: The 2008 Revision Population Database, United Nations Population Division, New York. http://esa.un.org/unpp (accessed January 29, 2009).

Valenzuela, E., D. van der Mensbrugghe, and K. Anderson. 2009. "General Equilibrium Effects of Price Distortions on Global Markets, Farm Incomes and Welfare", pp 503-560, Ch. 13 in Distortions to Agricultural Incentives: A Global Perspective, 1955 to 2007, edited by K. Anderson, London: Palgrave Macmillan and Washington DC: World Bank, October.

WTO. 2008. Revised draft modalities for agriculture, 6 December 2008, Chairperson's texts 2008, Agriculture Negotiations, World Trade Organization [TN/AG/W/4/Rev.4]. http://www.wto.org/english/tratop_e/agric_e/agchairtxt_dec08_a_e.doc (accessed January 22, 2009).

Walsh, K., M. Brockmeier, and A. Matthews. 2007. Implications of Domestic Support Disciplines for Further Agricultural Trade Liberalization. *Journal of International Agricultural Trade and Development* 3(2):173-198

Windhorst, H.-W. 2005. The time-spatial dynamic of global pigmeat production and trade. European Enterisol® Ileitis Symposium, October 13 – 15, 2005, Barcelona, Spain.

Windhorst, H.W. 2003. Patterns of EU poultry meat production and trade. Country report, World Poultry, Volume 19, No. 9, AgriWorld Netherlands.

Yijun Han, and T. Hertel. 2003. The Puzzling State of China's Meat Trade. *Choices* 18(2). American Agricultural Economics Association.
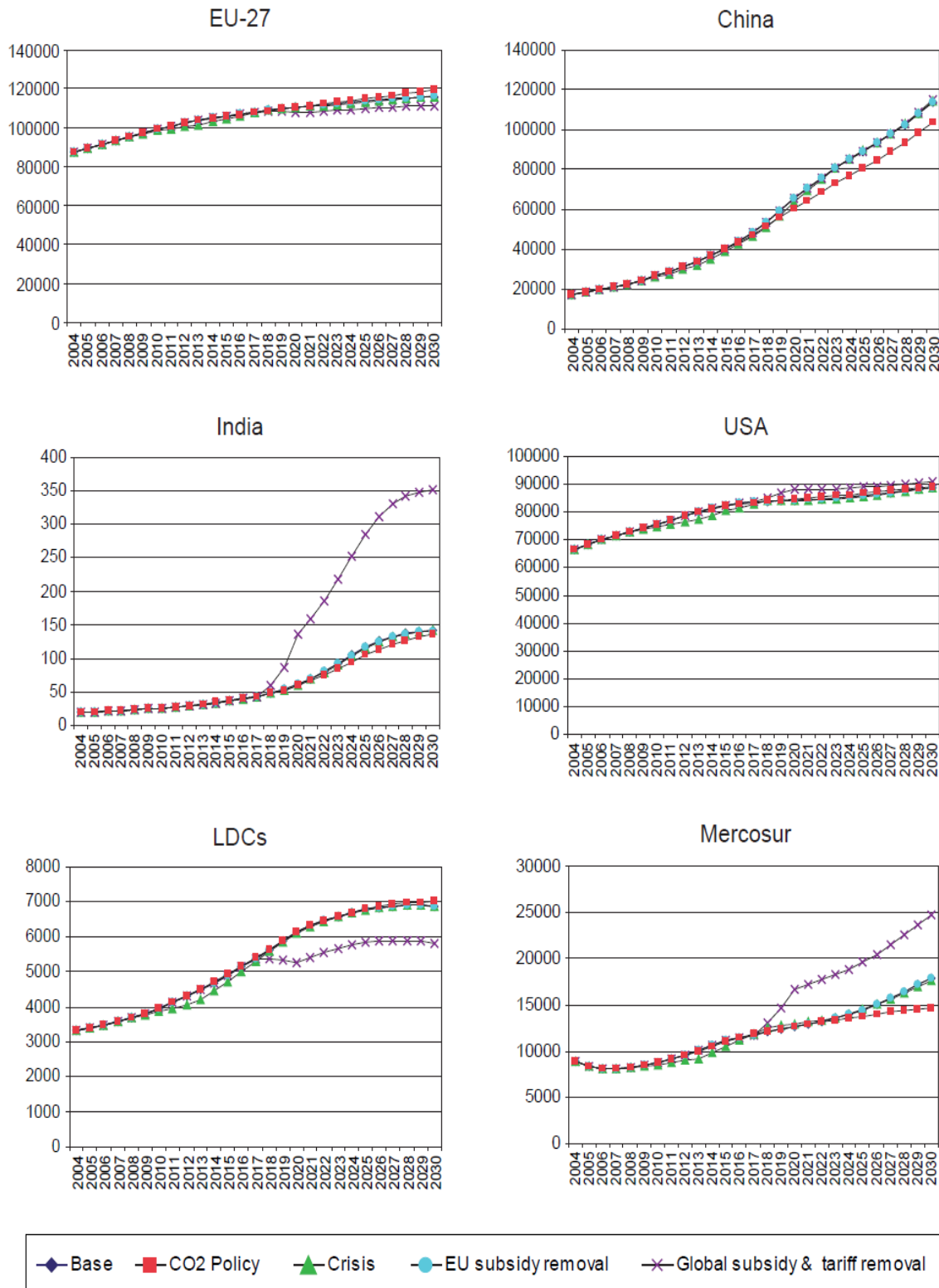
Appendix 1

Bovine meat production in millions of US dollars: Projections until 2030 for the baseline and four alternative scenarios in different countries and regions.
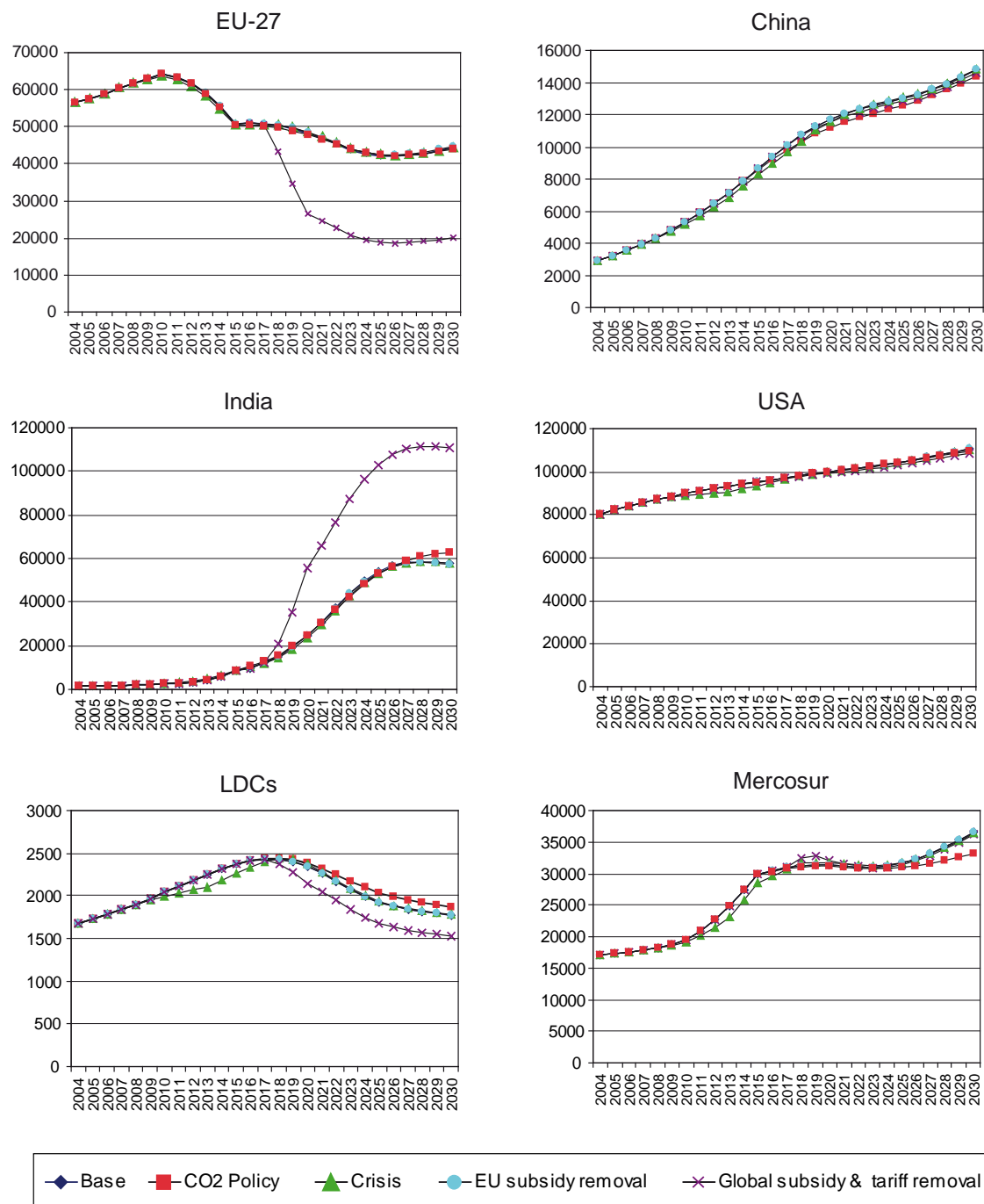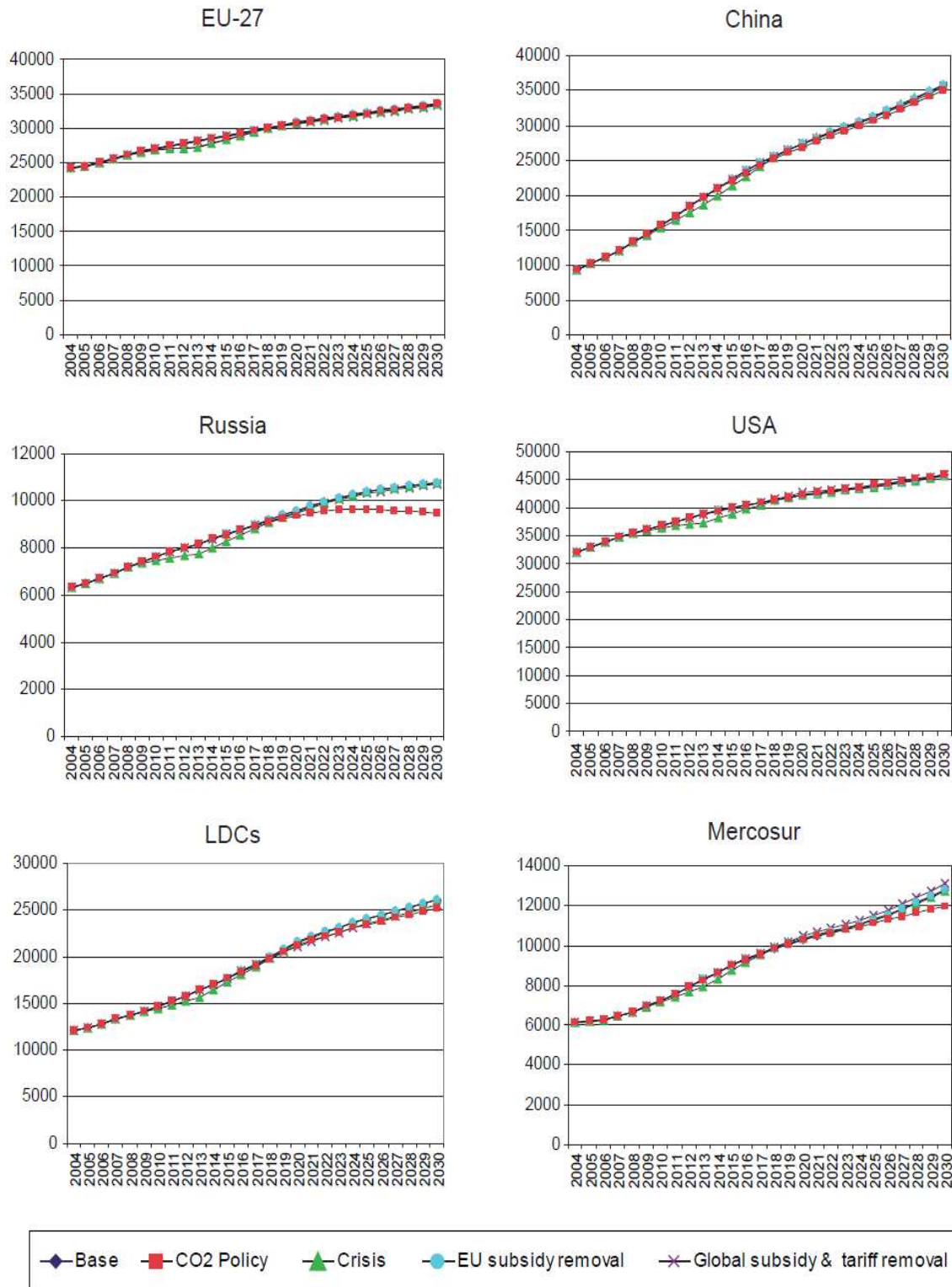
Appendix 2

Poultry and pigmeat production in millions of US dollars: Projections until 2030 for the baseline and four alternative scenarios in different countries and regions.

Appendix 3

Coarse grains production in millions of US dollars: Projections until 2030 for the baseline and four alternative scenarios in different countries and regions.

Ethanol Marketing and Input Procurement Practices of U.S. Ethanol Producers: 2008 Survey Results[1]

Timothy J. Schmidgall[a], Kerry W. Tudor[b], Aslihan D. Spaulding[①c] and J. Randy Winter[d]

[a]*Former Graduate Student, Department of Agriculture, Illinois State University, Campus Box 5020 Normal, IL 61790-5020, U.S.A.*

[b] *Professor, Department of Agriculture, Illinois State University, Campus Box 5020 Normal, IL 61790-5020, U.S.A.*

[c] *Associate Professor, Department of Agriculture, Illinois State University, Campus Box 5020 Normal, IL 61790-5020, U.S.A.*

[d] *Professor, Department of Agriculture, Illinois State University, Campus Box 5020 Normal, IL 61790-5020, U.S.A.*

Abstract

A mail survey was used to collect information about input procurement and ethanol and co-product marketing practices from 60 U.S. ethanol production facilities. Data were used to answer questions about the conduct or behavior of ethanol producers. It was anticipated that firm conduct or behavior would be fairly homogeneous because the ethanol industry was in Stage II of the industry life-cycle, and societal support for ethanol production resulted in large volumes of publicly available information about technology and markets. Age of facility, size of facility, and type of ownership jointly explained a limited number of differences in responses across ethanol facilities, thus supporting the concept of fairly homogeneous conduct or behavior.

Keywords: entry timing, ethanol, farmer-owned cooperatives, industry life-cycle

①Corresponding author:	Tel: + 1 309.438.8091
	Email: adspaul@ilstu.edu
Other contact information:	T. J. Schmidgall: timschmidgall@gmail.com
	K. W. Tudor: ktudor@ilstu.edu
	J. R. Winter: rwinter@ilstu.edu

137

Introduction

Rapid growth of U.S. ethanol production after 2002 can be attributed in part to restrictions on MTBE as a fuel-oxygenate (Solomon et al. 2007). The MTBE ban in Connecticut took effect on October 1, 2003 and bans in California and New York took effect on January 1, 2004 (Energy Information Administration 2003). The substitution of ethanol for MTBE coincides with a threefold increase in ethanol production between 1997 and 2005 (Solomon et al. 2007). Further impetus for expansion of the ethanol industry has been attributed to high crude oil prices, low corn prices, and the blenders' tax credit (Conley and George 2008), the Energy Policy Act (EPAct) of 2005 (109th Congress 2005), which created the Renewable Fuel Standard program, and the Energy Independence and Security Act of 2007 (Congressional Research Service 2007), which mandated that 36 billion gallons of renewable fuels be used annually by 2022.

Expansion of ethanol production and increases in the number of firms producing ethanol has resulted in a rapidly evolving industry and an altered industry structure. In 2007, the industry grew from 110 biorefineries in 19 states to 139 biorefineries in 21 states, and in 2008, 68 biorefineries were under construction or expanding (Renewable Fuels Association 2008). Solomon et al. (2007) reported that the ethanol industry had a four-firm concentration ratio of 32 percent and, significantly, the share of annual U.S. production generated by Archer Daniels Midland, one of the earliest and largest producers, had decreased from 75 percent in 1990 to 19 percent in 2005.

Gort and Klepper (1982) described five stages that commonly transpire during the life-cycle of an industry. Stage I begins with the introduction of a product and its length depends upon 1) the ease of copying the innovating firm(s); 2) the size of the market; 3) the number of potential entrants; and 4) the speed with which technological information is dispersed. Subsequently, Stage II includes a rapid increase in the number of firms producing the product. Stage I for the ethanol industry was lengthy because the size of the market remained limited for most of the 20th century. Tetraethyl lead, and later MTBE, were the preferred octane enhancers and oxygenates for gasoline (Solomon et al. 2007) and, with the exception of occasional supply disruptions, inflation-adjusted gasoline prices remained relatively low throughout the 20th century. However, in 2008, the ethanol industry was unabashedly in Stage II of the industry life-cycle.

Gort and Klepper hypothesized that the probability of entry of new firms in Stage II of the industry life-cycle depends upon firms' abilities to maximize returns on organization capital. Organization capital, as distinguished from human capital, consists of information about new product technology. It includes knowledge and skills that pertain to production processes as well as characteristics of the market for the new product, and it may be obtained from two sources: 1) firms operating in the focal market at a given point in time; and 2) entities external to the current set of producers. The former emanates from the experiences of firms producing a particular product, and has both transferable and non-transferable components. The transferable components are available to other firms, whereas the non-transferable components are the property of the producer and accumulate over time. The stock of accumulated, non-transferable information eventually tends to act as a barrier to entry into the industry. On the other hand, information from the latter source, some of which may come from firms in technologically related markets, from non-affiliated inventors, or from equipment manufacturers, has positive

effects on firm entry. The authors further hypothesized that most technological innovations in Stage II of the product life-cycle are driven by information from entities external to the current set of producers. Based upon life-cycle observations of 46 products, Gort and Klepper concluded that the number and composition of firms in a market are influenced by technical change and the flow of information among firms, both existing and potential.

Eisenhardt and Martin (2000) viewed the firm knowledge creation process as a crucial dynamic capability, which they defined as:

> *The firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die.*

The authors noted that "gatekeepers" at high-technology firms often possess explicit linkages to outside sources, including scientists at other firms, government laboratories, and universities, from whom they may collect information about technologies and markets.

Helfat and Lieberman (2002) discussed resources, defined as stocks of factors that are owned or controlled by a firm, and capabilities, defined as a firm's capacity to organize and utilize resources for desired end results, and the relationship of both to market entry. The authors noted that firms make entry decisions at multiple points during the life-cycle of an industry because shifts in technology or the state of business practices force firms to decide if they will participate in the next phase of the industry. Diversifying entrants, defined as established firms that enter new or established markets by internal growth or acquisition, tend to enter industries where existing firm resource and capability profiles match their own. For entrepreneurial start-ups, firms with no prior employment or financial ties with already-existing firms in the industry, pre-entry knowledge of industry suppliers and customers can be a valuable resource. Helfat and Lieberman discussed specialized resources, which include relationships with buyers and suppliers, and specialized capabilities, which include marketing and distribution activities tailored to the industry. The authors noted that pre-entry resources and capabilities likely affect the initial success of entry as well as long-run survival rates and market shares.

Bayus and Agarwal (2007) studied pre-entry experiences, entry timing, product technology strategies, and firm survival in the U.S. computer industry. They concluded that diversifying entrants were more likely to migrate to the industry technology standard when it was known, thus enjoying higher survival rates in the early years of the industry life-cycle. Among later entrants, entrepreneurial startups were more likely to offer the newest technology, thus realizing higher survival rates in later years. The authors suggested that "dominance by birthright" did not exist in the computer industry, but they were unwilling to generalize the results of their study to other industries without further research.

Goldsmith and Gow (2005) discussed establishment of long-jump, value-added ventures as responses to structural change in agriculture. Long-jump ventures were defined as new firms whose required core competencies were outside the core competencies of the principals of the firm, for example, farmers who established value-added cooperatives. The authors emphasized

that establishment of such ventures is a challenge to farmers because it forces them to strategically reposition and to acquire the competencies and knowledge necessary to compete in new markets. Vertical integration by farmers requires relationships with agencies outside the firm in order to acquire tacit knowledge, which may be difficult to copy or convey. Such relationships may require producer-owners to exchange ownership or control for knowledge. The concept of long-jump ventures is relevant to the ethanol industry because, as reported by Solomon et al. in 2007, 43 percent of the industry's mills "are owned by 'family-farm' cooperatives."

Input Procurement and Product Marketing in the Ethanol Industry

Mode of entry (diversifying entrant vs. *de novo* entrant) and entry timing (early entrant vs. late entrant) theoretically influence initial success of entry as well as long-run survival rates and market shares of firms. Because the ethanol industry was arguably in Stage II of the industry life-cycle in 2008, it was not feasible to analyze the long-run performance of late-entering firms. However, it was possible to observe the conduct or behavior of existing firms, particularly procurement and marketing activities, from a cross-sectional perspective. Porter (2004) proposed that industry structure and the actions of firms in the marketplace are mutually dependent. Furthermore, Weerawardena (2003) suggested that researchers explore the relationship between marketing capabilities and innovative and entrepreneurial firm behavior.

This study focused on the input procurement and product marketing activities of ethanol producers from a cross-sectional perspective. It was anticipated that because the ethanol industry was in Stage II of the industry life-cycle in 2008, much of the information about technology and markets was obtained from entities external to existing producers, and the information was fairly homogeneous. Subsequently, marketing and procurement conduct or behavior was fairly homogeneous across firms, even when comparing early-entry firms to late-entry firms and when comparing farmer-owned cooperatives to other firms. Results of the study provide cross-sectional information about the ethanol industry during a period of dynamic expansion, and the results should be of interest to active managers, owners, and management scholars.

Methodology

A questionnaire was designed to collect information about ethanol and co-product marketing, feedstock procurement, and related topics. Survey recipients were presented with a list of ethanol co-products and asked to identify those that were produced at their facility. Survey recipients were also asked to identify whether their ethanol and co-product marketing was conducted in-house, through a marketing firm, or through a larger ethanol producer. The term "in-house" was not defined in the questionnaire, but it had been utilized by Sims (2008a) in an *Ethanol Producer Magazine* article entitled Managing Risk Through Marketing Methods. Survey recipients who outsourced marketing were asked to identify terms of sale with the marketer, and those who utilized in-house marketing activities were asked to identify the types of arrangements or agreements that they had utilized. The list of arrangements or agreements from which survey recipients could choose was based upon a list compiled by the Illinois Institute of Rural Affairs (Brown et al. 2007), and it included consortium agreement, marketing agreement, independent marketing entity, exchange agreement, time trades, and credit trading agreement. A consortium

agreement allows several smaller producers to physically pool their products and reduce per-unit transportation expenses, and a marketing agreement permits a smaller producer to market its product through a larger producer. An independent marketing entity may be formed by multiple smaller producers to market a larger pool of product, but the entity is subject to anti-trust regulations. An exchange agreement represents a non-physical exchange of product between two producers so that product is closer to the end users and transportation costs are considerably reduced. Time trades allow producers to obtain product from another producer during scheduled maintenance periods or when unplanned production interruptions occur, and credit trading agreements permit credits to be traded so that those blenders in adverse geographic locations relative to ethanol need not blend ethanol. Finally, recipients were asked to identify the modes of transportation utilized to transport their ethanol and co-products.

With respect to feedstock procurement, survey recipients were asked to identify the types of feedstock that they were utilizing, whether they utilized in-house procurement activities or depended upon a marketing firm, and the types of contracts or arrangements that were utilized to procure feedstock. The list of potential contracts or arrangements was derived from a list provided by Dakota Ethanol (n.d.), and it included basis contract, cash forward contract, cash sale, delayed price contract, and minimum price contract. Furthermore, survey recipients were asked to rate statements that pertained to availability of and access to feedstock and to indicate if their facility could switch from one type of feedstock to another. Lastly, recipients were requested to identify the modes of transportation utilized to transport feedstock to their facility.

With regard to general information, survey recipients were asked to rank six items that were presented as potential challenges to ethanol producers and also to rate the importance of ten items that potentially affect plant location decisions. Some of the location factors presented to survey recipients were drawn from a study by Lambert et al. (2008). Finally, survey recipients were asked if the Renewable Fuel Standard (RFS) program impacted their production plans, and if they planned to expand ethanol production. The final draft of the questionnaire was approved by the Institutional Review Board (IRB) at Illinois State University.

The Renewable Fuels Association website was used to identify 191 U.S. ethanol production facilities, and a mail survey was conducted utilizing procedures suggested by Salant and Dillman (1994). A notification post card was sent to the marketing manager of each identified production facility two weeks prior to the first mailing of the questionnaire. At two-week intervals, there was a first-mailing of the questionnaire, a reminder post card, and a second-mailing of the questionnaire. Two weeks after the second-mailing of the questionnaire, all non-respondents of record were contacted by telephone. If the contacted company representative expressed an interest in survey participation during the telephone conversation, a third copy of the questionnaire was sent to the company address. All survey recipients were offered a printed summary of survey responses.

Data collected by the survey were analyzed using SAS procedures (SAS Institute, Inc., Cary, NC). Questions that generated binary or ordinal outcomes were analyzed with PROC LOGISTIC. Independent variables were age of the facility in years as reported by respondents, millions of gallons of ethanol produced annually as reported by the Renewable Fuels Association, and a binary variable that represented type of ownership (farmer-owned cooperative

vs. other). The purpose of logistic regression analysis was to determine if time of entry, as reflected by age of facility, and type of ownership impacted the conduct or behavior of ethanol producers after controlling for the possible impact of scale, as reflected by millions of gallons of ethanol produced. For the six challenge items that were ranked by survey respondents, PROC PHREG was used to determine if ranks differed between older facilities (in production for five or more years) and newer facilities (in production for fewer than five years) or between farmer-owned cooperatives and other types of firms. The analysis was based upon procedures outlined by Allison and Christakis (1994). Significance at the 0.01, 0.05, and 0.10 levels was reported.

Summary of Survey Results

Of the 191 questionnaires that were mailed, 60 usable questionnaires were returned for a response rate of 31.4%. The average age of facilities was 6.9 years, and the reported range was 0.08 years (1 month) to 28 years. Respondents produced an average of 61.6 million gallons of ethanol per year, whereas non-respondents produced an average of 57.6 million gallons of ethanol per year. The difference in production between respondents and non-respondents was not significant at the 0.05 level; therefore there did not appear to be a size bias in the collected data. Seventeen of 59 recipients who reported type of ownership indicated that their facility was affiliated with a farmer-owned cooperative. However, of the 24 newest facilities from which responses were received, only three were farmer-owned cooperatives. That result was consistent with the observation by Brown et al. (2007) that farmers had, by and large, shifted their investments from small, farmer-owned dry grind plants that gained popularity in the late 1990s to LLCs due to rising construction costs and larger capital requirements. With respect to age of facilities, there was no difference ($P = 0.79$) between farmer-owned cooperatives (6.0 ± 4.0 years) and other types of firms (5.5 ± 8.2 years). With respect to quantity of ethanol produced, farmer-owned cooperatives produced fewer gallons numerically (48.3 ± 24.0 million gallons vs. 67.2 ± 44.7 million gallons), but the difference was not significant ($P = 0.11$). Age of facility and gallons of ethanol produced were positively and significantly correlated ($P > F = 0.002$), but the computed R^2 value was low (0.17).

All reporting facilities utilized corn as a feedstock (Table 1). Less frequently used feedstocks included sorghum, which was utilized by six facilities (10.0%) and sugarcane and waste starches, each used by one facility (1.7%).

Table 1. Types of feedstock utilized by reporting facilities.

Feedstock	Number of facilities	% Responding facilities
Corn	60	100.0
Sorghum	6	10.0
Sugarcane	1	1.7
Waste starches	1	1.7

With regard to procurement channels, 50 facilities (83.3%) conducted some or all of their feedstock procurement activities in-house, and 15 facilities (25.0%) procured feedstock through a marketing firm (Table 2). The most common procurement arrangement was cash sale, which was utilized by 50 facilities (83.3%), and the second most common arrangement was utilization of basis contracts, which was selected by 47 respondents (78.3%). Cash forward contracts were

utilized by 39 facilities (65.0%), delayed price contracts were utilized by 27 facilities (45.0%), and minimum price contracts were utilized by 15 facilities (25.0%). Six facilities (10.0%) used "other" procurement arrangements, including two that utilized hedge-to-arrive contracts.

Table 2. Feedstock procurement procedures and arrangements.

	Number of facilities	*% Responding facilities*
Procurement channel[a]		
In-house	50	83.3
Through a marketing firm	15	25.0
Procurement arrangement[a]		
Cash sale	50	83.3
Basis contract	47	78.3
Delayed price contract	27	45.0
Cash forward contract	39	65.0
Minimum price contract	15	25.0
Other	6	10.0

[a] Respondents could select one or more.

Respondents were asked to gauge access to and availability of feedstock at their facility (Table 3). Specifically, respondents were asked to select either "all of the time," "sometimes'", or "never" as responses to the following statements: 1) we have easy access to feedstock, and 2) feedstock is readily available. The terms easy access and readily available were not defined in the questionnaire. The vast majority of respondents believed that they had easy access to feedstock all of the time (87.5%) and they perceived that feedstock was readily available all of the time (90.7%).

Table 3. Respondent perceptions of access to feedstock and feedstock availability.

	All of the time		**Sometimes**		**Never**	
	Number of facilities	*Percent*	*Number of facilities*	*Percent*	*Number of facilities*	*Percent*
Easy access to feedstock	49	87.5	6	10.7	1	1.8
Feedstock readily available	49	90.7	4	7.4	1	1.9

When asked about flexibility related to feedstock utilization, 22 respondents (36.7%) stated that their facility could switch from one feedstock to another, whereas 44 respondents (73.3%) indicated that they were limited to one type of feedstock (Table 4). Thirteen of the 44 respondents who reported a feedstock limitation indicated that their limitation was wholly or partially due to lack of access to an alternative feedstock, and 33 of the 44 stated that their feedstock limitation was wholly or partially due to the technology that they had in place. Sixteen respondents (26.7%) reported that they were exploring alternative feedstocks, and 10 respondents (16.7%) indicated that they were planning to update their facility at some unspecified time in the future in order to accommodate multiple feedstocks.

Table 4. Flexibility of feedstock utilization and activities related to potential upgrades.

	Yes	
	Number of facilities	*% Responding facilities*
Ability to switch from one feedstock to another?	22	36.7
Limited to one type of feedstock?	44	73.3
Exploring alternative feedstocks?	16	26.7
Planning to update facility to accommodate multiple feedstocks?	10	16.7

The most common co-product marketed by surveyed ethanol facilities was dry distillers grain (83.3%), and the least common co-product was whole stillage (5.0%) (Table 5). Wet distillers grain was marketed by 38 facilities (63.3%), modified distillers grain was marketed by 26 facilities (43.3%), and CO_2 was marketed at 17 facilities (28.3%). Fourteen respondents reported marketing "other" co-products, eight of whom reported extraction and sale of corn oil and five of whom reported production and sale of syrup.

Table 5. Marketed co-products.

Co-product	*Number of facilities*	*% Responding facilities*
Distillers grain - dry	50	83.3
Distillers grain - wet	38	63.3
Modified distillers grain	26	43.3
CO_2	17	28.3
Other	14	23.3
Thick stillage	7	11.7
Thin stillage (sweetwater)	7	11.7
Whole stillage	3	5.0

Most facilities marketed ethanol and co-products through a marketing firm (Table 6). Forty-five facilities (75%) marketed ethanol through a marketing firm, whereas 20 facilities (33.3%) marketed ethanol in-house, and two (3.3%) marketed ethanol through a larger ethanol producer. Thirty-seven facilities (61.7%) marketed co-products through a marketing firm, and 32 facilities (53.3%) marketed co-products in-house. As with ethanol, only two facilities reported the marketing of co-products through a larger producer.

For facilities that utilized marketing arrangements or agreements, marketing agreements were most common for both ethanol and co-products. Twenty facilities (33.3%) utilized marketing agreements when marketing ethanol, and 15 facilities (25.0%) utilized marketing agreements when marketing co-products. The second most common type of marketing arrangement for ethanol was the consortium agreement, utilized by 12 facilities (20.0%). The least commonly used arrangement for both ethanol and co-products was the credit trading agreement, where three facilities (5.0%) used the agreement for ethanol and one facility (1.7%) reported using the agreement for co-products. Eight facilities reported using "other" types of marketing arrangements for ethanol, and 10 facilities reported using "other" marketing arrangements for co-products, the most common of which were direct sale or cash.

Table 6. Marketing channels and marketing arrangements for ethanol and co-products.

	Ethanol		Co-products	
	Number of facilities	*% Responding facilities*	*Number of facilities*	*% Responding facilities*
Marketing channel[a]				
In-house	20	33.3	32	53.3
Through a marketing firm	45	75.0	37	61.7
Through a larger ethanol producer	2	3.3	2	3.3
Marketing arrangement[a]				
Consortium	12	20.0	7	11.7
Credit trading	3	5.0	1	1.7
Independent marketing	8	13.3	6	10.0
Exchange agreement	5	8.3	3	5.0
Time trade	4	6.7	3	5.0
Marketing agreement	20	33.3	15	25.0
Other	8	13.3	10	16.7

[a] Respondents could select one or more.

For facilities that outsourced marketing, the most common terms of sale agreement with the marketer was cash (Table 7). Twenty-four facilities outsourced using cash terms, while 20 outsourced using credit terms, one outsourced using collateral, and two outsourced using "other" terms of sale.

Table 7. Terms of sale for facilities that outsource marketing.

Terms of sale	*Number of facilities*	*% Responding facilities*
Cash	24	40.0
Credit	20	33.3
Collateral	1	1.7
Other	2	3.3

Truck was the dominant mode of transportation when transporting feedstock and co-products (Table 8). Fifty-eight facilities (96.7%) transported feedstock by truck and 57 facilities (95.0%) transported co-products by truck. For ethanol, modes were more evenly split between truck and rail. Fifty-seven facilities (95.0%) utilized trucks to transport ethanol, and 55 facilities (91.7%) utilized rail to transport ethanol. Barges were utilized infrequently, but co-products were more likely than feedstock or ethanol to be transported by that mode. Ten respondents (16.7%) reported shipping co-products by barge.

Table 8. Modes of transportation for feedstock, ethanol, and co-products.

	Truck		Rail		Barge	
	Number of facilities	*% Responding facilities*	*Number of facilities*	*% Responding facilities*	*Number of facilities*	*% Responding facilities*
Feedstock	58	96.7	30	50.0	3	5.0
Ethanol	57	95.0	55	91.7	6	10.0
Co-products	57	95.0	44	73.3	10	16.7

With regard to factors that potentially affect the locations of ethanol facilities, the factor that was most often identified as "not important" was access to a river (Table 9). That outcome was consistent with responses pertaining to modes of transportation in Table 8, where barges were reportedly used less frequently than truck or rail. On the other hand, location factors that were identified as "very important" by at least 90% of respondents included access to rail (96.6%), access to highways (94.9%), and access to feedstock (93.3%). Those results were consistent with Lambert et al. (2008), who reported that transport infrastructure and access to feedstock represented two of the more important factors in the ethanol plant location decision. Other location factors that were identified as "very important" by less than 50% of respondents included ease of obtaining permits (35.6%), local and state taxes (15.3%), and tax incentives (33.9%).

Table 9. Perceived importance of ethanol facility site factors.

	Not important		Somewhat important		Very important	
Factor	*Number of facilities*	*Percent*	*Number of facilities*	*Percent*	*Number of facilities*	*Percent*
Access to rail	1	1.7	1	1.7	57	96.6
Access to river	33	56.9	18	31.0	7	12.1
Access to highways	0	0.0	3	5.1	56	94.9
Access to water	3	5.1	5	8.5	51	86.4
Access to feedstock	0	0.0	4	6.7	56	93.3
Ease of permits	3	5.1	35	59.3	21	35.6
Local/state taxes	7	11.9	43	72.9	9	15.3
Tax incentives	7	11.9	32	54.2	20	33.9
Community support	6	10.2	19	32.2	34	57.6
Distance to feedstock	2	3.3	14	23.3	44	73.3

Respondents perceived input costs to be the most challenging of six potential challenges presented to them (average rank = 1.7) (Table 10). The second most challenging was government policy (average rank = 3.0) followed by the media (average rank = 3.5) and public perception (average rank = 3.7). The least challenging of the six potential challenges, as perceived by respondents, were competition (average rank = 4.0) and livestock producers (average rank = 5.0).

Table 10. Ranks of potential challenges to ethanol producers.

Challenge	Average rank[a]
Input costs	1.7
Government policy	3.0
Media	3.5
Public perception	3.7
Competition	4.0
Livestock producers	5.0

[a] 1 = most challenging; 6 = least challenging.

Statistical Analysis

Statistics provided for logistic regression analysis (Tables 11 through 13) include: 1) a regression parameter estimate (β) for each of the three explanatory variables, age of facility, size of facility (millions of gallons of ethanol produced), and type of ownership (farmer-owned cooperative vs. other); 2) an odds ratio (exp(β)) for each of the three explanatory variables; 3) the likelihood ratio χ^2 statistic for testing the hypothesis that the explanatory variable βs jointly equal zero; 4) the probability of a larger likelihood ratio χ^2 value; and 5) number of observations used to estimate each equation. Statistics were reported separately for variables related to feedstock procurement (Table 11), ethanol and co-product marketing (Table 12), and more general survey items (Table 13).

Of 14 equations related to feedstock procurement activities, four had at least one significant estimated parameter (if PROC LOGISTIC indicated that the validity of the model fit was questionable, parameter statistics were not reported). Age of facility was statistically significant in equations for 1) in-house procurement activities ($P < 0.10$) and 2) utilization of minimum price contracts ($P < 0.10$). The signs of both β values were positive indicating that older facilities were more likely to utilize in-house procurement activities and minimum price contracts for feedstock procurement. The estimated odds ratios indicate that the odds of a facility using in-house procurement activities increase by approximately 45% with each additional year of age, and the odds of a facility using a minimum price contract increase by approximately 10% with each additional year of age after controlling for quantity of ethanol produced and category of ownership.

Size of facility (millions of gallons produced) was statistically significant in equations for 1) utilization of minimum price contracts ($P < 0.10$) and 2) transport feedstock by truck-only ($P < 0.05$). Larger facilities were less likely to utilize minimum price contracts and less likely to transport feedstock by truck-only, or alternatively, smaller facilities were more likely to utilize minimum price contracts and more likely to transport feedstock by truck-only. The odds that a facility would utilize minimum price contracts for feedstock procurement increase by approximately 3% for every million gallon decrease in ethanol production, and the odds that a facility would transport feedstock by truck-only increase by approximately 4.5% for every million gallon decrease in ethanol production.

Type of ownership was a statistically significant binary explanatory variable in equations for 1) utilization of basis contracts ($P < 0.10$) and 2) transport by truck-only ($P < 0.05$). Farmer-owned cooperatives were less likely to utilize basis contracts for feedstock procurement and more likely to transport feedstock by truck-only. The odds that a farmer-owned cooperative would utilize basis contracts are 0.27 times the odds that another type of firm would use basis contracts, and the odds that a farmer-owned cooperative would transport feedstock by truck-only are 8.1 times the odds that another type of firm would transport feedstock by truck-only.

Table 11. Logistic regression results for questionnaire items related to feedstock procurement.

Dependent variable	Years in production		Mil. gallons produced		Farmer-owned coop		Global H$_0$: β=0		
	Estimate (β)	Odds ratio	Estimate (β)	Odds ratio	Estimate (β)	Odds ratio	Likelihood ratio[a] χ²	Pr>χ²	n
Procurement channel:									
In-house	0.371*	1.449	0.048	1.049	-0.203	0.667	9.216	0.027	55
Marketing firm	-0.104	0.901	-0.009	0.991	0.336	1.959	3.988	0.263	55
Procurement arrangement:									
Procurement: cash	0.014	1.014	-0.001	0.999	0.532	2.899	1.221	0.748	55
Procurement: basis contract	0.012	1.012	-0.002	0.998	-.0661*	0.267	3.429	0.330	55
Procurement: delayed price contract	-0.017	0.983	0.002	1.002	0.312	1.867	1.120	0.772	55
Procurement: cash forward	0.006	1.006	-0.005	0.995	0.057	1.121	0.632	0.889	55
Procurement: minimum price contract	0.096*	1.101	-0.031*	0.970	0.220	1.553	9.042	0.029	55
Feedstock:									
Easy access feedstock	0.016	1.016	0.012	1.012	-0.120	0.787	0.739	0.864	51
Feedstock readily available	0.172	1.187	0.007	1.007	-0.697	0.248	2.211	0.530	50
Flexibility to switch feedstock	0.028	1.029	-0.010	0.990	-0.345	0.502	2.149	0.542	54
Limited to one feedstock	0.064	1.066	-0.000	1.000	-0.398	0.451	3.670	0.299	55
Exploring alternative feedstock	-0.001	0.999	-0.006	0.994	0.310	1.859	1.646	0.649	55
Planning to update facility	-0.043	0.958	0.008	1.008	0.469	2.555	1.569	0.667	52
Transport by truck-only	0.022	1.023	-0.045**	0.956	1.045**	8.091	22.610	<0.0001	55

[a] 3 degrees of freedom.
* indicates significance at 0.10 level; ** indicates significance at 0.05 level.

148

Table 12. Logistic regression results for questionnaire items related to ethanol and co-product marketing.

Dependent variable	Years in production Estimate (β)	Odds ratio	Mil. gallons produced Estimate (β)	Odds ratio	Farmer-owned coop Estimate (β)	Odds ratio	Global H_o: β=0 Likelihood ratio[a] χ^2	Pr> χ^2	n
Co-products:									
Distillers grain-wet	-0.010	0.990	0.000	1.000	0.176	1.420	0.345	0.951	55
Distillers grain-dry	-0.101*	0.904	0.015	1.015	0.804	4.993	5.630	0.131	55
Modified distillers grain	-0.227**	0.797	0.013	1.013	0.238	1.610	12.517	0.006	55
Thick stillage	-0.002	0.998	-0.008	0.992	0.244	1.628	0.854	0.837	55
Whole stillage	-0.111	0.895	0.011	1.011	0.224	1.565	0.918	0.821	55
Thin stillage (sweetwater)	-0.113	0.893	0.004	1.004	0.062	1.131	1.723	0.632	55
CO_2	0.016	1.016	0.003	1.003	0.036	1.074	0.438	0.932	55
Ethanol marketing channel:									
In-house	0.192**	1.212	0.026**	1.026	-0.102	0.815	16.549	0.001	55
Marketing firm	-0.162**	0.850	-0.007	0.993	0.589	3.249	14.399	0.002	55
Co-product marketing channel:									
In-house	0.164**	1.178	0.027**	1.027	-0.283	0.568	12.310	0.006	55
Marketing firm	-0.136**	0.873	-0.011	0.989	0.332	1.941	11.040	0.012	55
Outsource marketing, terms of sale:									
Cash	-0.104	0.901	-0.008	0.992	0.071	1.152	4.936	0.177	55
Credit	-0.128	0.880	-0.010	0.990	-0.524	0.351	8.558	0.036	55
Marketing arrangement:									
Ethanol: consortium	0.050	1.052	-0.008	0.992	-0.270	0.583	1.527	0.676	55
Co-products: consortium	-0.044	0.957	-0.039	0.962	-0.083	0.848	2.977	0.395	54
Ethanol: independent marketing	0.011	1.011	-0.019	0.981	0.175	1.419	1.979	0.577	55
Co-products: independent marketing	-0.040	0.960	-0.019	0.981	-0.396	0.453	1.601	0.659	55
Ethanol: exch. agreement	0.131*	1.140	0.000	1.000	0.696	4.025	4.783	0.188	55
Co-products: exch. agreement	-0.699	0.497	-0.174	0.840	0.033	1.067	5.673	0.129	55
Ethanol: marketing agreement	-0.051	0.950	0.006	1.006	0.292	1.792	1.688	0.640	55
Co-products: marketing agreement	-0.174**	0.840	0.019*	1.019	0.615	3.422	7.754	0.051	55
Transport by truck-only:									
Ethanol	0.022	1.022	0.004	1.004	0.880	5.808	1.989	0.575	53
Co-products	-0.015	0.985	-0.007	0.993	-0.469	0.392	1.856	0.603	52

[a] 3 degrees of freedom.

* indicates significance at 0.10 level; ** indicates significance at 0.05 level.

Table 13. Logistic regression results for questionnaire items generally related to procurement and marketing.

Dependent variable	Years in production Estimate (β)	Odds ratio	Mil. gallons produced Estimate (β)	Odds ratio	Farmer-owned coop Estimate (β)	Odds ratio	Global H$_o$: β=0 Likelihood ratio[a] χ^2	Pr> χ^2	n
Importance of site factors:									
Rail access	0.097	1.101	-0.018	0.982	-0.584	0.311	1.193	0.755	54
River access	0.068	1.070	0.007	1.007	0.291	1.788	6.742	0.081	53
Access to water	0.055	1.057	0.018	1.019	-0.215	0.650	1.975	0.578	54
Access to feedstock	0.492	1.635	0.046	1.047	-0.170	0.712	4.348	0.226	55
Ease of obtaining permits	-0.018	0.982	0.006	1.006	-0.106	0.809	0.946	0.814	54
Local/state taxes	-0.037	0.964	0.005	1.005	0.083	1.180	0.707	0.872	54
Tax incentives	-0.056	0.946	0.004	1.004	0.050	1.105	1.817	0.611	54
Community support	-0.052	0.949	-0.003	0.997	0.110	1.245	3.156	0.368	54
Distance to feedstock	0.041	1.042	-0.007	0.993	-0.384	0.464	1.736	0.629	55
Planning:									
RFS impacts production plans	0.058	1.060	0.007	1.007	0.874**	5.748	10.949	0.012	54
Planning to expand	-0.020	0.981	-0.004	0.996	0.102	1.227	0.775	0.855	53

[a] 3 degrees of freedom.
* indicates significance at 0.10 level; ** indicates significance at 0.05 level.

Of 23 equations related to ethanol and co-product marketing activities, eight contained at least one statistically significant explanatory variable. Age of facility was statistically significant in equations for 1) marketing of dry distillers grain ($P < 0.10$), 2) marketing of modified distillers grain ($P < 0.05$), 3) utilization of in-house ethanol marketing activities ($P < 0.05$), 4) utilization of a marketing firm when marketing ethanol ($P < 0.05$), 5) utilization of in-house co-product marketing activities ($P < 0.05$), 6) utilization of a marketing firm when marketing co-products ($P < 0.05$), 7) utilization of exchange agreements when marketing ethanol ($P < 0.10$), and 8) utilization of marketing agreements when marketing co-products ($P < 0.05$). Older facilities were less likely to market dry distillers grain and modified distillers grain, less likely to utilize a marketing firm when marketing either ethanol or co-products, and less likely to utilize a marketing agreement when marketing co-products. On the other hand, older firms were more likely to utilize in-house activities when marketing either ethanol or co-products and more likely to utilize an exchange agreement when marketing ethanol. For each additional year of age, the odds that a facility would market dry distillers grain decrease by approximately 10%, the odds that a facility would market modified distillers grain decrease by approximately 20%, the odds that a facility would utilize a marketing firm for ethanol marketing decrease by approximately 15%, and the odds that a facility would utilize a marketing firm for co-product marketing decrease by approximately 13%. Lastly, for each additional year of age, the odds that a facility would use in-house ethanol marketing activities increase by approximately 21%, the odds that a facility would use in-house co-product marketing activities increase by approximately 18%, and the odds that a facility would utilize an exchange agreement when marketing ethanol increase by approximately 14%.

Size of facility (millions of gallons produced) was a significant explanatory variable in equations for 1) in-house ethanol marketing activities ($P < 0.05$), 2) in-house co-product marketing activities ($P < 0.05$), and 3) utilization of marketing agreements when marketing co-products ($P < 0.10$). Larger firms were more likely to utilize in-house activities when marketing either ethanol or co-products, and they were more likely to utilize marketing agreements when marketing co-products. The odds that a facility would utilize in-house marketing activities for either ethanol or co-products increase by approximately 3% for each additional million gallons of ethanol produced, and the odds that a facility would utilize marketing agreements when marketing co-products increase by approximately 2% for each additional million gallons of ethanol produced.

With regard to more general survey items, only one of 11 equations contained a single significant explanatory variable. Respondents from farmer-owned cooperatives were more likely to agree with the statement that the RFS program impacted their production plans. The odds that a farmer-owned cooperative respondent would agree with that particular statement were 5.7 times the odds that a respondent from another type of firm would agree with the statement. There were no significant variables in nine equations representing perceived importance of plant site factors.

Logit analysis of six potential challenges to ethanol producers revealed that the average ranks of input costs, government policy, media, public perception, and competition were significantly different from the average rank of livestock producers (Table 14). The odds that a respondent would rank input costs first were approximately 10.6 times the odds that a respondent would

rank livestock producers first, and the odds that a respondent would rank government policy first were approximately 5.4 times the odds that a respondent would rank livestock producers first. All possible pairs of challenges, other than media and public perception, exhibited unequal ranks ($P < 0.05$). The latter result is reflected by the similarity of odds ratios between media and public perception.

Table 14. Logit analysis of challenges ranked by respondents[a].

Challenge	Mean rank	Estimate (β)	Wald χ^2	Odds ratio
Input costs	1.71	2.359***	90.747	10.576
Government policy	2.96	1.694***	47.111	5.441
Media	3.47	1.088***	20.047	2.969
Public perception	3.73	0.983***	16.257	2.673
Competition	4.04	0.535**	4.418	1.708
Livestock producers[b]	5.00			

[a] "Please rank the following from 1 to 6 with 1 being the biggest challenge you face as a producer."
[b] Reference category in Logit model.
** indicates rank is significantly different from rank of livestock producers at 0.05 level;   *** indicates rank is significantly different from rank of livestock producers at 0.01 level.

Table 15. Logit analysis of challenges ranked by respondents[a] with tests for differences by age of facility[b] and type of ownership[c].

Challenge	Estimate (β)	Wald χ^2	Odds ratio
Input costs	1.904***	30.822	6.715
Government policy	1.764***	23.260	5.841
Media	1.074***	9.198	2.926
Public perception	1.025***	8.568	2.786
Competition	0.659*	2.888	1.934
Age x input costs[d]	0.807**	6.442	2.242
Age x government policy[d]	-0.234	0.497	0.792
Age x media[d]	-0.083	0.064	0.920
Age x public perception[d]	-0.041	0.016	0.960
Age x competition[d]	-0.055	0.022	0.947
Ownership x input costs[d]	0.011	0.001	1.011
Ownership x government policy[d]	0.487	1.833	1.627
Ownership x media[d]	0.314	0.776	1.369
Ownership x public perception[d]	-0.050	0.020	0.951
Ownership x competition[d]	-0.303	0.557	0.739

[a] "Please rank the following from 1 to 6 with 1 being the biggest challenge you face as a producer."
[b] Facilities that had been in production for 5 or more years = 1; others = 0.
[c] Farmer-owned cooperatives = 1; others = 0.
[d] Hypothesis that βs jointly equal 0 cannot be rejected ($P >$ Wald χ^2 with 10 d.f. = 0.301).
* indicates significance at 0.10 level; ** indicates significance at 0.05 level; *** indicates significance at 0.01 level.

A test designed to determine if ranks of potential challenges differed between older (≥ 5 years of age) and newer facilities or between farmer-owned cooperatives and other types of firms failed to reveal differences (Table 15). The computed Wald χ^2 statistic associated with the hypothesis that all βs associated with age of firm and type of firm were jointly equal to zero was not significant, indicating that there were no differences in ranks across the two age categories or across the two firm-type categories.

Discussion

This study provided a cross-sectional view of the ethanol industry during a period of rapid expansion, or what is oftentimes referred to as Stage II of the industry life-cycle. The study also represented an attempt to answer questions about the impact of time of entry and cooperative ownership on firm conduct or behavior during Stage II of the industry life-cycle. Results of previous studies imply that information about new technologies and markets comes predominantly from external agencies during Stage II, and this notion is particularly relevant to the ethanol industry. Societal interests in developing alternative fuels have fostered government support for growth of the ethanol industry in the form of tax incentives and government sponsored research at public agencies and institutions. Research findings from the USDA, land grant universities, and other government supported research institutions should flow freely to ethanol firms, thus contributing a degree of homogeneity to firm conduct or behavior.

Empirically, this study revealed that there were a limited number of variables for which age of facility, size of facility, as measured by millions of gallons of ethanol produced, and the type of ownership (farmer-owned cooperative vs. other) could jointly explain observed differences among firms, even when recognizing statistical significance at the 0.10 level. In those situations where relationships were significant, the directions of relationships were generally intuitively appealing, thus lending support to the legitimacy of the estimated models as evidence of fairly homogeneous behavior.

In this study, older facilities were found more likely to utilize in-house feedstock procurement activities and in-house ethanol and co-product marketing activities. Newer facilities, on the other hand, were more likely to take advantage of the services of marketing firms when marketing ethanol and co-products. Those results were consistent with Qian et al. (2010), who concluded that later entrants into the ethanol industry were able to take advantage of a more developed market and avoid internalization of value chain activities such as feedstock procurement and ethanol and co-product marketing. Newer facilities were more likely to market dry distillers grain and modified distillers grain, which is consistent with the fact that most of the recent expansion in ethanol capacity has come from dry mill facilities (U.S. Department of Energy 2010). Finally, larger facilities were more likely to utilize in-house ethanol and co-product marketing activities, presumably because they could economically justify employing marketing staff members.

With regard to transportation, smaller facilities and farmer-owned cooperatives were more likely to depend solely upon truck transport for feedstock procurement. Smaller facilities may not be able to justify rail transport due to the limited quantities of feedstock processed, and farmer-owned cooperatives generally procure feedstock from patrons who are geographically concentrated.

Respondents from farmer-owned cooperatives were more likely to agree that the RFS program impacted their production plans. That result reflects the value-added philosophy that supported the establishment of many farmer-owned cooperatives during the expansion of the ethanol industry. Fred Yoder, then President of the National Corn Growers Association, testified before

the U.S. Senate Subcommittee on Clean Air and Nuclear Safety that RFS would create more value-added opportunities for farmer-owned cooperatives (U.S. Senate 2003).

Conclusions

Subsequent to the completion of the survey described in this paper, the ethanol industry has observed further structural changes. Due to deteriorating macroeconomic conditions that began in 2008, multiple companies have ceased production or filed for bankruptcy protection (Sims 2008b). A consultant in the industry recently reported that many producers in the industry have been operating without profits since the economic downturn began and predicted that the industry would shrink to approximately 25 firms in 10 years (Burns 2010).

Future ethanol industry research should include cross-sectional analysis of the industry as it continues to evolve. Such information would be of interest to managers, owners, and management scholars. Statistical analyses of collected data should be based upon procedures described in the literature that pertains to industry life-cycles and firm behavior and performance. To expand on the procedures utilized in this study, diversifying entrants should be distinguished from entrepreneurial startups, and farmer-owned cooperatives should be distinguished from both publicly-held firms and other privately-held firms as per Qian et al. Other interesting information could be derived from comparisons of facilities that have ceased operations with facilities that have had continuous production.

References

109th Congress. 2005. *Public Law 109–58 – Aug. 8, 2005, Energy Policy Act of 2005*. http://www.epa.gov/oust/fedlaws/publ_109-058.pdf.

Allison, P. D., and N. A. Christakis. 1994. Logit models for sets of ranked items. *Sociological Methodology* 24:199-228.

Bayus, B. L., and R. Agarwal. 2007. The role of pre-entry experience, entry timing, and product technology strategies in explaining firm survival. *Management Science* 53 (12): 1887-1902.

Brown, R., E. Orwig, J. Nemeth, and C. S. Rocha. 2007. *The economic potential for ethanol expansion in Illinois*, Revised ed. Illinois Institute for Rural Affairs at Western Illinois University. http://www.iira.org/pubs/publications/IVARDC_Other_690.pdf

Burns, S. 2010. *US ethanol to shrink to 25 firms in 10 years – consultant*. ICIS News. http://www.icis.com/Articles/2010/06/16/9368572/us-ethanol-to-shrink-to-25-firms-in-10-years-consultant.html

Congressional Research Service. 2007. *Energy Independence and Security Act of 2007: A Summary of Major Provisions*. CRS Report for Congress. http://energy.senate.gov/public/_files/RL342941.pdf.

Conley, D. M., and A. George. 2008. Spatial marketing patterns for corn under the condition of increasing ethanol production in the U.S. *International Food and Agribusiness Management Review* 11 (3): 81-98.

Dakota Ethanol. n.d. *Corn contracts available*. http://www.dakotaethanol.com/Contract%20Description2.pdf

Eisenhardt, K. M., and J. A. Martin. 2000. Dynamic capabilities: What are they? *Strategic Management Journal* 21:1105-1121.

Energy Information Administration. 2003. *Status and impact of state MTBE ban*. http://www.eia.doe.gov/oiaf/servicerpt/mtbeban/.

Goldsmith, P., and H. Gow. 2005. Strategic positioning under agricultural structural change: A critique of long jump co-operative ventures. *International Food and Agribusiness Management Review* 8 (2): 41-61.

Gort, M., and S. Klepper. 1982. Time paths in the diffusion of product innovations. *Economic Journal* 92 (3): 630-653.

Helfat, C. E., and M. B. Lieberman. 2002. The birth of capabilities: Market entry and the importance of pre-history. *Industrial and Corporate Change* 11 (4): 725-760.

Lambert, D. M., M. Wilcox, A. English, and L. Stewart. 2008. Ethanol plant location determinants and county comparative advantage. *Journal of Agricultural and Applied Economics* 40 (1): 117-135.

Porter, M. E. 2004. *Competitive strategy: Techniques for analyzing industries and companies*, First Export ed. New York: Free Press.

Qian, L., R. Agarwal, and G. P. Hoetker. 2010. Configuration of value chain activities: The effect of pre-entry capabilities, transaction hazard and industry evolution on the decision to internalize. Paper presented at the 7th Annual Atlanta Competitive Advantage Conference, Atlanta, Georgia, May 18-20.

Renewable Fuels Association. 2008. *Changing the climate: Ethanol industry outlook 2008*. Washington, DC.

Salant, P., and D. A. Dillman. 1994. *How to conduct your own survey*. New York: John Wiley & Sons.

Sims, B. 2008a. Managing risk through marketing methods. *Ethanol Producer Magazine*, March. http://www.ethanolproducer.com/article.jsp?article_id=3726

Sims, B. 2008b. Volatile economics hurt ethanol producers. *Ethanol Producer Magazine*, November. www.ethanolproducer.com/article-print.jsp?article_id=4925.

Solomon, B. D, J. R. Barnes, and K. E. Halvorsen. 2007. Grain and cellulosic ethanol: History, economics, and energy policy. *Biomass and Bioenergy* 31 (6): 416-425.

U.S. Department of Energy. 2010. *Starch- and sugar-based ethanol production*. Energy Efficiency and Renewable Energy, Alternative Fuels and Advanced Vehicles Data Center Ethanol. http://www.afdc.energy.gov/afdc/ethanol/production_starch_sugar.html

U.S. Senate, Committee on Environment and Public Works. 2003. Testimony by Fred Yoder, President of the National Corn Growers Association, before the Subcommittee on Clean Air and Nuclear Safety, March 20, 2003. http://epw.senate.gov/public/index.cfm?FuseAction=Hearings.Testimony&Hearing_ID=cf8b6be5-802a-23ad-41f4-f489a684657b&Witness_ID=92e309be-ee59-4783-8e9f-05ab0cc09265

Weerawardena, J. 2003. The role of marketing capability in innovation-based competitive strategy. *Journal of Strategic Marketing* 11 (1): 15–35.

A Guatemalan Soycow Cooperative:
Is the Whole Greater than the Sum of its Parts?

Meredith Blumthal[a], Eric T. Micheels[⊕b], Nicholas D. Paulson[c], and Rhett C. Farrell[d]

[a]*Experiential Learning Coordinator & Academic Advisor, Agricultural & Consumer Economics, University of Illinois, 326 Mumford Hall, 1301 W. Gregory Dr., Urbana-Champaign, Illinois, 61801, U.S.A.*

[b]*Instructor, Agricultural & Consumer Economics, University of Illinois, 326 Mumford Hall, MC-710, 1301 W. Gregory Dr., Urbana-Champaign, Illinois, 61801, U.S.A.*

[c]*Assistant Professor, Agricultural & Consumer Economics, University of Illinois, 326 Mumford Hall, MC-710, 1301 W. Gregory Dr., Urbana-Champaign, Illinois, 61801, U.S.A.*

[d]*Graduate Student, Agricultural & Consumer Economics, University of Illinois, 326 Mumford Hall, MC-710, 1301 W. Gregory Dr., Urbana-Champaign, Illinois, 61801, U.S.A.*

Abstract

The introduction of soycow systems into the developing world is not a new strategy in the fight against malnutrition. Soycows have been placed in diverse locations including VietNam, India, South Africa, Honduras, and Guatemala. The success of these projects is not guaranteed, and often the soycows are not used after the initial supply of soybeans is exhausted. One of the main issues impeding long-term success of the soycow projects is that recipients may possess technical knowledge enabling them to operate the soycow, but generally lack the intangible, human resources that could provide the requisite marketing know-how needed for these projects to survive long-term. This case was developed to foster case-based teaching methods for course instruction while providing a unique context for the examination of managerial decision making.

Keywords: Soycow, cooperative, Guatemala

[⊕]Corresponding author: Tel: + 1 217.714.7046
                          Email: micheels@illinois.edu
Other contact information: M. Blumthal: mblumtha@illinois.edu
                          N. Paulson: npaulson@illinois.edu
                          R. Farrell: rfarr03s@illinois.edu

IFAMA Agribusiness Case 13.4A

Background

The introduction of soycow systems into developing nations is not a new strategy in the fight against malnutrition. Soycows have been placed in diverse locations ranging from VietNam, India, South Africa, Honduras, and Guatemala. Included in the aid package is the processing equipment and operations training, and an initial supply of soybeans. It is expected that a realistic marketing plan will be developed which will ultimately lead to a sustainable business model that delivers soy food products to the local community.

However, the success of these projects is not guaranteed, and often the soycows are not used after the initial supply of soybeans is exhausted. Several important factors have been noted which have limited the long-term success of these food aid projects. First, there seems to be a lack of coordination between soycow operators. This can lead to a number of problems such as significant periods of downtime when, for example, mechanical breakdowns cause production to stop. Second, credit constraints on individual firms limit the ability of soycow recipients to purchase the needed soybeans following the initial endowment. Finally, the short-term success of many of these projects may be caused by a lack of marketing skill on the part of soycow recipients. This is due to the fact that many of the recipients do not have business training or backgrounds in market development. Furthermore, in regions such as Latin America, soy products are not an existing component of traditional diets.

The objective of this teaching case is to present a real-world situation faced by the recipients of a development aid package and to introduce several management concepts. The main concept is the difference in organizational forms and the pros and cons of each in this unique situation. One of the main issues that may impede long-term success of the soycow projects is that recipients may possess technical knowledge that would enable them to operate the soycow, but generally lack the intangible, human resources that could provide the requisite marketing expertise to enable these projects to survive long-term. Different organizational forms can be presented and analyzed to highlight the pros and cons of each in terms of capital acquisition, scalability and managerial control.

The case was developed to foster case-based teaching methods as part of course instruction while providing a unique context for examining managerial decision making. The target audiences are juniors, seniors, or first year graduate students in upper-level business management courses. The teaching note is also adaptable for use in senior and graduate level development courses.

The Dilemma

Danny Knutson sat at his desk at the National Soybean Research Lab and thought intently on his last visit to Guatemala. He had just returned from installing a new soycow at Fundaniñas, a small girls' orphanage in Guatemala City. During his stay he worked tirelessly training their staff to operate their new equipment. While overjoyed that this machine would enhance nutrition for the young residents by providing an excellent source of protein, he was concerned this project would be short-lived and thus fall short of providing the intended long-term nutritional and financial benefits. From his experience with similar operations in Guatemala and other parts of the developing world, Danny was well aware of the many issues the orphanage would need to deal

with over the coming months. How would they get soybeans after the donation ran out? What would happen if the equipment broke down and they could not access the necessary replacement parts? Could they really sell the product in the surrounding areas of Guatemala, a market in which soy was not a traditional part of the diet?

It was this last concern that really stuck with Danny. Danny was aware that sources of protein other than soy could also ease the incidence of malnutrition. While dairy cows or goats could also provide the much-needed protein, a relatively high rate of lactose intolerance within the population provides an opportunity for the use of soy products. Furthermore, as an employee of the National Soybean Research Laboratory (NSRL), Danny is acutely aware that his employer is partially funded by the American Soybean Association (ASA) through the soybean checkoff. Furthermore, both Malnutrition Matters and the World Initiative for Soy in Human Health (WISHH) – two of the organizations that support the soycow projects – have ties with ASA and their mission.

The soycow program was created to achieve two main goals: 1) to reduce malnutrition through the use of soy products, and 2) to promote and create new markets for U.S. soybeans. Given these goals and the relationships between the ASA, NSRL, and WISHH, Danny realizes that while there may be other options for combating malnutrition in Guatemala and other locations, he is tasked with trying to figure out how to make the soycows currently in place, and new projects that may be coming on-line in the future, successful and sustainable.

The email he just received from a Rotary International representative in Guatemala further highlighted the importance of this issue. According to the email, Rotary was interested in partnering with WISHH to install yet another soycow in Guatemala. However, before this could happen something had to be done to demonstrate the success of the existing soycows.

Danny thought about the soycow operations for which he had provided training over the past 3 years. Each operation had achieved varying levels of success, each was equipped with different skill sets, and each faced their own specific challenges. He wondered if a cooperative agreement between these individual operations could solve many of the issues which continued to plague the existing soycow projects?

The Soycow

Malnutrition Matters is a non-profit organization whose mission is the alleviation of malnutrition through the creation of micro-enterprises, primarily in rural areas of developing countries. The objective of these small businesses is two-fold: 1) the improvement of community nutrition, and 2) long-term sustainability to provide jobs and income to members of the community, further leveraging the nutritional benefits. These projects have been co-sponsored by a number of organizations including WISHH, Africare, the World Bank, Alpro, and Rotary International.

The soycow is a small-scale tabletop system that processes soybeans and water into soymilk and a byproduct, referred to as okara, using electric power (see figure 1). The first soycow was installed in India at Child Haven with the help of Prosoya in 1990. Today there are more than 1,000 soycows in over 40 countries helping to alleviate malnutrition and bring about sustainable

microenterprises. In 2009/2010, another 30 projects are designated for installation across the globe. Existing projects have been established in a number of regions throughout Africa, Asia, India, North America, and, more recently, Central America. Project sites are often established in high-need areas in close proximity to schools and hospitals.
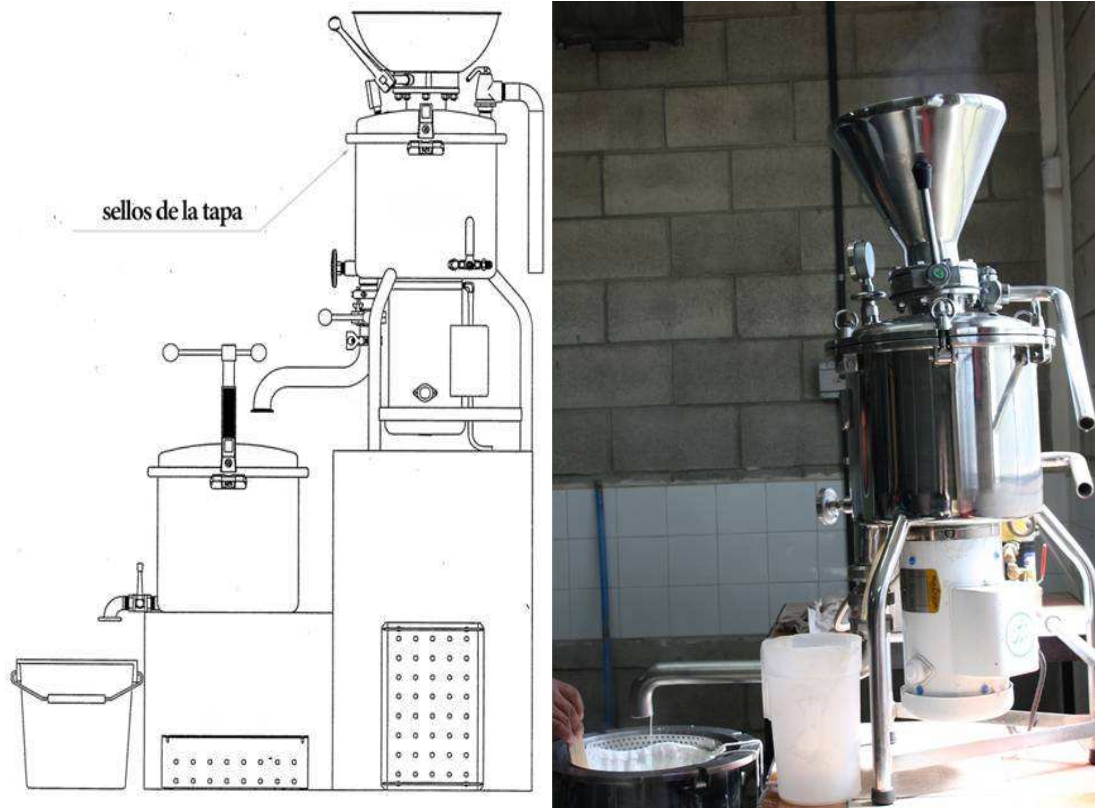

Figure 1. Diagram and Image of a Soycow Production System

Soymilk can be consumed directly or flavored to taste; the milk can also be further processed into other soy-based food products such as tofu, yogurt, or ice cream. The okara also has many uses as a food product and nutritional supplement. For example, okara can be used in many types of baked goods (i.e. breads, cakes) or as a meat extender in a variety of dishes. The soycow has a production capacity of about 40L of soymilk per hour. The production process includes the grinding, cooking, and filtering of pre-soaked soybeans to produce the soymilk beverage and okara byproduct. In addition to electric power, a clean production area, basic cleaning supplies, and a clean water supply are additional requirements of the processing system. An alternative production system is also available – referred to as the Vita Goat – which is powered manually. The grinding process is powered through a pedaling system similar to a bicycle, while heat for the cooking process is provided directly by fire.

The soycow serves as an example of the type of microenterprise projects sponsored by Malnutrition Matters. The nutritional benefits of the soycow projects are important and obvious, especially in areas in which malnutrition and protein deficiencies are problematic. However, the sustainability component of the mission for these microenterprises has been more difficult to achieve on a consistent basis. The standard aid package associated with the projects includes an

endowment of the processing equipment, roughly a year's supply of soybeans, and the technical training required to operate the system. While general guides to business planning are available through Malnutrition Matters (2009, 2006), the business side of operations – a critical component of ensuring sustainability – is largely left up to the individuals receiving the donation.

Numerous business and marketing constraints need to be considered. In many regions, soy is not a traditional component of the local diet. Thus, individual operations are faced with issues related to the introduction and marketing of a new product. Research is generally required to develop recipes aligned with local tastes and preferences. Some forms of marketing and advertising may be needed to establish a customer base. Diligent record-keeping and accounting practices are necessary to identify production costs and ensure profitability. Proper distribution to the public may entail licensing as it pertains to sanitary requirements for food products. Finally, developing a profitable pricing scheme requires information related to both marketing and operations. These problems are exacerbated by the lack of basic business training and, in most developing areas, the difficulty in gaining access to credit.

Examples of Soycow Economics

Soycows have been installed globally over the years often with limited or short-term success. An overview of two of the larger regional project initiatives in Vietnam and India are provided below to serve as examples of successful projects in other parts of the world.

Vietnam

Over the past few years, NSRL, WISHH and the U.S.-Vietnam Foundation have collaborated to establish FaifoSoy, a microenterprise in Da Nang, Vietnam. FaifoSoy projects use the soycow system to produce soymilk, tofu and a variety of baked goods utilizing the okara byproduct. The first organization was located in a wet market and has been successful in establishing retail sales while also donating a portion of their production within the community. The success of the first project has led to plans for opening a second branch of FaifoSoy on nearby Cham Island.

FaifoSoy has subsidized contracts with 13 schools in the Da Nang area to supply soy products to a total of 4,061 children. Currently, 55% of FaifoSoy employees are women from economically marginalized families in rural areas. FaifoSoy is unique in that rather than receiving the equipment as a donation, they asked for marketing training workshops to be offered in Vietnam. As part of the agreement to receive these services, FaifoSoy is required to donate a small portion of their production to schools in the community (Tamimie 2010).

India

Bharat Integrated Social Welfare Agency (BISWA) is a Nongovernmental Organization (NGO) in India that was established as a philanthropic organization in 1994. The promotion of Self Help Groups (SHGs), extending micro-finance, encouraging microenterprise development, ensuring social justice for the disabled, socio-economic rehabilitation of leprosy cured persons, and the creation of alternative avenues for livelihood for the poor have been core to their mission

(www.biswa.org/en/about). Over the years, BISWA has incorporated various means and methods to achieve desirable results in pursuance of these objectives.

In 2005, BISWA initiated a series of Vita Goat projects in Orissa, India. Loans were provided to several SHGs comprised mainly of women to finance 75 % of initial capital costs associated with the Vita Goat system. To establish an initial revenue stream, the SHGs worked together to secure a government contract to provide fortified soymilk as part of an existing midday meal program. The SHGs now also sell tofu and okara in open markets to generate extra income. The SHGs are responsible for covering all of their production costs including rent, labor, inputs, product transportation and delivery (which is done by bicycle), and loan repayment. Each Vita Goat can serve up to 1,000 children per day, and the current system requires no refrigeration or packaging (Jansson, Boros, and Scates 2009).

Key factors for success of these projects include the early efforts to provide marketing training in Vietnam, and securing the meal program contract in India. The projects in India have also benefited from the strong network of cooperation across the SHGs and their local community partner BISWA. Furthermore, these businesses had an advantage in marketing their products within their communities since soy products are already familiar and established components of the diets in both Vietnam and India.

Malnutrition in Guatemala

Situated geographically between Mexico, Belize, Honduras and El Salvador, Guatemala is not similarly situated on the malnutrition spectrum as it has the highest levels of malnutrition in the region. Using a cross-sectional study of 106 countries de Onis, Frongillo and Blossner (2000) found that malnutrition has declined across the globe in the 20-year-period from 1980 to 2000. Central America, however, has not seen marked improvement over the same time span.

Malnutrition is caused by inadequate sources (type as well as amount) of food which results in the body not being able to fully utilize the caloric intake (WHO). Malnutrition has been a serious issue facing leaders and policy makers in the recent past (Marini and Gragnolati 2003) and continues to pose serious problems in many regions. In 2002, WHO reported that 54.3% of children under five-years of age were stunted and 17.7% of children under five-years of age were underweight for their age.

In Guatemala, recent events suggest cause for growing concern. In 2009, the World Health Organization found that 46% of children under five have some degree of malnutrition stemming from a lack of protein. In indigenous areas, this rate approaches 80% (Leowenberg 2009). The presence of prolonged drought in the country and the incidence of several deaths attributed to malnutrition led President Alvaro Colom to declare a "state of public calamity" on September 8, 2009, which allowed the government to purchase food supplies for malnourished children (Valladares 2009).

Within the Guatemalan economy, agriculture still plays a vital role. Agriculture accounts for roughly 21% of GDP, while an estimated 50% of the population works in the agricultural sector (CIA). Major agricultural crops include sugarcane, corn, bananas, coffee and beans; the main

types of livestock production include cattle, sheep, pigs and chickens. While the presence of livestock production may suggest access to protein for Guatemalan producers, some choose to sell their production to earn a living rather than utilizing the production for their own consumption. This often leads to a diet that lacks adequate amounts of protein. This shortfall has been exacerbated by the recent drought that has reduced crop yields for many producers in the region (Nybo 2009).

Why Soy Foods?

Soy provides numerous nutritional benefits including a high protein and iron content, and offers a wide variety of derived foods, including soymilk, tofu, textured soy protein (tsp) and okara. These foods can be consumed directly, as with soymilk and tofu, or used as ingredients or meat extenders in recipes (i.e. okara and tsp). Okara can also be added to breads to increase the fiber content.

In Guatemala, alternative protein sources are available through dairy products and meat from livestock. However, both meat and dairy products are relatively expensive if purchased by retail. While, some poor rural households may own or have access to livestock for a portion of their protein needs, these alternatives are not nearly as feasible for poor households in urban areas.

Soy products are imported and available at many retail locations in Guatemala. However, they typically cost much more than alternative sources of protein. For example, the price of imported soymilk is two to three times the price for an equivalent amount of dairy milk. In contrast, the prices charged for soymilk and other soy foods produced by the existing soycow operations is much lower than those for imported soy, and competitive with the prices of domestic dairy products.

Additionally, lactose intolerance is prevalent throughout many developing regions and soymilk provides a lactose-free alternative to dairy products. Furthermore the production methods of such foods are environmentally friendly as the processes use little water and electricity, and the amount of waste can be very minimal.

Soycows in Guatemala

There are three soycows in Guatemala donated under the Rotary International and WISSH agreement. Two of the operations are located in Guatemala City, while the third is located in Antigua. A fourth soycow is located in Retalhuleu, but was not established under the standard Rotary-WISHH agreement. The geographic locations of the operations are depicted in figure 2, and shows that all four of the Guatemalan soycows are located relatively close to one another in the south-central region of the country.

The standard aid package includes the soycow equipment, pictured in figure 1, which is valued at $6,500 to $8,000. Once the soycow equipment donation is in place, the facilities receive technical and operational training thru the National Soybean Research Lab (NSRL) at the University of Illinois. Danny Knutson serves as the Program Coordinator for the soycow projects and travels to each site presenting one-on-one training for the soycow operators. WISSH

coordinates and organizes the soybean donation, which is typically one container of soybeans from U.S. based producers. Once the donated soybeans have run out, the organizations must begin to purchase soybeans from the world or domestic markets.
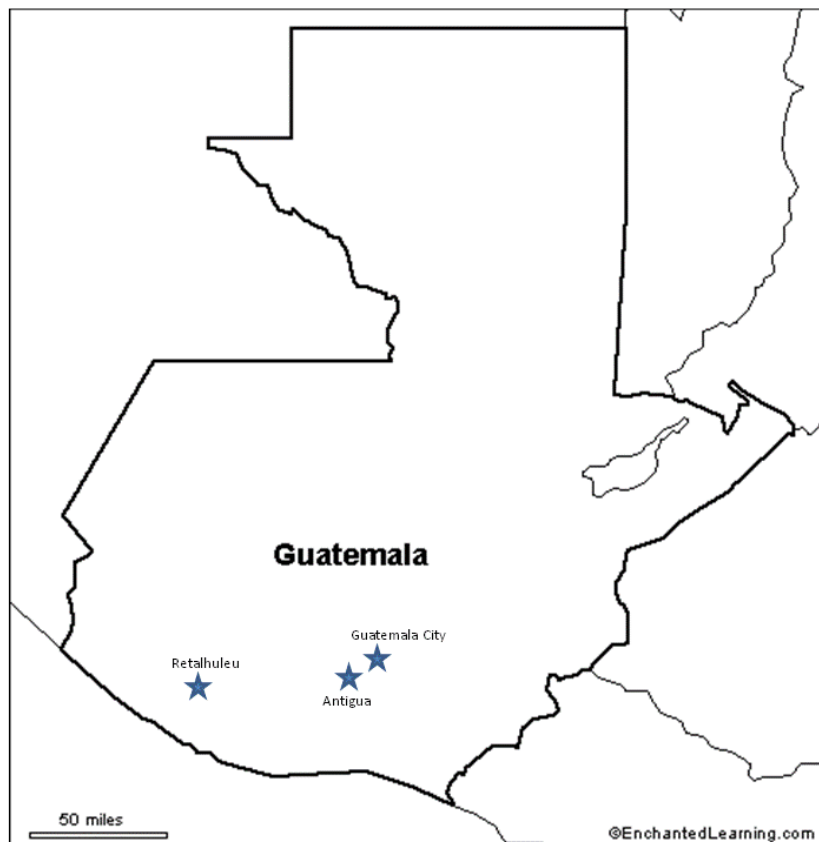
Figure 2. Locations of Soycow Operations in Guatemala

The issue of procuring soybeans is one of the largest hurdles faced by the individual soycow operations. While soybeans can be imported at a cheaper unit price than can be obtained locally, an entire 40 foot container of soybeans, approximately 1,000 bushels, is sufficient to serve the needs of three to four individual soycow operations for an entire year. The transportation and storage needs for a container of soybeans are limiting factors, as most sites are not equipped to handle such large volumes.

An additional three to four soycows have been installed in Guatemala, in most cases through donations from U.S. based Rotary clubs. These donations are facilitated outside the WISSH–Rotary International relationship. In these cases the equipment is donated, but recipients must purchase the required soybeans.

The following subsections provide descriptions of four of the existing soycows in Guatemala. Each project is associated with an organization with unique missions and varying uses for the soycow. Additionally, each organization differs in the amount of experience and success they have had thus far with their soycows. Table 1 provides a summary of the four organizations,

while tables 2 and 3 outline existing pricing schemes and the basic recipes being used by the organizations, respectively.

Table 1. Summary of the Soycow Operations

	Primary Mission	**Organizational Structure**	**Soycow Experience**	**Potential Strengths**	**Potential Weaknesses**
Fundaniñas	Rescuing and housing at-risk girls	Non-profit	3 months	Market access: nearby open market, relationship with area orphanages and daycares; Influential political relationships	Lack of experience and business training; potential loss of trained operator;
Centro de Artes	Education through training programs with specific trade foci	For-profit	2 years	Education training and backgrounds; Current marketing opportunities; Multiple trained staff	Educational programs and backgrounds of staff do not include business
Hospital	Affordable health care for the poor	Non-profit	2 years	Backgrounds in health and nutrition; Nutrition research	Lack of business training; Lack of trained staff; Equipment failures
CECYPSA	Education and housing of children in the community	For-profit	3 years	Existing and successful soy business model; Multiple trained staff; Marketing opportunities in surrounding communities	Organizational structure; Logistical issues in serving larger market area

Fundaniñas

Fundaniñas is an orphanage located in Guatemala City. Their mission is to rescue young girls who are at risk of living on the streets of Guatemala and provide them with a home, offer education, a family environment and a future. Support from a well-connected and wealthy benefactor, Maria Lopez, allows them access to financial and professional resources both domestically and abroad. While her strong involvement with Rotary almost certainly helped Fundaniñas receive their soycow in September 2009, the benefits of the project being located at the orphanage are plenty.

Table 2. Summary of Soymilk Sale Prices

Size	Location	Price (Quetzal)
1 liter	Centro de Artes	6.00
1 liter	CECYPSA	6.00
1 liter	Pharmacy	8.00
500 ml	Centro de Artes	3.00
500 ml	CECYPSA	3.50
500 ml	Pharmacy	5.00
250 ml	Centro de Artes	1.75
250 ml	CECYPSA	2.00
250 ml	Pharmacy	3.00

Source: Personal interview data
Note: As of February 2010, the Guatemalan exchange rate was approximately 8.30 quetzal per U.S. dollar.

Table 3. Basic Soymilk Recipes and Mass Balance

Location	Soybeans (lbs.)	Soymilk (L)	Okara (lbs.)
Fundaniñas	2.2	12	3
Centro de Artes	3	14	3.5
Hermano Pedro	2.2	18	3
CECYPSA	4	14	4.5

Source: Personal interview data

Their soycow serves a population of approximately 30 girls who represent a captive market for the nutritional benefits from soymilk. Using soymilk to feed the girls may also provide long term cost savings as the soymilk is substituted for fresh milk or the more common alternative, powdered milk. While they are now producing a soymilk recipe that the girls like, their soycow operation is still very new and its capacity is currently under utilized as they are only producing for the needs of the orphanage. Even if Fundaniñas used soy products to feed the girls every day, they lack sufficient scale to utilize machine capacity to its fullest. Thus, while they may realize cost savings on in-house nutritional units, in the long term they will continue to have excess capacity on the capital invested if they do not expand to serve a larger population.

Anxious to see the success of their new machine, Maria is proposing they develop a strategy to sell soymilk within the surrounding community. She believes this will enable them to earn revenue and continue purchasing soybeans after the donation period has ended. Fundaniñas' location in Guatemala City gives them access to a large urban area for marketing the product. They are also situated next door to a small traditional indoor market selling fruits and vegetables, clothing, and household items. Additional opportunities to utilize excess capacity include servicing other orphanages in nearby regions and possibly selling to nearby daycares. Maria already has already established relationships with many of these organizations.

One concern Maria must resolve before moving forward with this project is the difficulty they are having in determining a profitable pricing scheme for the soymilk. Their costs have been difficult to pinpoint due to the anticipated donation of soybeans. While waiting for the donated beans to arrive, they have been buying soybeans in a local market for six quetzals[1] per pound. Furthermore, a packaging and delivery system for the soymilk has not been determined. Record keeping thus far has been minimal, so it has been difficult to document the operation's cost structure.

Finally, there is still uncertainty with respect to who would handle the business component of operations. Fundaniñas has a capable soycow operator, but he is the only person on staff with the requisite technical training and he does not have a background in business. Additionally, the operator was recently offered another job, so Fundaniñas may soon be left without staff trained in operating the soycow. The uncertainty of the operation's future is the main factor affecting his decision to leave the orphanage.

Centro de Artes

Centro de Artes aspires to become the regional training center for soycows in Guatemala. As a vocational training school in Guatemala City, they offer training programs in areas of traditional handicrafts such as painting, mosaics, and sewing. Additional course offerings include computer training, baking and cooking, and cosmetology. Tuition fees are 35 quetzals per month with roughly 800 graduates per year from the various training programs. Current projects include the construction of a new building to meet growing demand for their new program where students can study to become electricians.

Centro de Artes received their soycow in 2008, with the intent to serve as a training facility for all the soycow operations in Guatemala. The school currently produces several batches of soymilk weekly, which is flavored and packaged by hand into 1 liter, 500 ml and 250 ml single serving plastic containers, pictured in figure 3. The okara by-product is either utilized within the baking and cooking programs or sold to local farmers for 1 quetzal per pound. Available soymilk flavors include plain, vanilla, chocolate, and strawberry. When packaged and refrigerated, the soymilk has a shelf life of approximately three weeks. The market for their soymilk includes the students and a standing monthly order from a local priest who purchases 100 liters per month to give to area children. The training center charges 6 quetzal per liter, 3 quetzals for the 500 ml size, and 1.75 quetzals for the 250 ml bottle of soymilk.

---

[1] The Quetzal is the Guatemalan currency. As of February 2010, the exchange rate was approximately 8.30 quetzal per U.S. dollar.

Figure 3. Plastic Containers Used for Soymilk Packaging at Centro de Artes and CECYPSA

The center has adequate space for soycow training for small to medium sized groups, and two members of their staff are trained to operate the soycow. Furthermore their culinary curriculum gives Centro de Artes the opportunity to experiment with okara and soymilk as baking ingredients. Foods currently produced include cakes, tortillas, and breads. Because of their existing curriculums, the development of a soycow training and product development curriculums or workshops is a natural fit for Centro de Artes.

The biggest problems facing the staff are to accurately determine and document their cost of production, and procurement of inputs. The soybeans currently utilized by the training center were donated, and they have not yet identified an alternative local source for this necessary input. The training center staff estimates that their soybean supply will be exhausted within the next few months. Therefore, if they hope to continue to serve their existing customers while also expanding their market, identifying a local source for soybeans is critical. In addition, their pricing scheme will need to be readdressed to ensure continued profitability once they begin purchasing soybeans.

Hermano Pedro

Obra Sociales del Santo Hermano Pedro (Hermano Pedro) is a hospital which has been serving the local community in Antigua for more than 25 years. Currently, the hospital has the capability to treat and accommodate more than 230 patients. They serve a diverse clientele with patients ranging from children to the elderly; some are severely handicapped while others have been abandoned by their families who are too poor to afford their care. Nearly all patients suffer from malnutrition as either a primary or secondary condition. Patients are charged based on an

assessment of their financial ability to pay for services rendered. The hospital is able to provide outpatient care, mainly in family practice and surgery, and specifically in treating children with cleft palates through reconstructive surgery. The hospital relies heavily on professional medical staff volunteers, mainly from U.S., European, and Canadian doctors who come for one to three week periods to perform specialized surgeries. Volunteers include 31 medical groups from four different countries, making a difference in the lives of over 100,000 people and performing over 6,000 surgeries per year.

In 2008, Hermano Pedro received a soycow from Rotary International along with technical training and a donation of a container of U.S. soybeans. Because of their large facilities they are able to store the container of soybeans on site. They typically produce three batches per day, and run the cow two days each week. Each batch produces 18 liters of soymilk using one kilogram of soybeans. The hospital's nutritionist has performed a number of recipe trials to analyze nutrition and taste of the soymilk. Since many of the patients do not like the flavor of the unflavored soymilk, corn or oats are added to mask the "beany" flavor.

The hospital provides free meals not only to its patients but also to their families, staff and the community. They serve an average of 1,300 meals each day. The addition of the soycow to the hospital means that they can better tackle the issue of malnutrition with many of their patients. The addition of the soycow also provided significant cost savings for the hospital, with estimates of 50,000 quetzals saved over a six-month period by substituting the soymilk for powdered dairy milk, and the use of the okara in the foods they prepare and provide as part of their meal program.

The hospital is not without experience of diversification, as operational funds are in constant need. Several years ago they opened a small clothing store inside the hospital. The inventory is based on donations, mainly from international church organizations. Though sold at very low prices to accommodate their patients and families financial situations, the income generated is used to fund a variety of projects for the hospital.

Despite the significant nutritional benefits and cost savings generated internally, some members of the hospital staff have been contemplating selling additional soymilk to customers within the community. Compared with the other types of services provided, selling soymilk poses several different challenges for Hermano Pedro. First, the hospital has been struggling with mechanical issues with their soycow equipment. Lack of access to even simple spare parts led to a six month period with no production. Second, their status as a charitable organization limits their ability to aggressively market and sell products for profit within the local community.

Once the inventory of donated soybeans is depleted, the hospital will need to identify an alternative source for additional soybeans. Additionally, they will need to generate sufficient monies to fund the purchase of soybeans. If they wish to continuing producing soymilk, the hospital is faced with either documenting the internal costs savings generated by the soycow to justify the use of funds from their budget, or developing a profitable external market for soymilk sales.

CECYPSA

Centro Ecumenico do Capacitacion y Promocion San Antonio (CECYPSA) is a private non-profit organization operated by a group of Catholic nuns in Retalhuleu. Retalhuleu is approximately five hours, by car, to the west of Guatemala City. The facility was built using donations from foreign organizations and a Spanish priest, and houses 50 to 60 students each year in its dormitory facilities. The students, who range in age from 12 to 25 years, pay 400 quetzals per month in tuition to cover the costs of housing and related services. While living at CECYPSA the students receive two meals per day, tutoring services, and religion courses in the evenings while attending local schools during the day. On the weekends and during holiday periods, students are allowed to travel home to be with their families.

In addition to the dormitory, CECYPSA also offers basic practical courses to members of the community, focusing mainly on women. Available courses include training in cosmetology, cooking and baking, natural medicine, computers, and sewing. CECYPSA has always been a self-sustaining enterprise and receives no outside funding from individuals or the Catholic Church. They produce many of their own food needs onsite, including fruit, tilapia and goats. Excess production is sold within the community. Other funding comes from fundraising events such as raffles.

After learning of the soycow projects, the CECYPSA staff spent seven years requesting the installation of a soycow from Rotary International. Finally, after submitting a prepared budget and business plan, their request was granted by a Hawaiian Rotary group. As a result, CECYPSA is not part of the Rotary International-WISSH agreement and therefore have not received donated soybeans. This, however, has not hindered their success with the soycow.

CECYPSA produces soymilk two to three times per week, using a recipe that uses 4 pounds of soybeans to produce 14 liters of milk. CECYPSA contracts soybeans locally and stores them at a nearby facility, paying 270 quetzals for a 100 pound bag. When their supplies run low they re-order, utilizing a just-in-time inventory control system for the soybeans. Four staff members are trained to operate the cow, with two individuals operating the cow during production and packaging.

CECYPSA retains roughly 25 % of the soymilk they produce for use internally, and provide the remaining 75 % to the community in exchange for donations. Their soymilk is available in four different flavors - plain, vanilla, chocolate, and strawberry - and in three different sizes which are packaged in plastic containers similar to those used at the training center. A single liter can be obtained for a donation of six quetzals, a half liter for 3.50 quetzals, and 250 ml for two quetzals. They also distribute their milk through a local pharmacy, which adds a small markup to the prices they charge. Their target market is the local elderly, who purchase the milk because of the general health and nutritional benefits. To develop this market, the nuns provided small samples to the community and advertised through word-of-mouth, announcements on a catholic radio station, and posters at local churches.

In addition to the soymilk, they utilize all of the okara produced by adding it to tortillas and breads which are baked on site and served to the students and staff. Attempts to market baked

goods with okara within the community have been made in the past, but with little success, attributed, at least partially, to dishonesty on the part of their salesman.

CECYPSA has an opportunity to further expand their market through serving ten surrounding communities. Each of these communities is within 14 km or about 30 minutes by car, and hold regular traditional markets. CECYPSA does have access to one or more trucks for transportation, but not the portable refrigeration that would be required to consistently deliver a safe product. In addition to this transportation and logistics issue, their inability to officially sell products because of their not-for-profit status is another limitation to further expansion.

Idea for Cooperative Formation

After some serious reflection, Danny realized that forming a cooperative between the individual soycow facilities might provide an opportunity for the operations to work together and leverage current resources and capabilities. He thought of how the orphanage could benefit from communicating with an already established project like CECYPSA. Or how the hospital's lengthy shut down could have been avoided through the sharing of spare parts across operations. The potential benefits from cooperation and communication seemed endless.

However, Danny also knew that the creation of a formal cooperative would take some work and might be too complex of a solution for the problems facing the soycow businesses. Furthermore, the creation of a formal cooperative could potentially introduce new challenges that are often associated with that type of organizational structure, such as the free-rider problem (Cook and Iliopoulis 2000).

How would they organize the governance of the cooperative and how could they ensure success? How might each individual operation benefit from such an alliance so as to encourage each to sufficiently contribute? Furthermore, what aspects of the business operations would the cooperative agreement address? For example, the soycows could form a marketing cooperative to focus on improving sales and developing markets for their products. As an alternative, organizing more like a supply cooperative would shift focus towards more efficient procurement of inputs.

Maybe a cooperative business structure was not the answer to solving the problems of the soycow businesses. Still, Danny was convinced that the operations could benefit by working together and communicating about both successful and unsuccessful experiences related to the soycow project. Was there a simpler way to encourage some level of teamwork, collaboration, and support within the system?

More importantly, how should Danny communicate his idea about forming a cooperative or enhancing communication among the existing projects to Rotary and WISHH? The email he had received earlier was requesting a reply as soon as possible. He needs to find a solution to this problem, and quickly.

References

Cook, M.L. and C. Iliopoulis. 2000. "Ill-defined property rights in collective action: the case of US agricultural cooperatives" in Institutions, Contracts, and Organizations: Perspectives from New Institutional Economics. Edited by Claude Ménard, Edward Elgar Publishing, Northampton, Massachusetts, USA.

de Onis, M., E. Frongillo, and M. Blossner. 2000 Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. *Bulletin of the World Health Organization*, 78(10): 1222-1233.

Jansson, H., Boros, A. and N.Scates. 2009. "Soycow and Vitagoat Panel Discussions" Presentation made at the WISHH Midwest Soy Protien Workshop, October 6-9, Urbana, IL http://www.wishh.org/workshops/midwest/oct09/jansson-boros-scates.pdf

Leowenberg, S. 2009. "Malnutrition in Guatemala: A national shame." *The Economist*, August 27. Online version available with subscription at: http://www.economist.com/world/americas/displayStory.cfm?story_id=14313735.

Malnutrition Matters Inc. 2009. The SoyCow/VitaGoat Micro-Enterprise Selection and Assistance Strategy. Original version October 2006, revised version September 2009.

Malnutrition Matters Inc. 2006. The SoyCow/VitaCow/VitaGoat Business Guide.

Marini, A. and M., Gragnolati. 2003. Malnutrition and poverty in Guatemala. Policy Research Working Paper Series 2967. The World Bank, Washington, DC.

National Soybean Research Lab. 2009. *Soy to the World Bulletin*. www.nsrl.uiuc.edu

Nybo, Thomas. 2009. "Fighting Chronic Malnutrition Among Impoverished Children in Guatemala." United Nations Children's Fund. At a glance: Guatemala. http://www.unicef.org/infobycountry/guatemala.html

Tamimie, C. 2010. "Soy dairy micro-enterprise". Presentation made at the WISHH Washington Conference, March 18, Washington D.C. http://www.wishh.org/workshops/washington/march10/ppt/tamimie.pdf

Valladares, D. "Guatemala: Malnutrition killing children again." Inter Press Service News Agency. September 11, 2009.

UNICA: Challenges to Deliver Sustainability in the Brazilian Sugarcane Industry[1]

Fabio Ribas Chaddad[ⓘ]

Assistant Professor, Agricultural and Applied Economics. University of Missouri and Insper, 125 Mumford Hall, Columbia, Missouri, 65211, U.S.A.

Abstract

After a successful career at the University of São Paulo, Marcos Jank became the President and CEO of the Brazilian Sugarcane Industry Association (UNICA) in July 2007. He was hired with a mandate to establish ethanol as a global commodity and to open new markets for the industry's sugar, ethanol and bioelectricity output. But he faced complex challenges. The main challenge related to the role of UNICA in leading industry-wide sustainability initiatives. This required coordination of 70,000 sugarcane producers and 430 processors; engagement with outside stakeholders in Brazil and abroad; and implementing programs that balanced economic, social and environmental outcomes. A second set of challenges emanated from the rapid growth and dramatic structural changes occurring in the industry. This case study describes UNICA's unique approach to sustainability and how it is changing the industry, allowing the reader to analyze the effectiveness of this approach in delivering sustainability.

Keywords: sustainability, biofuels, ethanol, industry association.

ⓘCorresponding author: Tel: +1 573.882.0155
                        Email: chaddadf@missouri.edu

IFAMA Agribusiness Case 13.4B

---

[1] The author would like to acknowledge excellent research assistantship from Paula Moura.

Introduction

After attending the COP15 climate change summit in December 2009, Marcos Jank was finally able to relax on a flight back home from Copenhagen to São Paulo. He sipped a glass of wine and pondered about the future of the Brazilian sugarcane industry. After a successful career as a professor of agribusiness management at the University of São Paulo and the executive director of ICONE, a think tank, Marcos became the President and CEO of the Brazilian Sugarcane Industry Association (UNICA) in July 2007. He was hired with the mandate to establish ethanol as a global commodity and to open new markets for the industry's sugar, ethanol and bioelectricity output. To accomplish these goals, he designed a three-pronged strategy based on industry competitiveness, sustainability and communication. His vision for UNICA was "to build a sustainable bioenergy network, support public policies that make sense, and correct the vast disinformation that still exists regarding our industry."

Few sectors spark as much interest, as the Brazilian sugarcane industry. In 2009, for example, UNICA received 162 delegations from 83 countries that were interested in the Brazilian experience with ethanol and bioelectricity. In addition, UNICA received more than 30 requests for information from journalists – every day. This interest resulted from Brazil's unique experience with renewable energy. The sugarcane industry was the country's second leading energy source with an estimated 18% of the national energy mix in 2009 (Exhibit 1). Ethanol was available in practically all service stations across the country and virtually all new cars sold in Brazil were flex fuel. In March 2008 ethanol consumption in Brazil surpassed gasoline use (Exhibit 2). Brazil was the only country in the world where the alternative fuel was fossil and the main source of fuel was renewable. UNICA estimated that the use of sugarcane ethanol had generated a reduction of about 600 million tons in CO_2 emission since 1975.
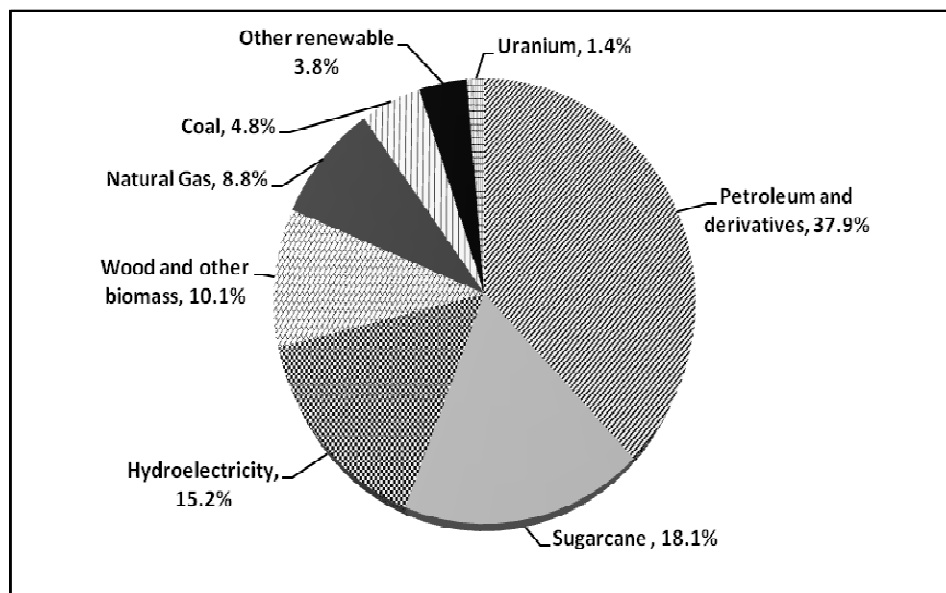
Exhibit 1. Brazilian Energy Balance (2009) in 103 TOE (Tons of Oil Equivalent)
Source: Brazilian Ministry of Energy and Mining.
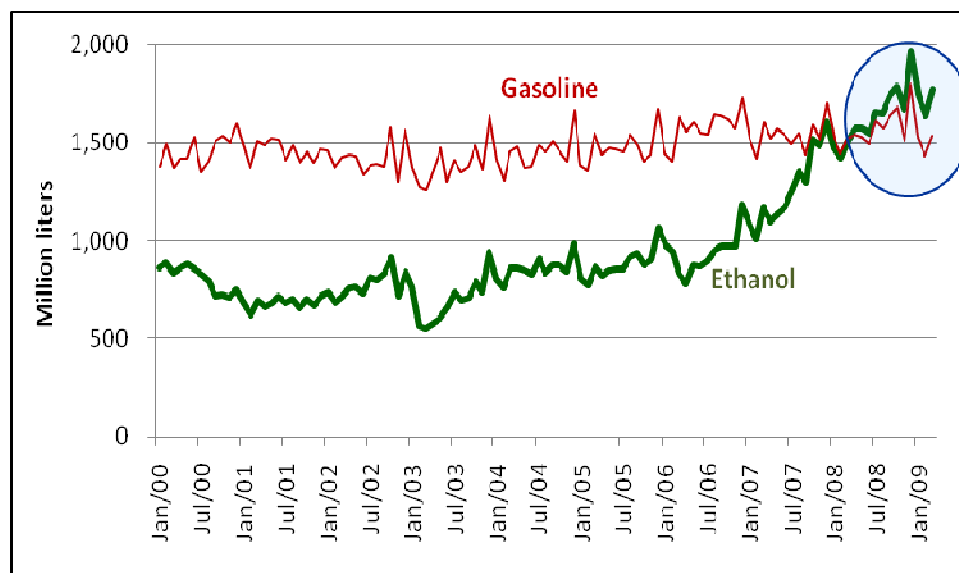
Exhibit 2. Ethanol and Gasoline Consumption in Brazil (million liters)
Sources: ANP (National Oil and Fuels Agency) and UNICA.

Despite these achievements, the Brazilian sugarcane industry was the target of considerable criticisms and "bad press." These criticisms were related to perceived negative externalities of sugarcane production including the food-versus-fuel debate, land use changes, deforestation of natural habitats, air pollution due to sugarcane burning and workers well being. For example, the Brazilian Environment Ministry stated that sugarcane was "a deforestation vector" in the Cerrado region. The leading Brazilian weekly newsmagazine *Veja* identified sugar as the main culprit of a "global obesity epidemic" in a cover story. One of the largest Brazilian producers of sugar and ethanol was accused of buying sugarcane from a supplier that used "slave labor." In addition to such domestic criticisms, the industry was under considerable pressure from NGOs, civil society organizations, trade groups, and governments outside Brazil. "As the sugarcane industry evolved, diversified its output from sugar to ethanol and bioelectricity, and became increasingly global, the game became tougher," explained Marcos.

Given this backdrop, Marcos faced a complex set of challenges. The first challenge was related to the role of UNICA in coordinating the sustainability agenda in an industry-wide effort. More specifically, Marcos wanted to better understand the tradeoffs of the strategy pursued by UNICA to deliver sustainability and also the limitations of an industry association in gaining legitimacy from society at large. UNICA's approach was to proactively engage with domestic and foreign governments to shape the regulatory environment; to collaborate with NGOs and civil society organizations in multi stakeholder initiatives aiming to develop certifications for sustainable products; and translating the complex sustainability debate to industry participants. In doing so, UNICA attempted to close the gap between industry practices and stakeholder demands and also to gain legitimacy with society at large.

A second set of challenges emanated from the rapid growth and structural changes occurring in the industry, including geographic expansion, consolidation, vertical integration, innovative business models, and entry of new players. Should Marcos attempt to redesign the current

governance structure and strategy of UNICA so as to remain a viable organization? As the lights in the airplane cabin were dimmed and Marcos got ready to rest, he wondered if UNICA's efforts were effective in helping the organization come close to fulfilling his vision.

An Overview of the Brazilian Sugarcane Industry

Sugarcane was an integral part of Brazil's social, political and economic history. One of the first decisions Portuguese conquerors made after landing in the southern coast of Bahia in 1500 was to introduce sugarcane brought from India and East Asia. Sugarcane producers were given very large tracts of land by the Portuguese crown and used slave labor to produce sugar – the country's first export crop. Sugar was produced in large, vertically integrated plantations. For several decades, it was the country's most important economic activity.

It was not until the 1970s that the sugarcane industry started to become less dependent on sugar exports, when it received massive investments in science and technology both from private and public sources. These investments led to impressive productivity gains at the farm production and processing levels, which translated to lower fuel prices paid by consumers (Exhibit 3). As a result, production of ethanol per hectare of sugarcane increased from 3,000 liters in the early 1970s to 7,000 liters in 2009. The industry started to convert sugarcane into a diverse range of value-added products including ethanol, bioelectricity and bioplastics.
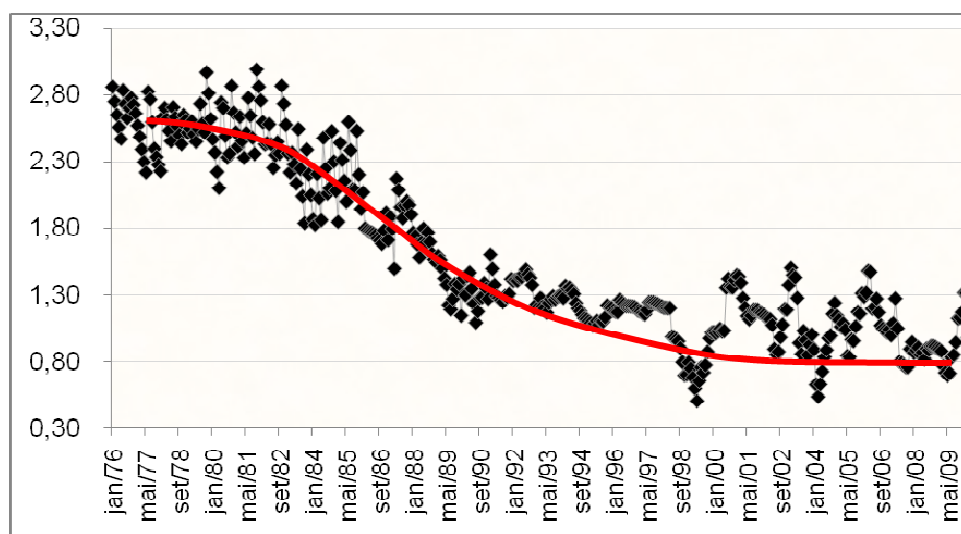
Exhibit 3. Prices Received for Anhydrous Ethanol by Sugarcane Processors (in R$/Liter)
Note: Prices were deflated by the IGP-DI index (base is April 2010). As a result of efficiency gains, the inflation-adjusted price currently received by ethanol processors is about 1/3 of the price received in the beginning of the *Proalcool* in the 1970s.
Source: UNICA.

The first defining moment in this process happened in the mid-1970s when the Brazilian government enacted the National Alcohol Program – known as *ProAlcool* – to reduce the country's dependence on foreign oil. The major pillars of *ProAlcool* included investment incentives for the construction of ethanol distilleries attached to existing sugar mills; a 5% mandatory ethanol blend (E-5) in all gasoline sold in the country, which was gradually increased

to the current level of 25% (E-25); and incentives to the production of pure ethanol powered vehicles (E-100).

The industry was heavily regulated until the beginning of the 1990s. Federal law 4870 enacted under a military dictatorship in 1965 defined the "rules of the game" from sugarcane fields to sugar and ethanol production, distribution and exports. Prices were set at each stage along the value chain and each mill and distillery was allocated production and export quotas. The Sugar and Ethanol Institute (IAA) was the federal agency in charge of regulating the industry. This institutional setting tied the hands of the private sector and restricted entrepreneurial activity. As a result, the industry mindset was production driven. Industry participants also engaged in lobbying activities as profit margins and industry growth were decided at the corridors of the IAA in Brasilia.

Democracy was restored in the late 1980s and a new Constitution was enacted that significantly altered the role of the state in the economy. Starting in the early 1990s the economy was liberalized, Brazil joined the Mercosur trade block and the Real Plan was adopted to control inflation. The sugarcane industry embarked on a gradual process of deregulation starting with the extinction of the IAA in 1990. A new law in 1994 discontinued all price and quantity controls and also liberalized sugar exports. In 1997 the ethanol domestic price control was extinguished. During this transition period, industry participants became increasingly driven by competitiveness and profitability. But still the overwhelming majority of sugar mills and ethanol distilleries were family-owned firms.

Another turning point that shaped the Brazilian sugarcane industry was the introduction of flex-fuel vehicles (FFVs) in 2003. FFV technology allowed consumers to fuel their cars with gasoline, ethanol or any mixture of both. That is, fuel choice could be made at fueling stations reducing risks for car owners and allowing the market to self regulate based on relative prices of each fuel. FFV technology has been very popular among consumers and over 90% of all new light vehicles sold in Brazil in 2009 were FFVs. Thirteen automakers – including major U.S., European and Asian firms – manufactured more than 80 flex-fuel car models. The FFV fleet reached 10 million vehicles in early 2010 or approximately 42% of the light vehicle fleet in the country, which was expected to surpass 50% by 2011. Domestic ethanol demand increased in a similar pace to FFV sales with ethanol use surpassing total gasoline demand in 2008 (Exhibit 2). Ethanol use included anhydrous ethanol blended in gasoline (E-25) and hydrous ethanol (E-100). According to UNICA estimates, the use of sugarcane ethanol in flex-fuel cars since 2003 had decreased CO_2 emissions by 83 million metric tons.

A more recent breakthrough was the 2007 Energy Independence and Security Act that significantly increased the mandate for renewable fuel use in the U.S. The Renewable Fuel Standard (RFS) legislation determined an ambitious target of 136 billion liters of renewable fuels by 2022. Other countries followed the U.S. initiative to create a market for renewable fuels including the EU Renewable Energy Directive (Exhibit 4). Although the global market for ethanol was still very small due to tariffs and import restrictions, these mandates for renewable fuel use represented growth opportunities for the industry.
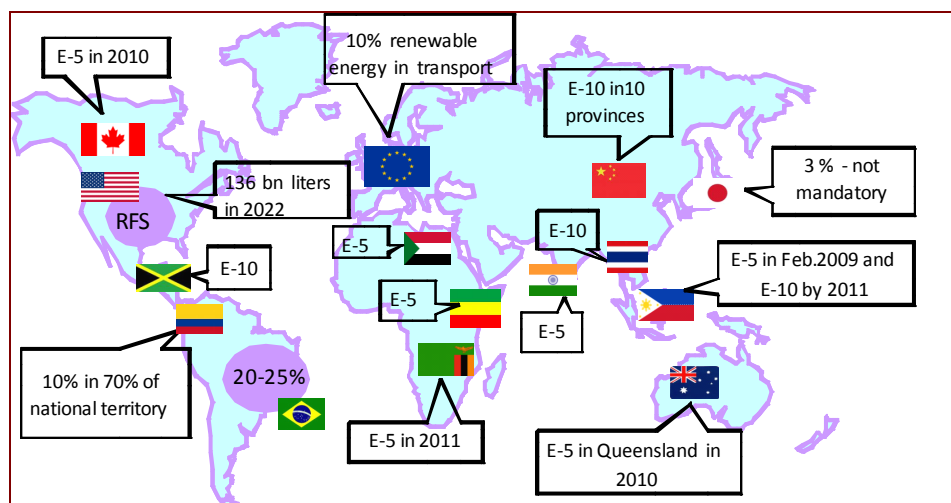
Exhibit 4. Mandates for Renewable Fuel and Energy across the Globe
Sources: Lindsay Jolly, Future Trends in World Food Security; WSRO Annual Meeting 2008; F.O. Licht and LMC International.

As a result, the industry entered a new phase of rapid growth and structural change in the mid-2000s. Sugar and ethanol processors engaged in joint ventures to make the necessary investments in logistics infrastructure and thereby take advantage of scale economies in distribution, exports and risk management. The industry started a consolidation process with several mergers and acquisitions. According to KPMG Corporate Finance, 99 M&A transactions involving sugarcane processors occurred between 2000 and 2009. Family-owned processors began to hire professional managers and adopt corporate governance best practices. Some domestic firms converted to publicly traded corporations to access outside sources of capital with IPOs in Brazil and New York. Copersucar – a cooperative owned by 36 processors in São Paulo – adopted a hybrid ownership model allowing the introduction of outside equity. Since 2006, 115 new, greenfield mills and distilleries were built across the country in non-traditional areas in São Paulo and adjoining states. Foreign players – including Tereos, Dreyfus, Bunge, ADM, Noble Group, Adecoagro and Shree Renuka Sugars Ltd. – and oil companies Shell, BP and Petrobras entered the industry buying existing plants and building new ones. Industry sources estimated that multinational players controlled about 25% of the industry capacity in early 2010. As a result of this structural change process, the industry became more heterogeneous and more geographically dispersed.

Economic, Environmental and Social Impacts

The Brazilian sugarcane industry was comprised of about 70,000 sugarcane producers, 430 processing units (sugarcane mills and distilleries) controlled by 160 groups, and 1.2 million workers. Sugarcane production in Brazil was spread out in 8.1 million hectares – equivalent to 2.5% of the country's arable land. The land area used to produce ethanol was about 4.9 million hectares, which was sufficient to displace more than 50% of the country's gasoline needs and export. UNICA estimated that ethanol production could triple if 2% of existing degraded pastures were replaced with sugarcane fields. The Brazilian government introduced an agro-ecological zoning policy in 2009 to delimit areas where sugarcane (and other crops) could be

produced. According to this zoning rule, the permitted land area to grow sugarcane could not exceed 64.7 million hectares or about 7.5% of the Brazilian territory. This law prohibited agricultural production in sensitive biomes such as rainforests and wetlands. It also limited agricultural expansion into native vegetations including the Cerrado.

Sugarcane production was clustered around two main regions (Exhibit 5): along the northeastern coast (2,000 km to the east of the Amazon rainforest) and in southeastern states around São Paulo (2,500 km to the south of the Amazon rainforest). Although the industry was first established in northeastern Brazil, the region represented less than 10% of total industry output with the remaining 90% produced in the southeast. In addition to dispersion in geography and industry structure, the industry was also characterized by heterogeneous ownership structures, including multinational firms, publicly listed corporations, cooperatives and many smaller, family-owned processors (Exhibit 6).

Fonte: NIPE-Unicamp, IBGE e CTC
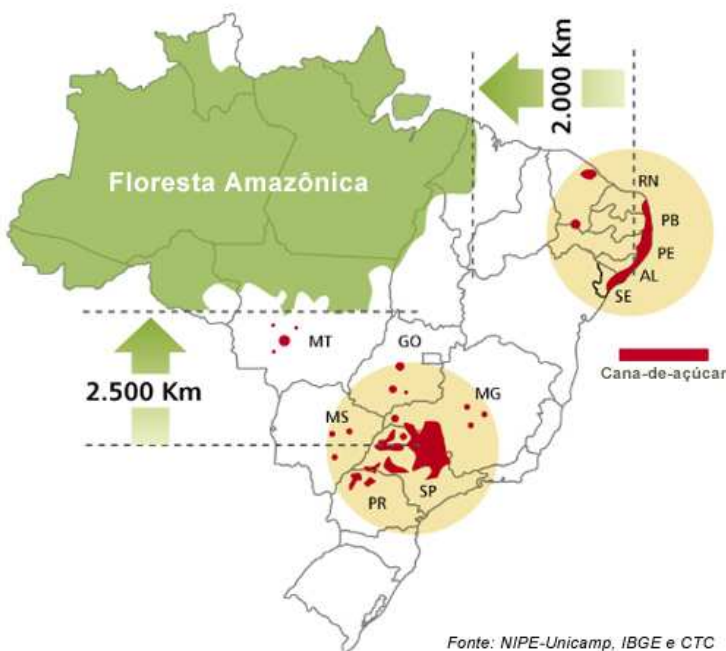
Exhibit 5. Geographic Footprint of the Sugarcane Industry in Brazil

The industry output was impressive: 542 million metric tons of sugarcane was used as raw material to produce 29 MMT of sugar (equivalent to 20% of world production and 45% of world exports), 25 billion liters of ethanol (30% of world production and 60% of world exports) and bioelectricity (Exhibit 7). Ethanol production alone created 465,000 direct jobs, which was six times larger than the oil industry in Brazil. Ethanol production was present in 1,042 municipalities across the country, compared to only 176 for oil. This economic activity translated into more income distribution and community development in rural areas. University of São Paulo (USP) scholars estimated that a 15% nationwide gasoline substitution with ethanol created 118,000 new jobs and generated U.S. $140 million in additional wages annually.

	Processed Sugarcane (2009/2010)	Ownership Structure
COPERSUCAR	68,322,123	Cooperative
COSAN	52,781,685	Publicly-traded corporation
LDC (DREYFUS)	19,388,223	Multinational
TEREOS	13,652,029	Multinational
SÃO MARTINHO	12,923,436	Publicly-traded corporation
BUNGE	9,285,292	Multinational
SÃO JOÃO ARARAS	7,371,057	Family owned
CERRADINHO	6,588,721	Family owned
EQUIPAV / Shree Renuka Sugar Ltd.*	6,582,275	Multinational
COLOMBO	6,518,941	Family owned
BAZAN	6,110,957	Family owned
GRUPO TONIELLO	4,728,588	Family owned
LUIZ CERA OMETTO	3,606,616	Family owned
ETH ODEBRECHT	2,832,469	Publicly-traded corporation
Other 28 firms	53,580,386	--------
TOTAL	**274,272,798**	--------

Exhibit 6. Size and Ownership Structure of Largest Sugarcane Processors in Brazil
Note: this list only includes processors that are members of UNICA.
* Transaction announced February 2010.
Source: UNICA
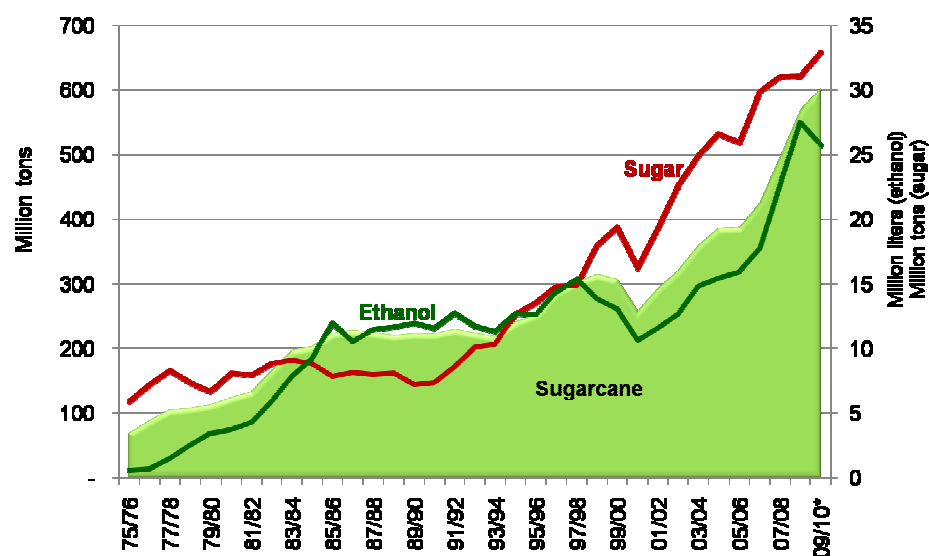
Exhibit 7. Sugarcane Industry Output Growth
Source: UNICA

The increased use of sugarcane ethanol as a renewable fuel in Brazil had considerable impacts on the reduction of GHG emissions in the transportation sector. An assessment by the International Energy Agency (IEA) suggested that sugarcane ethanol could deliver a verifiable reduction in

GHG emissions of 90%, depending on adopted production techniques, when compared to gasoline (Exhibit 10). As part of the RFS legislation, the U.S. Environmental Protection Agency (EPA) labeled sugarcane ethanol as an "advanced" biofuel as it reduced GHG emissions by 61% compared to gasoline, considering direct and indirect land use changes. In economic terms, specialists concluded that for every liter of ethanol use Brazil saved U.S. $ 20 cents in carbon mitigation costs. Air quality researchers at the University of São Paulo School of Medicine estimated that if every car in the São Paulo metropolitan region were fueled exclusively with gasoline, the city would face annually more than 400 additional deaths, 25,000 hospitalizations and an increase of U.S. $80 million in healthcare expenses.

All sugarcane mills and distilleries in Brazil were self-sufficient in electricity. Processing plants used sugarcane bagasse – the cellulosic residues left after sugarcane is crushed – to generate vapor and produce bioelectricity for self-consumption. The excess of this clean energy not used in the plants was sold to distribution grids thereby substituting other forms of carbon-intensive electricity such as fossil thermoelectric plants. Sugarcane mills generated the equivalent of 3% of the installed Brazilian electrical capacity in 2009. With the increased adoption of mechanized harvesting, part of the sugarcane biomass that was left on the fields would also be used to generate additional bioelectricity. The sugarcane bioelectricity share was expected to increase to 15% of total electricity capacity in 2020. Another benefit of sugarcane bioelectricity was its synergy with hydropower. Sugarcane was harvested and processed during the dry season, when hydropower dams experienced a reduction in electricity generation. This greatly increased the stability and reliability of the national grid.

Despite these benefits, the industry was under pressure from criticisms in Brazil and also from stakeholders outside the country. Consequently, future industry growth had to be closely linked with responsible production and consumption practices. As the largest industry association, UNICA played a key leadership role in coordinating industry participants to achieve this goal.

The Brazilian Sugarcane Industry Association (UNICA)

The history of UNICA started in 1932 with the formation of the Sugarcane Millers Association (*Associação dos Usineiros*) by processors in the state of São Paulo. Between 1932 and 1990, the Association office was housed at the Copersucar headquarters together with the sugar and ethanol processors' unions. The presidents of processors – the majority of which were family-owned firms – took turns in managing the association. With the enactment of *ProAlcool* in the 1970s many processors decided to leave Copersucar and form competing industry associations. It was only in 1997 that UNICA was formed as a union of these rival associations.

In 2009 UNICA represented about 50% of the total processed sugarcane in the country. Processors in northeastern states had their own industry associations and some processors in the southeastern region were not members of UNICA. Although the northeastern states were responsible for less than 10% of total sugarcane production in the 2009-10 crop season, they still had considerable political influence. "They have always been better organized politically than us," explained Antonio de Padua, the Technical Director of UNICA.

In 2000 UNICA members decided to hire Eduardo Pereira de Carvalho as its first professional President and CEO. With extensive industry experience, Mr. Padua was hired as the Technical Director to assist Eduardo. The board of directors maintained responsibility for setting the policies and providing strategic direction, but execution was delegated to a professional staff with considerable autonomy. Eduardo changed the organizational structure of UNICA and introduced objectives, goals and performance measures for the management staff. Eduardo led UNICA until 2007 with a focus on increasing industry competitiveness in a deregulated market environment. His major accomplishments were to consolidate UNICA as the unified industry voice and to introduce professional management to UNICA, which was rare among industry associations in Brazil.

By the late 2000s the industry dynamics had changed again especially after the U.S. introduced the renewable fuels mandate. But the Brazilian sugarcane industry started to become the target of attacks and accusations. Opponents argued that sugarcane ethanol was a cost effective alternative to gasoline but it destroyed native forests, it employed slave labor and it was responsible for escalating food prices (Exhibit 8, see Appendix 1). The industry was not ready to face these criticisms and adopted a distant, passive approach as it had done for several decades. This started to change in July 2007 when Marcos was hired to develop a sustainability agenda, to better communicate with outside stakeholders and to consolidate ethanol as a globally traded commodity.

Governance and Organizational Structure

UNICA members were 41 processors located in São Paulo and adjoining states. Membership was voluntary and open but applications of new members had to be approved by the board of directors. These 41 members owned 123 processing plants that crushed 274 million tons or about 50% of the Brazilian sugarcane crop. Membership fees and voting rights in the association were set in proportion to sugarcane crushing volume. As a result, the largest processors contributed more to UNICA's budget but also controlled more board seats. The two largest processors represented 44% of total sugarcane volume and the five largest groups 60% (see Exhibit 6).

The UNICA governance structure was based on a three-tiered model: the Board, three committees and the executive team (Exhibit 9). The board of directors was responsible for making decisions and setting policy. It was comprised of 24 elected seats in addition to the President-CEO. Each director was elected for a three-year term with no term limits. Board meetings occurred every Tuesday afternoon at the UNICA office in São Paulo. The last board meeting of each month, when UNICA staff briefed members about current affairs, was plenary and opened to all members. "These monthly meetings are very important to our members as it is also an opportunity for them to interact socially. Our association has the culture of a club," believed Eduardo Leão de Sousa, the Executive Director and Board Secretary.

The governance structure of UNICA also included a Fiscal Board and three technical committees. The Fiscal Board – formed by five elected members – met on a quarterly basis to perform the internal audit function. The three permanent committees were charged with developing the strategic agenda set by the Board. Each committee was formed by eight board directors with the support from professional staff. They met monthly to provide strategic

leadership related to their assigned areas of responsibility – competitiveness, sustainability and representation. Each committee was charged with developing specific policy proposals regarding key issues and also an action plan that formed the basis for UNICA's annual strategic plan and budget. A General Assembly of members occurred once a year to approve financial statements and the budget and to conduct the election of Board directors.
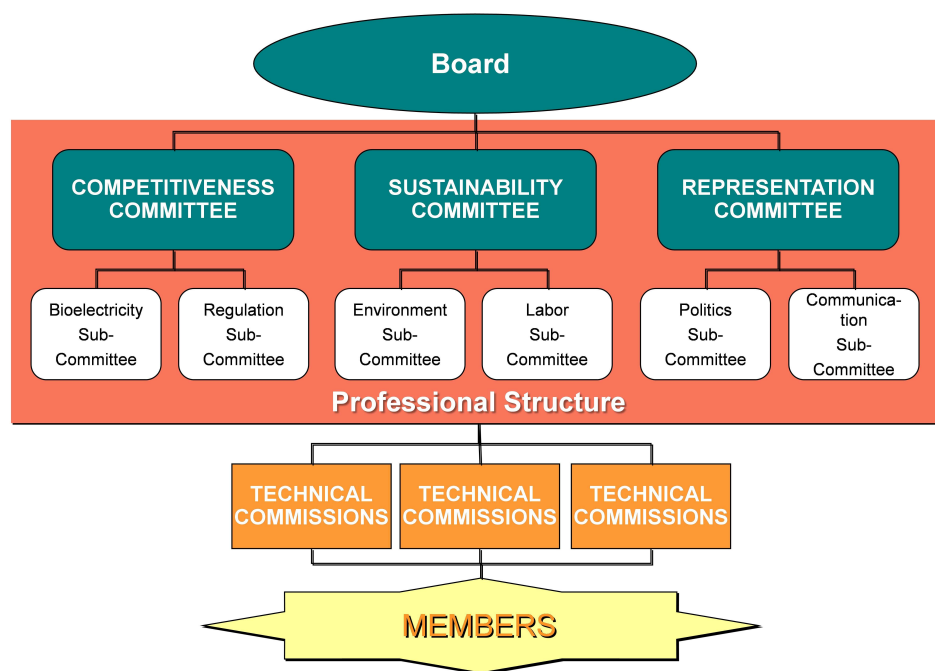

Exhibit 9. UNICA Governance Structure

The execution of the strategic and action plans laid out by the Board and its committees was the responsibility of the professional staff. UNICA's current organizational structure, implemented by Marcos in 2007, included the President-CEO and three Directorships – Executive, Technical and Communications. The CEO and the three directors formed the Executive Committee. The staff included full-time employees, executives and specialists – in addition to consultants hired on a project basis – bringing a diverse set of skills and experience to UNICA. The professional team was also in charge of coordinating several technical commissions. These commissions were formed on a non-permanent basis to discuss issues of importance to the industry with the participation of members, non-members and industry specialists. The goal was to ensure an efficient operation in tune with the Board and to foster member involvement and participation.

UNICA's Sustainability Efforts

Since 2007 the UNICA team had been working on several international and domestic fronts to introduce industry-wide sustainability efforts. These efforts included engagements with foreign governments, multistakeholder initiatives, NGOs, labor unions and with several federal and state agencies in Brazil.

International policy, regulatory and certification initiatives

Geraldine Kutas provided leadership to UNICA in international affairs. She reported directly to Marcos given the centrality of international issues to UNICA's objective of consolidating ethanol as a globally traded commodity. Geraldine led a team that engaged with international stakeholders on several fronts.

First, UNICA interacted with foreign government officials and legislators to influence the development of policies and regulations concerning renewable sources of energy such as the Renewable Fuel Standard (RFS) and California's Low Carbon Fuel Standard (LCFS) in the U.S. and the EU Renewable Energy Directive. These policy processes were critical to the industry as they had the potential to open or close markets for sugarcane ethanol. UNICA believed that scientific evidence should play an important role in informing the policy making process. Building on Marcos' experience and network in academia, UNICA coordinated the development and communication of technical papers about the Brazilian sugarcane industry. Since the 1970s, Brazilian scientists had developed an extensive body of literature about biofuels, which was not readily accessible to their peers abroad – as they were published in Portuguese. UNICA provided support for these scientists to publish in English and also to participate in international conferences. In addition to coordinating the efforts of the scientific community in Brazil, UNICA also established foreign offices in Washington, D.C. and Brussels to coordinate more closely its lobbying efforts and influence the policy debate in a timely fashion.

Second, UNICA participated in discussion groups involving multilateral organizations, NGOs and foreign governments. An example was the Global Bioenergy Partnership (GBEP), an inter-governmental forum bringing together governments, inter-governmental agencies (like the FAO and UNEP) and the UN Foundation (an NGO) in a joint commitment to promote bioenergy for sustainable development. UNICA only participated in GBEP as an advisor to the Brazilian government. GBEP focused its activities in three strategic areas: sustainable development, climate change, and food and energy security. UNICA also helped establish the Sugarcane Discussion Group (GDC) to foster sustainable development practices in Brazil. These discussion groups identified and debated relevant issues but did not have clearly defined goals.

Third, UNICA represented sugarcane producers in relevant roundtables including the Roundtable of Sustainable Biofuels (RSB) and the Better Sugarcane Initiative (BSI). These multistakeholder initiatives (MSIs) were governing systems intended to regulate business behavior and promote sustainable business practices with the development of certification processes. Ideally they were formed by a broad range of participants such as NGOs, civil society organizations, trade unions and multinational corporations. However, the intricacy and divergent interest nature of MSIs had given rise to questions about their efficacy and continuance.

UNICA decided to participate in these MSIs to represent the interests of producers from a "south" or developing country perspective. Geraldine argued that the main challenge in these roundtables was to close the gap between the "sustainability demands of consumers, processors and retailers in the developed world and the realities faced by commodity producers in developing countries. In addition, nobody wants to bear the increased costs associated with sustainability certification of a commodity – such as sugar and ethanol – and the producer always

ends up bearing these costs." Despite these challenges, she believed MSIs were very important to open direct channels of communication and build trust between participants.

Certification Initiatives in Brazil

Eduardo Leão de Sousa was in charge of the "domestic front" – including all initiatives with Brazilian government officials, policy makers, consumers, labor unions and NGOs leading to certification of sustainable practices. He was also responsible for the team headquartered in the Ribeirão Preto office – at the heart of the sugarcane country – that engaged directly with industry participants. Eduardo believed that achieving sustainability should involve "a two-way communication process as information must flow upstream to sugarcane producers and they must be ready to respond to the demands of customers and end consumers." Examples of certification of sustainable practices involving the sugarcane industry included the Green Protocol, the National Labor Commitment and the RenovAction program.

The Green Protocol

In June 2007 the São Paulo Governor and Secretaries of Agriculture and the Environment signed with UNICA the Agro-Environmental Protocol – also known as the Green Protocol – to promote sustainable environmental practices in sugarcane production and processing in the state. The protocol established a series of guidelines to be voluntarily followed by processors seeking eligibility for the Certificate of Environmental Compliance. These guidelines comprised practices related to soil and water resource conservation, riverside forest protection, greenhouse gas emission reduction and responsible agro-chemical use, among others (Exhibit 10, see Appendix 2).

Despite the breadth of the protocol, the most important directive was the more rapid introduction of sugarcane harvest mechanization in substitution for the traditional practice of sugarcane burning that allowed cutters to manually harvest the fields. Prior state legislation required sugarcane burning to be eliminated by 2021 in areas where mechanization was possible and by 2031 in areas where mechanization was not feasible due to land steepness. Under Green Protocol directives, these deadlines were anticipated to 2014 and 2017 respectively. According to UNICA estimates, accelerating the harvest mechanization process would reduce CO_2 emissions from sugarcane straw burning by 8.2 million tons by 2017. Furthermore, the protocol required all new sugarcane plantations in the state to be developed in fields where mechanization was possible.

According to UNICA statistics, 160 sugarcane mills had voluntarily adopted the protocol since 2007 representing 85% of the total number of processing plants in the state. Additionally, approximately 54% of the cane harvested area had already been mechanized by the 2009-10 crop year (Exhibit 11, see Appendix 3). The Green Protocol had become an important instrument to evaluate the environmental performance of the sugarcane industry. Also, it had fostered research in new technology development such as bioelectricity production from sugarcane straw and the adaptation of mechanical harvesting processes for small- and medium-sized sugarcane producers.

The National Labor Commitment

In June 2009 the National Commitment for the Improvement of Labor Conditions in Sugarcane Production was launched by the Brazilian federal government, UNICA, the Federation of Rural Workers in the State of São Paulo (FERAESP), the National Confederation of Workers in Agriculture (CONTAG) and the National Sugar-Energy Forum. The main purpose of the National Labor Commitment (NLC) was to encourage and recognize best labor practices in the sugarcane industry. Also, it was intended to promote education, training and placement of workers whose jobs were at risk due to sugarcane harvest mechanization. The Brazilian sugarcane industry employed approximately 1.2 million workers in both the farm production and processing sectors in 20 states. Although the industry had made significant progress in improving work conditions, labor related issues still persisted even among some large processors.

Processors that voluntarily committed to the program seeking to receive the Conformity Certificate had to follow 30 guidelines set forth by the terms of the agreement. These guidelines included labor best practices that were stricter than the legal obligations of federal labor laws. They addressed issues related to safety, health, and general working and hiring conditions of workers engaged in manual operations in sugarcane fields. Furthermore, under the NLC the federal government was responsible for implementing public policies for worker education, requalification and job placement to mitigate unemployment caused by increased mechanization. According to UNICA, more than 300 processors representing approximately 75% of total industry output embraced the NLC in its first day of operation.

The RenovAction Project

RenovAction was a training program created by UNICA in partnership with the Federation of Rural Workers of the State of São Paulo (FERAESP). The project also received financial support from the Inter-American Development Bank (IDB), Syngenta, John Deere and Case IH. The initiative was launched in 2009 as a response to the fast mechanization of sugarcane planting and harvesting triggered by growing environmental and social concerns. The phasing-out of pre-harvest burning and manual harvest suggested that a great number of workers employed as sugarcane cutters would eventually lose their jobs. The industry estimated that every mechanical harvester would replace up to 80 cane cutters while creating 18 higher-paid jobs that required training. As a result, 75% of the 150,000 cane cutters employed in the state had their jobs at risk. The other 25% would have to be retrained to perform other functions in the sugarcane industry. It was within this context that the RenovAction program would operate.

The objective of the RenovAction program was to train every year 7,000 workers from local communities in six sugarcane production areas in the state of São Paulo. The training program was divided into two major components: courses to reposition cane cutters within the sugarcane industry (e.g., as mechanical harvester operators, mechanics, truck drivers, electricians, etc.) and courses to reposition displaced cane cutters in other sectors of the local economy (e.g., construction, pulp and paper mills, and horticulture). Course development was "demand driven" as offerings would target local opportunities and specific labor demands in each affected community.

The RenovAction program received funding from sugarcane processors and also from industry participants Syngenta, John Deere and Case. All 41 processor groups associated to UNICA – representing 123 mills – voluntarily joined the program. A committee – formed by two UNICA representatives, two labor union (FERAESP) representatives and one representative from each industry donor – was responsible for the strategic use of funding, course development approval, and project evaluation and monitoring. According to Eduardo, the success of this program rested on the engagement and effective coordination of all participants involved in the sugarcane supply chain.

Corporate Social Responsibility Efforts

In addition to providing industry leadership and representing members in the negotiation and development of certification processes, UNICA coordinated the development of corporate social responsibility (CSR) efforts at the processor level. Since it had signed agreements such as the Green Protocol and the NLC, UNICA needed to bring its members along to be able to deliver on its commitments. Because the adoption of sustainable practices by sugarcane processors was voluntary, UNICA staff debated the incentives of industry participants to follow their leadership and deliver sustainability.

Interacting directly with owners and managers of member processing plants was the responsibility of Maria Luiza Barbosa and Daniel Lobo. According to Iza Barbosa, "the main challenge of our job is that we don't see results every day. When we first enter a processing plant we need to earn the trust of owners and plant managers. Then we have to help them understand the necessity and urgency of the CSR agenda. When I joined UNICA ten years ago only 4 processors engaged in social-environmental reporting. Now we have the majority of our members representing more than 100 plants." UNICA's CSR team also offered courses and leadership development programs for processors interested in adding CSR to their strategic initiatives. Exhibit 12 shows the major CSR projects initiated by UNICA and member participation.
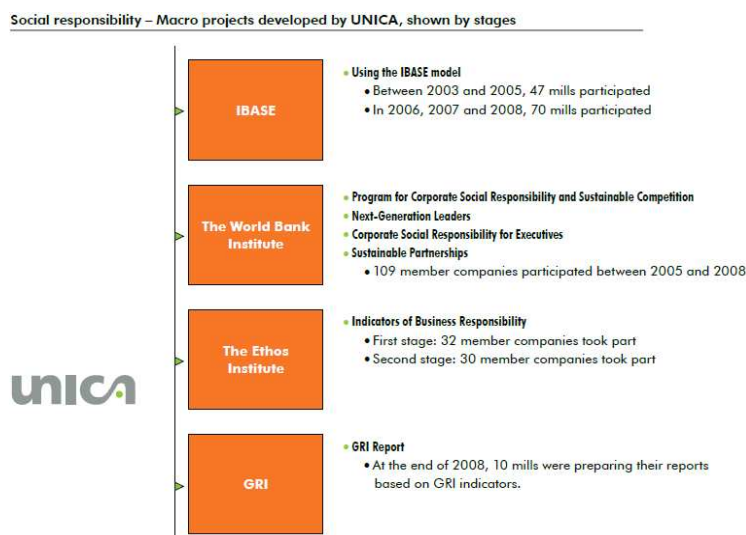

Exhibit 12. CSR Projects Developed by UNICA and Member Participation since 2003

Iza and Daniel used the information collected directly from processors to develop industry benchmarks for key social and environmental indicators. These indicators served as a management tool allowing processors to benchmark their sustainability performance against industry averages and best practices. Additionally, bankers, customers and the Brazilian society at large were increasingly demanding sustainable business practices. It was more and more difficult to get funding from major banks or do business with large customers if a processor did not follow sustainable practices. Iza believed that "when a sugarcane processor adopting sustainable practices signs a big supply contract with Coca Cola or Nestlé, this is a major incentive for industry rivals to follow."

The combined CSR efforts and projects of UNICA members were compiled in the industry sustainability report. In 2009 UNICA became the first Brazilian industry association to publish a sustainability report based on the guidelines developed by the Global Reporting Initiative (GRI), an international organization based in the Netherlands. The GRI was created to give sustainability reports levels of consistency equivalent to financial reports. In its 2008-09 sustainability report – meeting the requirements of GRI version G3, level B checked – UNICA described 618 CSR programs implemented by its members during that crop year. These programs in the areas of education, culture, health, quality of life and the environment required annual investments of R$ 158 million and benefited 480,000 people living in communities around sugarcane mills. UNICA's GRI-checked sustainability report served as an important communication tool, a subject to which we now turn.

Communication Efforts

When Marcos joined UNICA, the Brazilian sugarcane industry was under considerable pressure from external stakeholders. The industry, however, had a historical culture of not responding to outside criticisms leading to the perception that it lacked transparency. As the industry did not position itself relative to critics, misinformation or "myths" were widespread. Adhemar Altieri was recruited as UNICA's Communications Director in November 2007. Since then he built a team of 12 professionals in charge of communication, media relations, marketing, public relations and content management. His major goals were to provide information about the sugarcane industry to 100% of all requests, to correct erroneous information published or broadcast about the industry, and to collect and organize information about major industry advances that had been systematically overlooked by the media and other outside stakeholders.

To support this proactive communications strategy, UNICA invested in the internal production of information to outside stakeholders by a team of professionals led by Adhemar, a journalist by profession. The association newsletter – which used to be sent only to members – had more than 4,000 opt-in subscribers in 2009. About 1,000 individuals in Brazil and abroad followed UNICA on Twitter. The association website was completely overhauled in late 2007 to provide updated industry information both in Portuguese and in English and since then visits increased three-fold. The investments in industry communication also led to an increase in UNICA's presence in seminars, including the Ethanol Summit, which in 2009 attracted more than 3,000 participants.

In 2009 UNICA also launched the AGORA Project – a communication effort with 2010 budget of R$3.2 million funded by UNICA, Orplana (an association of sugarcane producers) and several

other industry participants including Monsanto, BASF, Dedini, SEW Eurodrive, Amyris, FMC and BP Biofuels. AGORA is a marketing and communication project focusing on the benefits of ethanol as a green and sustainable source of energy as the main message. Three main groups were initially targeted: consumers, the government and public elementary schools.

Is UNICA's Model Delivering Sustainability?

As the airplane approached the São Paulo international airport, Marcos pondered about the progress of his first three years at UNICA. The organization had engaged with governments and stakeholders outside Brazil and also developed a unique sustainability model in Brazil. This model was based on a partnership between the public and private sectors that introduced incentives for the adoption of sustainable practices such as the Green Protocol. These protocols were not coercive but provided incentives for voluntary adoption by industry participants. It had also made headways in informing the policy debate regarding renewable fuel use in developed countries. The EPA decision to recognize sugarcane ethanol as an "advanced" biofuel under the RFS was an important outcome. The recognition in California as a low carbon fuel created an export opportunity to a state that leads the world in environmental policy. UNICA's communication efforts also started to pay off in Brazil and abroad – it was now regarded as a more transparent organization and a reliable source of industry information. Perhaps more importantly, industry participants in Brazil followed UNICA's leadership and embraced the sustainability agenda. For instance, several processors adopted their own GRI reports.

Notwithstanding these important accomplishments, Marcos recognized that much remained to be done in the future. The model adopted by UNICA was based on the leadership of a well-funded and professionally staffed industry association. UNICA deployed its financial and human resources focusing on public good initiatives that complemented the competencies and efforts of its members. UNICA was also unique in leading the sustainability debate in Brazil and also taking responsibility for connecting industry participants with outside stakeholders. But is the "UNICA model" effective in delivering sustainability? What are the pros and cons of this model? Marcos wondered what should be the role of an industry association such as UNICA in "building a sustainable bioenergy network" that is legitimate in the eyes of society.

At the same time that UNICA pursued its strategy focusing on competitiveness, sustainability and communication, the Brazilian sugarcane industry was going through dramatic structural change in 2010. Industry consolidation was gaining momentum with new M&A transactions announced almost on a weekly basis. The investment bank Itaú-BBA predicted that by 2015 the top-5 processors would increase their share from 25% to 40% of total industry capacity. Control over processing assets was quickly being shifted from family-owned, single-plant operations to multinational, diversified processors (such as Bunge and Dreyfus) and partnerships with big oil companies (such as Petrobras, Shell and BP). The Cosan-Shell joint venture signaled the emergence of a vertically integrated model with control of assets from sugarcane fields to ethanol pumps in service stations. Sugarcane production was rapidly expanding to areas outside São Paulo, UNICA's traditional influence territory. Should UNICA redesign its membership policy and governance structure to accommodate the conflicting interests of the new industry players? Perhaps more importantly, should it reassess its strategy or simply wind up? Marcos wondered if UNICA would remain relevant in light of these industry changes.

Appendix 1

Brazilian Ethanol: Good for America?

Brazil has been noted as a model for ethanol-fueled energy independence. But will the same strategies that worked for Brazil work for the U.S.? And how much would importing Brazilian ethanol help America?

Thanks to their government programs in the 1970s and 1980s, Brazil's ethanol industry has flourished. The country now runs all cars on a blend of at least 25 percent ethanol. Flex fuel cars, introduced in Brazil in 2003, have become more popular than ever. Brazil makes their ethanol from sugar cane, which can be harvested 200 days out of the year, and grows abundantly in Brazil's tropical climate. The labor required for this harvest, however, is extensive and poorly regulated.

Workers recruited to harvest sugar cane in Brazil are often victims of exploitation. With miniscule paychecks, they are forced to depend on food and shelter provided by the plantation, who they soon become indebted to. Trapped between backbreaking labor and piles of debt, they effectively become slaves. While slavery is against both international and Brazilian law, authorities have been unsuccessful in reigning in the culprits. Today, an estimated 25,000 to 40,000 men and women in Brazil are still subjected to forced labor, according to the International Labour Organization. In contrast, American ethanol is revitalizing our rural economy.

While cane sugar can be harvested for almost two-thirds of the year in Brazil, it must be processed at the ethanol plant within two days or else the sugar molecules deteriorate. Because most of America is unsuitable for growing sugar, our ethanol is primarily made from corn. While corn may be slightly less efficient for making ethanol than sugar is, it has one huge advantage – it can be stored for much longer periods before being made into ethanol. There are also plants being built in America right now which will be able to turn other materials, such as wood scrap, citrus rinds and other agricultural waste into ethanol, making it more efficient than ever.

The American ethanol industry out-produces many foreign suppliers in gasoline equivalence, including Saudi Arabia, Venezuela and Mexico. By using more homegrown ethanol, we can reduce our reliance on potentially volatile nations while strengthening our national security. Additionally, if all new vehicles sold in the U.S. were flex fuel, any blend of ethanol and gasoline could be used, giving consumers more choices and further reducing our need for foreign energy.

The U.S. has placed a tariff on imported ethanol to help foster our own energy independence and to offset a U.S. tax credit, called the blender's credit, that benefits foreign suppliers. Because energy is so important to our national security, the tariff on imported ethanol ensures that our own ethanol industry can continue to grow, innovate and keep creating much-needed jobs for Americans here at home. Why would we want to trade a dependence on foreign fuel with another? By using American ethanol, we never have to make that compromise.

Ethanol is more than a fuel. It's a solution. Learn more at GrowthEnergy.org.

Exhibit 8. Attacks on the Brazilian Sugarcane Industry: A Sample
Source: www.growthenergy.org

Appendix 2

Processors seeking the Green Protocol certificate need to follow these guidelines:

a. Anticipate the deadline for eliminating pre-harvest burning of sugarcane from 2021 to 2014, in fields with an inclination of up to 12%, accelerating the percentage of mechanized sugarcane harvesting from 50% to 70% by 2010.
b. Anticipate the deadline for eliminating pre-harvest burning of sugarcane from 2031 to 2017, in fields with inclination above 12%, accelerating the percentage of mechanized sugarcane harvesting from 10% to 30% by 2010.
c. Pre-harvest sugarcane burning is not allowed in expansion areas.
d. Take the necessary actions to ensure that cane straw burning or of any other sugarcane byproduct does not occur.
e. Protect riverside forests in sugarcane production areas given their importance in preserving the environment and protecting biodiversity.
f. Protect river or stream headwaters in sugarcane production areas recovering the surrounding vegetation.
g. Implement a soil conservation plan including the control of erosion and surface runoff.
h. Implement a water conservation plan favoring the adequate functioning of the hydrologic cycle, including a water quality control program and the reuse of water utilized in industrial processes.
i. Adopt good practices in the disposal of agrochemical containers by conducting triple wash, correct storage, adequate labor training and mandatory use of individual protection equipment.
j. Adopt good practices to minimize atmospheric pollution from industrial processes and assure adequate recycling and reuse of the residues generated in sugar and ethanol production.

Exhibit 10. Green Protocol: Certification Criteria
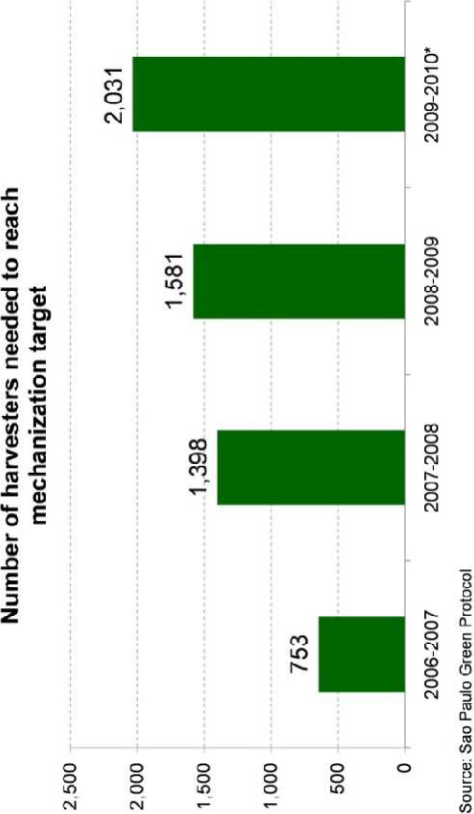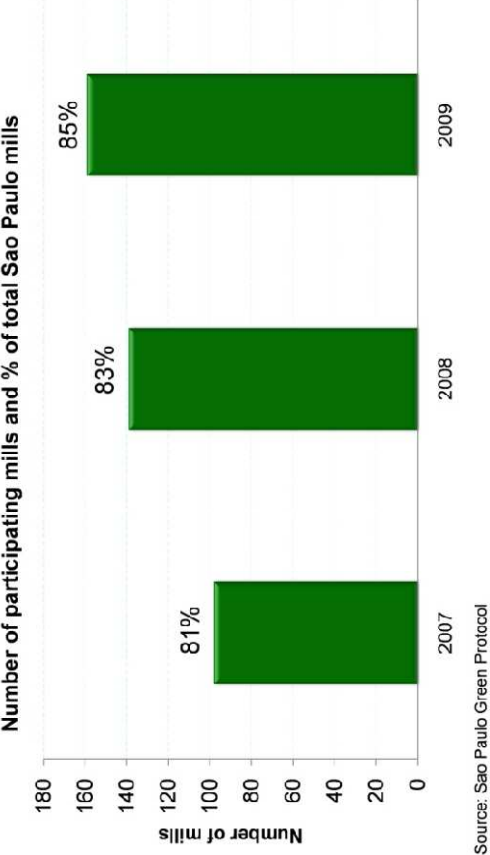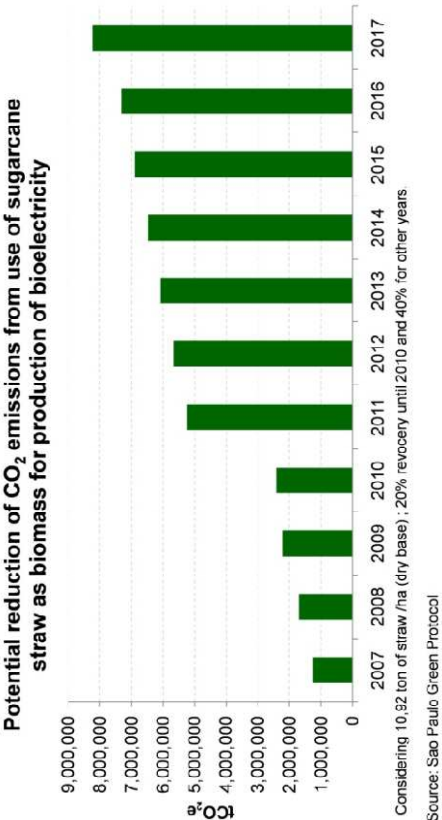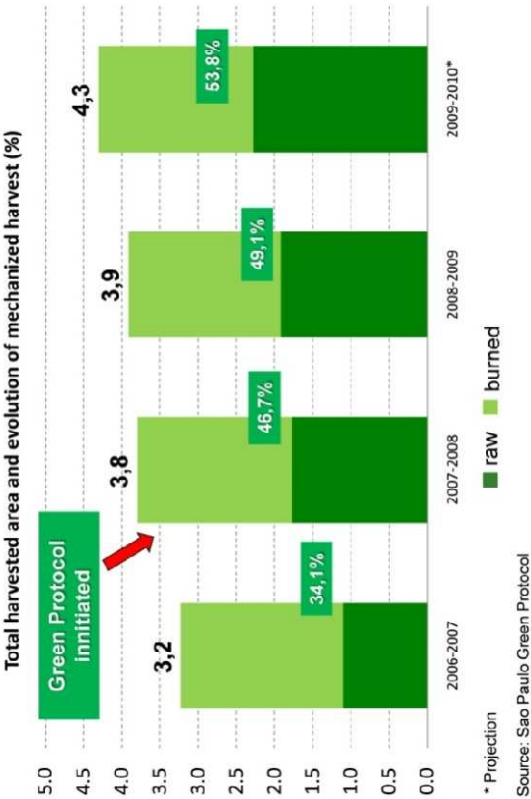**Source:** Secretary of Agriculture, São Paulo State (http://www.ambiente.sp.gov.br).

191

Exhibit 11. Green Protocol Statistics
Source: UNICA

Bánffi Soda Limited Partnership[1]

Tradition, innovation, and culture ~ past, present, and future

Imola Kisérdi-Palló[a] and Gregory A. Baker[⊕][b]

[a]*Head, Traditional Food Working Group, Hungarian National Committee of EOQ, HNC and Hon. Associate Professor, University of Szeged, Kossuth ter 11, Budapest H-1055 Hungary*

[b]*Director, Food and Agribusiness Institute, Professor, Management Department, 500 El Camino Real, Santa Clara University, California 95053-0396, U.S.A.*

Abstract

The Bánffi Soda Limited Partnership (Bánffi) case describes a small, family-owned Hungarian soda water producer. The company faces several challenges, including declining industry sales, changing market structure, and increasingly popular substitute products. The case challenges students to work with the limited company, market, and industry information that is typically available to small businesses. Students are asked to summarize the competitive situation for the company and develop and analyze several alternatives to help the company improve profitability.

Keywords: strategy, competitor analysis, soda water, Hungary

[⊕]Corresponding author:	Tel: + 1 408.554.5172
	Email: gbaker@scu.edu
Other contact information:	I. Kisérdi-Palló: imola.pallone.kiserdi@vm.gov.hu

IFAMA Agribusiness Case 13.4C

Bánffi Soda Limited Partnership

Tradition, innovation, and culture ~ past, present, and future

Motto:

"Because soda water is no mineral water, we should not forget that. Soda water means a civilized world, it is true, but the experience of generations and centuries was needed before Hungarians invented fröccs [spritzer]*, the secret of long life."*

Sándor Márai (Kiss, 2008)

Introduction

István Bánffi, owner and Managing Director of Bánffi Soda Limited Partnership (Bánffi), sat in his office in the company's new manufacturing plant reviewing the financial results for 2008. The company had just made a significant investment in the plant and equipment and he was hopeful that he could someday turn the company over to his 22-year-old son, Ádám. However, he faces many challenges in the years ahead, first among them rapidly declining industry sales. While his industry is heavily influenced by tradition, he wonders if it is time for a new direction.

Soda Water and Culture

Soda water occupies an important place in the history of Hungarian gastronomic culture. It is enjoyed equally by both wealthy and middle-class citizens and may be found on the tables of households, restaurants, evening parties and wedding receptions. Soda water is consumed directly to quench people's thirst and mixed with wine to make a drink known as a spritzer. In Hungary, a special culture has evolved around the consumption of the spritzer. When properly mixed, the wine preserves its original taste and flavor while the soda water reduces the alcoholic content. Hungarian writer, Sándor Márai, wrote that "Hungarians showed a profound understanding of life when they invented this miraculous, sagacious and prudent potion, concentrated enough to kindle the wine-drinker's imagination but not so fierce as to harm the noble organs." Wine and soda water mixtures of various proportions are known by different names such as, "Minor Spritzer" (kisfröccs), "Major Spritzer" (nagyfröccs), and "Long Stride" (hosszúlépés), with more than thirty recognized spritzer mixtures. Spritzers have appeared prominently in plays, books, and paintings in Hungary and throughout the world.

History of Soda Water Production

Soda water, also known as seltzer, is created by aerating drinking water with carbon dioxide. Soda siphons equipped with a special nozzle are filled with the soda water, maintaining a high pressure by means of a closed system technology. Among the carbonated beverages, soda water has the highest carbon dioxide content at 7 to 8 grams carbon dioxide per liter. Due to the closed system and nozzle, the last drop of soda water has the same bubbly appearance as the first. Furthermore, the closed filling system protects the soda water from contamination.

Joseph Priestly, a British clergyman and scientist is credited with being the the first to mix carbon dioxide with water in 1767. He was followed by Jacob Schweppe of Geneva, who, in 1783, invented an efficient but jealously guarded secret process for the commercial manufacture of artificial mineral water. In 1813 Charles Plinth constructed and patented the soda water dispensing fountain or siphon.

Other innovations soon followed, leading to the beginning of the soda water industry in Hungary. In 1829, the Hungarian Ányos Jedlik (inventor of the electric dynamo) developed an inexpensive means of saturating water with carbon dioxide. He built Hungary's first small scale soda water manufacturing plant in 1841, launching the soda water industry in Hungary. By 1869, the production of soda water became so widespread in Hungary that the government began regulating the industry.

At the end of the 19th century, Hungary had between 4,500 and 5,000 soda water manufacturing plants. Supporting industries, including glass and equipment manufacturers aided the development of the industry. Other major advances included the separate production of carbon dioxide, storage of carbon dioxide in steel containers, and motorized equipment, which replaced manually operated machines.

In 1901, the soda water manufacturers formed an alliance establishing a trade association, which produced a monthly journal entitled "Soda Water Industry." Following the nationalization of many industries that occurred at the end of World War II, the soda water manufacturers became members of the National Craftsmen's Organization. After the political transition in Hungary (1989-1990), the National Trade Association of Soda Water Makers (or MOSZI, its Hungarian acronym) was reestablished in 1990, building on the intellectual heritage of the old trade association. During the transition to a market economy, MOSZI strove to meet the challenges of the modern era under the leadership of the late Ferenc Zoltai. Between 2000 and 2008, László Deák, , led the association of nearly 500 members as its president.

During the 1970s and 1980s, soda water trade experienced a Renaissance in Hungary, with approximately 3500 producers. Most of these operations were small family businesses where the trade was passed down from father to son. Prior to Hungary's entering the EU, there was great uncertainty concerning the future of soda water production in Hungary. The EU had no regulations for soda water and rumors circulated that soda water production would be banned upon Hungary's entry into the EU. Fueled by these fears, soda water manufacturers developed and implemented a HACCP food safety system, replacing older equipment with modern machinery. Today, soda water is filled into reusable, hygienic, and environmentally friendly plastic bottles and steel canisters. It is manufactured in about 1,500 plants employing nearly 10,000 people. Before Hungary entered the EU in 2004, traditional soda water earned the Hungarian classification of "Guaranteed Traditional and Special Product," the only product in Hungary to receive such a designation. MOSZI is currently pursuing the EU designation of "Traditional Special Products (TSG)" defined under Regulation (EC) No 509/2006.

Bánffi Soda Limited Partnership

History of the Bánffi Family and Company

2008 marked the 100th anniversary of the founding of the company that would eventually become Bánffi Soda Limited Partnership. The company had its beginnings as a soda water plant founded by Mrs. Ferenc Belányi next to her bar in Kistelek, Hungary. While the soda water plant provided a decent living to the family, the Great Depression brought the family to the brink of ruin. The company fell on hard times again during World War II.

After Mrs. Belányi's death in 1941, her daughter, Mrs. Mihály Bánffi, inherited the bar along with the soda water plant. However, in 1944 the Soviets removed all alcoholic beverages from the bar and took the horse used to transport the soda water. The enterprise struggled during the following years until 1950 when many industries were nationalized and the company's assets were confiscated by the state. In 1952, Mrs. Mihály Bánffi bought back her soda water manufacturing machine from the state so she could resume production. During the socialist regime the price of one bottle of soda water was set at1.10 HUF (U.S. $0.09) because it was included in the list of essential foodstuffs.

In 1974, Tibor Bánffi, the son of Mrs. Mihály Bánffi, built a new soda water plant in Szeged. The privatization of the restaurant industry allowed the company to grow rapidly. Tibor took advantage of the company's small scale and flexibility and was soon supplying most of the restaurants in Szeged with soda water. Sales volume grew to 120,000 to 150,000 liters per year and the business was highly profitable. After the death of Tibor in 1985, the business was taken over by his son, István Bánffi. István succeeded in contracting with several large companies and producing soda water for them, thereby substantially increasing sales volume and revenue. By the end of the 1980s, production reached 300,000 to 400,000 liters per year. Unfortunately, hard times returned after the collapse of the Soviet Union and competitive pressures made it difficult to compete. Product sales were down in Eastern Europe and demand from Western Europe had not yet developed. Moreover, the appearance of Coca-Cola in restaurants further diminished demand for soda water. Many of the smaller soda water manufacturers went bankrupt.

With sales falling and the industry near collapse, István and his wife Mrs. Éva Andóczi Balogh decided to start collecting relics of soda water manufacturing. They planned to set up a Soda Water History Museum to commemorate the soda water industry. After many years of collecting important artifacts of the industry, the collection was displayed in the Museum of Commerce and Catering in Budapest and later as a travelling exhibition in several of Hungary's largest cities. In 2006, this unique soda water historical collection obtained a permanent place in the restored water tower in St. Stephen Square in Szeged where the Bánffi's 80-year-old soda water manufacturing machine is also exhibited.

In 1991, Lajos Nagy, an entrepreneur in Püspökladány, patented a plastic bottle with a siphon head and provided the industry with a new opportunity. The Bánffis immediately recognized this opportunity and were among the first firms to sell soda water in these plastic bottles. Production volume rose rapidly starting in 1992. Over the next several years the Bánffi plant was modernized; they bought modern machines and installed water-cooling equipment. Product

quality was improved by a filter system. Two other plants were built and four new delivery trucks were purchased. By 1995, production volume exceeded 2 million liters (25,600,000 HUF or USD $205,000) reaching 2.3 million liters in 2003(70 million HUF or $314,000). With Hungary's entry into the EU came greater access to goods and increased competition. Bánffi's revenues have steadily declined since that time. One bright spot was the previously mentioned designation of "Guaranteed Traditional and Special," which has had a significant positive impact on the industry's marketing efforts.

Suppliers

There are two raw materials used in the production of soda water, drinking water and carbon dioxide. Drinking water is provided by Szeged Water Works, a public utility. The carbon dioxide is purchased from two of the three leading suppliers, Linde Hungary, Ltd. and SIAD, Ltd. Although carbon dioxide is a commodity, Bánffi purchases from both companies in order to have increased bargaining power.

The other two principal inputs are plastic bottles and siphon heads. Both are commodities and may be purchased from several suppliers. Bánffi purchases plastic bottles from the Dutch company, Constar, and siphon heads from a local supplier, Györök Ltd.

Production

Bánffi operates two plants, one built in 1998 and another that was constructed in 2005 to replace an older plant that did not comply with EU regulations. Construction of the newer plant took place over a five-year period and was financed from the company's profits. The new plant has four machines, two with a capacity of 600 liters per hour and two with a capacity of 800 liters per hour. The older plant (1998) contains three production lines, each with a capacity of 600 1.5 liter bottles per hour.

Other major physical assets owned by Bánffi include six bottling machines, two industrial cooling units for cooling water during production, and four delivery trucks.

With the newly designed plant, product flows smoothly from room to room. Empty bottles are returned by customers and stored in a separate room. From there the bottles are moved to another room where they are cleaned and, if needed, repaired. Both the bottles and labels must be clean and intact before refilling. A "best used before date" is added to the label. Next, the bottles are moved to a room containing equipment for filling the plastic bottles and stainless steel canisters. Once filled, the bottles are moved to a storage room where they await delivery to the customer.

Bánffi employs nine people, including the Managing Director, a Production Manager, a Deputy Production Manager, three bottling workers, and three delivery drivers. A family-like atmosphere prevails in the workplace, consistent with the small size of the company. Bánffi also contracts with three people, one who is responsible for marketing activities, another person who is in charge of managing suppliers, and a bookkeeper.

Production of the soda water is conducted using the HACCP system, whose regulations and standards are applied throughout the entire manufacturing process to ensure a high quality product. Great emphasis is placed on preventing work accidents; all workers are required to wear protective gear.

Marketing

Products: Bánffi's main product is soda water, sold in 1.5 liter bottles and 21.5 liter pressurized stainless steel canisters. To offset declining sales, Bánffi introduced a new filtered drinking water product called Aquamarin in 2008. Aquamarin is available in 5- and 19-liter bottles. In addition to the consumer market, this product is sold to companies for consumption by their workers, including CORA (a supermarket chain based in Belgium with operations in Hungary) and the Szeged Crude Oil Refinery.

Pricing: Prices for soda water are €0.2 and €2.3 for 1.5 liters and 21.5 liters, respectively. Filtered water is priced at €0.9 and €3.4 for 5 and 19 liters, respectively. Both soda and filtered waters are essentially commodities. There is little product differentiation, and pricing among competitors, both large and small, is similar. Bánffi prices its products slightly below that of its competitors.

Distribution: Hungary has seen significant growth in modern retail channels, including supermarkets, shopping centers, and hypermarkets. Nonetheless, soda water is still sold primarily through small corner shops, which have experienced substantial sales declines in recent years. Despite the declining sales, Bánffi enjoys substantial loyalty among its customers. Bánffi's soda water is also sold through some Hungarian chain stores, including CBA and COOP. However, the large national supermarket chains have been unwilling to distribute local soda water, largely due to the effort involved in collecting and returning refillable containers to the producer. Furthermore, soda water producers have been reluctant to pay fees, such as slotting allowances, to access shelf space from the national chains. In order to offset declining sales, many of the small corner shops have increased their margins, making the product increasingly expensive for consumers. As a result, Bánffi has returned to the old way of selling soda water through home delivery and selling through small shops.

Promotion: Bánffi's products are promoted through the use of flyers, television advertising, and on its delivery trucks. Flyers are developed each year and distributed throughout the principal sales season lasting approximately from Easter through the end of September. Flyers are distributed directly to residents' homes using a student labor company. Bánffi participates in several regional exhibitions and fairs, such as the Szeged Festival of Hungarian Products and Beauty and Health Exhibition. Information is also available on the company's website, www.banffiszoda.hu. Total spending on promotion is about €2,000 per year.

Competition

There are numerous competitors in the market and practically every city and village in Hungary has a soda water plant. The industry is made up of 1,200 companies and employs approximately 10,000 employees when direct suppliers to the industry are included.

Greater Szeged has a population of approximately 170,000. The market for soda water is dominated by two companies, Bánffi and COMIX. Bánffi is the market leader with a market share of 60%, followed by COMIX with a market share of 30%. Five smaller firms account for the remaining 10% market share. Bánffi entered the market for filtered water in 2008 and has grown its market share to 20% in less than two years. In 2008 they produced 2014 19-liter bottles of filtered water. Production more than doubled in 2009 to 4236 bottles.

Bánffi's main competitor, COMIX, is a franchise-based enterprise that produces both soda water and oxygenated drinking water. COMIX obtained an industrial design protection by the Hungarian Patent Office, granting them legal protection for the appearance of their product, in this case the plastic bottle. COMIX holds exclusive rights to this bottle, which can be licensed to its franchisees. The introduction of COMIX's oxygenated drinking water has been very successful and the product has shown consistent growth over the last several years.

Consumption

There are numerous substitute products on the market, including mineral water (carbonated), filtered water, and soft drinks (Exhibit 1, see Appendix I). These substitute products are more widely available than soda water and sold in shopping centers and supermarkets. They are sold in disposable containers and attractively priced. For example, mineral water is priced comparably to soda water at about €0.2 for a 1.5 liter bottle.

Several products have experienced rapid growth in sales over the last decade, led by mineral water and fruit juices. This growth has come largely at the expense of soda water sales, which have experienced a decline of per capita consumption of almost 50% since 2000. The growth in mineral water sales has been helped by a flood of new, innovative products, including mildly carbonated mineral water, flavored mineral water, and iced tea-based mineral water. Similarly, sales of fruit juices have experienced rapid growth over the last decade while soft drink sales have remained relatively flat.

The principal drivers of these trends are higher incomes and greater health consciousness among consumers. This is particularly true for natural fruit juices. Mineral water sales have also benefited as it is perceived as both healthful and fashionable. Moreover, many consumers have chosen to substitute poor quality tap water with mineral water that is sold in convenient, disposable plastic bottles.

Financial Information

The company's assets total approximately €485,000 with the land and buildings valued at €450,000. Equipment and vehicles are valued at €35,000. The firm has no debt.

Exhibit 2. Selected financial information for the period 2000 to 2008*

Year	Production liters	Gross Revenue euros	Expenses euros	Profit euros
2000	2,264,729	169,000	134,842	34,314
2001	2,302,129	182,346	143,310	39,035
2002	2,366,632	202,564	163,050	39,514
2003	2,309,624	211,350	176,221	35,128
2004	1,925,254	177,253	148,442	28,800
2005	1,657,074	159,785	135,696	24,089
2006	1,444,849	138,835	117,367	21,464
2007	1,130,169	132,775	113,871	18,903
2008	1,153,411	139,696	134,639	5,057

*Profits declined significantly in 2008 because the firm expensed a major purchase.

Access to Capital

In the current recessionary environment, access to capital is difficult, particularly for small and medium-sized businesses. However, most banks in Hungary have credit opportunities for such companies. Additionally, there are programs available that specifically make credit available to small business, such as the New Hungary Micro Credit Program, which helps strengthen small businesses, and the Nationwide Micro Credit Program, which targets entrepreneurs with distinctive ideas and solid plans for making their businesses more successful. Bánffi could obtain up to €30,000 in short- to medium-term financing (1to 10 years) at an interest rate of about 8%.

SWOT Analysis

Several in-depth interviews with István Bánffi form the basis of a SWOT (strengths, weaknesses, opportunities and threats) analysis. This analysis, which represents his view of the industry and his company, is presented in Exhibit 3 (Appendix 2).

Looking to the Future

István Bánffi ponders the past and future of his company. While the museum project has been very successful, it is a reflection of the company's and industry's past successes. The Bánffi Soda Limited Partnership faces many challenges if it is to be successful in the future. As István's son, Ádám, currently a marketing student at the University of Szeged, enters the business, István hopes that he will bring innovative ideas and the energy to propel the company forward to meet these challenges.

Questions

1. Summarize the key competitive issues and challenges for the Bánffi Soda Limited Partnership. Porter's Five Forces Model provides a framework for analyzing the industry and Bánffi's competitive position.
2. Develop and analyze several alternative strategies that will allow Bánffi to be successful in the future. Specifically, conduct an opportunity analysis (you may want to consider opportunities presented in the SWOT analysis presented in Exhibit 3 as well as other

opportunities). In addition to discussing the pros and cons of each strategy, be sure to address the information needed to analyze each alternative.
3. Recommend a strategy that Bánffi should pursue to improve profitability and address the major threats and opportunities that it faces.

References

Hungarian Mineral Water Product Council. Budapest. 2009.

Kiss, Imre. 2008**.** "Soda Water, a Cult Drink in Hungary." Budapest, Hungary. 95-96.

Appendix 1

Exhibit 1. Prices and Consumption Trends of Soda Water, Mineral Water, Carbonated Drinks, and Still Drinks, Hungary, 2000 to 2008

Soda Water
1. Number of bottling companies: approximately 1,200.
2. Number of bottled products: hundreds of brands.
3. Average price: approximately €0.13 per liter.
4. Bottle size and type: approximately 50% is sold in pressurized refillable 1.5 liter plastic bottles and 50% in 21.5 liter stainless steel pressurized canisters.

Natural mineral water and other bottled water (excluding soda water)
1. Number of bottling companies: between 30 and 35.
2. Number of brands of bottled water: between 55 and 60.
3. Average price: approximately €0.13 per liter.
4. Bottle size and type: approximately 80% 1.5 liter, 15% 0.5 liter, and 5% others; 95% PET bottles.

Carbonated and still drinks
1. Number of bottling companies: between 18 and 20.
2. Number of bottled products: hundreds of brands.
3. Average price: approximately €0.35 per liter.
4. Bottle size and type: approximately 50% 0.5 liter and 50% 2.0 liter; 95% PET bottles.

| Per capita consumption of non-alcoholic beverages (liters/person) | | | |
	Soda Water	*Mineral Water*	*Carbonated Drinks*	*Still Drinks*
2000	40.0	39.2	68.6	31.8
2001	50.0	42.4	67.6	30.5
2002	50.3	50.0	68.5	35.0
2003	47.0	60.0	70.0	40.0
2004	37.5	60.0	65.2	40.5
2005	33.2	70.0	62.1	40.8
2006	27.1	85.0	67.0	43.4
2007	24.0	105.0	65.9	43.6
2008	22.0	105.0	67.3	34.6

*Source: Hungarian Mineral Water Product Council.

Environment
Approximately 95% of non-alcoholic beverages are sold in disposable plastic bottles. The reason for this is that there is little demand for refillable bottles. Over the past 10 to 12, years the proportion of reusable bottles has dropped from about 65% to the current 5%. Companies producing non-alcoholic beverages have had to pay a tax in order to help create and improve a system of segregated waste disposal and recycling. This is also true for soda water manufacturers, although the tax is less since they use refillable bottles.

According to a study by independent Austrian and German experts, the harmful effects of disposable bottles on the environment are no greater than those of refillable bottles. Refillable bottles require detergent and water to clean the bottles, produce sewage that must be treated, require the construction of large storage depots, necessitate the use of large vehicles for transportation, and require more fuel and produce more air pollution due to transportation than do disposable bottles.

Source: Hungarian Mineral Water Product Council, Budapest, 2009.

Appendix 2

Exhibit 3. SWOT Analysis for Bánffi and the Soda Water Industry

Industry Strengths
- Long industry history
- Traditional production methods result in high consumer confidence
- Right to use "Guaranteed Traditional and Special" trademark

Bánffi Strengths
- Long history and reputation – more than 100 years
- Top quality products
- Experienced and disciplined workers
- HACCP production system
- Strong relationships with many distributors
- Successful introduction of home delivery service
- Refillable containers are environmentally sound
- Small, private nature of the firm results in a flexible firm that can respond quickly to the market

Industry Weaknesses
- Product sold only in refillable, returnable containers, which many customers find inconvenient
- Soda water production is very labor intensive (a large beverage plant could produce about 30,000 bottles with six workers; the equivalent soda water production could be produced in roughly 200 plants employing 400 workers)

Bánffi Weaknesses
- Small-scale venture means that managers find it difficult to be specialists
- Distribution limited to Szeged, population 170,000
- Distribution is limited to independent retailers as large chain stores require distribution to stores throughout Hungary

Industry Opportunities
- Soda Water History Museum in Szeged may be exploited to strengthen consumer confidence
- New products that can exploit long tradition of soda water industry
- Cooperation with the Agrarian Marketing Center and National Trade Association of Soda Water Makers may be utilized to develop promotional materials and to promote products at events, such as fairs and festivals

Bánffi Opportunities
- New products may take advantage of the Bánffi name and reputation

Industry Threats
- Popular substitute products, including mineral water, carbonated drinks, and still water
- Novel products that are heavily marketed provide consumer excitement
- Wine producers no longer make wine intended for making spritzers (wine mixed with soda water); Note: mineral water is a poor substitute for soda water in spritzers as the carbon dioxide content declines rapidly due to the high mineral content
- Government regulations have contributed greatly to the cost of doing business for smaller firms

Bánffi Threats
- Major competitor introduced a popular oxygenated water product, sold in a disposable bottle

Reconfiguring Supply Schemes in the Cocoa Value Chain: Organic Chocolate from Honduras for the Swiss Market[1]

An Executive Interview with Anton von Weissenfluh

By Ingrid Fromm[⊕]

Abstract: Numerous corporations worldwide source raw materials from developing countries, often not knowing exactly who is producing these commodities. This has been particularly the case in the chocolate and coffee industries. However, consumers in Europe, and especially in Switzerland are increasingly demanding more information on the products they buy, thus motivating corporations to find alternative ways to fulfill these demands. In response to the changing market trends, Chocolats Halba, a division of Coop, one of the largest retailers in Switzerland, has launched a pilot project that not only satisfies consumer concerns, but also embraces their corporate philosophy and values. Since 2008, Chocolats Halba has developed a collaborative relationship with organic cocoa producers in Honduras, who now have a contract scheme where they are supported in both production and certification aspects and are paid a fair price. Dr. Anton von Weissenfluh, CEO of Chocolats Halba explains the project and his long-term vision.

Keywords: cocoa, certification, collaboration, Honduras, Switzerland

⊕Corresponding author: Tel: + 41.0.31 910 2194
Email: ingrid.fromm@bfh.ch

[1] Dr. Anton von Weissenfluh, is CEO, Chocolats Halba, Switzerland. He can be contacted by email at: Anton.VonWeissenfluh@halba.ch   Visit their website at: www.chocolatier-suisse.ch
[⊕] Dr. Ingrid Fromm is a Scientific Collaborator at the Department of International Agriculture, Swiss College of Agriculture in Bern, Switzerland.

Introduction

Small-scale cocoa farmers in Honduras have faced a series of ups and downs over the past decade due to the fluctuating prices for raw cocoa and market uncertainties. Sometimes the price paid to farmers has not covered production costs. However, for about 500 cocoa farmers in Honduras, these days of uncertainty seem to be over. Thanks to the collaborative relationship developed with a visionary and social responsible firm in Switzerland, they are now under a contract scheme where the firm supports them in production and certification aspects and buys the cocoa. Chocolats Halba is working together with a private development cooperation organization, the Association of Honduran Cocoa Producers (APROCACAHO) and other partners to produce and export organic cocoa. They assist organic cocoa farmers in quality improvements, building up infrastructure and export-related paperwork. Local partners have helped farmers in strengthening their organization, acquiring certifications (organic, FairTrade), and capacity building concerning cocoa production. The main benefit of having a close collaboration with the organic farmers is that Chocolats Halba can sell consumers a product where they can trace the cocoa beans utilized to make their chocolates right down to the farm where they were produced. Furthermore, a strong relationship and joint investments enable the value chain to jointly improve quality and therefore add value to the product. Organic cocoa farmers in Honduras now have a better income and Chocolats Halba has a secure source of certified organic cocoa beans, improving the transparency of this chain and assuring the farmer a fair price in the long term. This case is a successful example of how a firm with a social vision can help small-scale producers secure a steady income while bringing consumers in Europe fair trade organic chocolate.

Many consumers in Europe and particularly in Switzerland are conscious about the choices they make and how it impacts the environment and people around the world. Would you say that Chocolats Halba has positioned itself to answer to these demands?

von Weissenfluh: Customers in Switzerland are in fact special. Not only are they conscious about the choices they make, they are also looking for high-quality products. They have a sense of responsibility that sets them apart from many consumers in the world. Supermarkets, in particular Coop, clearly designate where products come from. Many of these changes are a response to the information need of the Swiss consumers. This is a trend that is becoming more popular. The function of a product is not only to fulfill a need or want, but to do so in a way that speaks for the values of the consumer. Chocolats Halba is well-aware of this and answers these needs, wants and values but we also have identified five main issues that we want to keep in mind and work for when producing chocolate:

1. Quality, first and foremost
2. Fair income for the suppliers abroad
3. Biodiversity, making sure that it is conserved and protected
4. Global warming, by reducing as much as possible CO_2 emissions
5. International work rights, respecting them

The goal we have set for ourselves is to produce high-quality chocolate, while helping farmers in cocoa producing countries have a sustainable income. Biodiversity should be guarded and the environmental impact should be as minimal as possible. Chocolats Halba has positioned itself to answer to customer demands while maintaining our corporate goals.

How did Chocolats Halba start working with development cooperation organizations (i.e. Helvetas) and cooperatives in Honduras?

von Weissenfluh: Helvetas is a private organization for development cooperation in Switzerland. Their aim is to help partners in procuring food and improved living conditions, increased production and income or improved infrastructures. Moreover, Helvetas has vast experience in the region and in the cocoa sector. We first approached Helvetas in 2007 and did exhaustive analysis of the cocoa regions in the world. We came up with the 10 most important regions in the world and selected Honduras because of the potential it presented. According to the studies we conducted, the genetic material of the cocoa in Honduras is ideal for the production of high-quality organic chocolate.   In 2008 the project started and other local partners were brought on board. A farmers union, APROCACAHO, was the first partner approached. FHIA (Fundación Hondureña de Investigación Agrícola) has over 20 years of experience in agro- forestry in the cocoa sector and is oriented to the generation, validation and transfer of knowledge and technology to small-scale producers. They were a natural choice as a project partner.

What are the biggest challenges for Chocolats Habla in this project?

von Weissenfluh: Clearly managing a project of this nature presents several challenges. Switzerland is not exactly close to Honduras and logistically, there are some barriers including language and cultural differences. Communication is imperative in the success of any project, so in order to facilitate the flow of information from one end to the other, Chocolats Halba hired a local employee to coordinate these issues. His tasks include first and foremost quality assurance. Last year presented additional challenges because of the political instability in Honduras.

In the present working scheme, intermediaries are practically eliminated. What are the benefits for the small-scale cocoa producers in Honduras? Chocolats Halba? The consumer?

von Weissenfluh: Transparency is the main benefit for all parties. The producers are paid a fair price for their product. Traditionally, this sector has paid farmers 30 to 50% of the FOB price for cocoa beans. Chocolats Halba pays 75 to 80% of the FOB price to the producers because the

intermediaries are eliminated. Small scale producers now know where their product is going. In fact, in April 2010 several stakeholders, including 8 producers and representatives from APROCACAHO, were invited to visit our facilities in Switzerland. The saw the whole production process and now have a better understanding of why quality is so important. Workshops were conducted as well as visits to the main retail centers. They have literally seen where the end product is sold and who buys it. This is a distinctive value chain because the producer is part of the whole process and they've developed a sense of pride in their work and product. For Chocolats Halba, the benefit of this project is that we are doing something in tune with our corporate values. This is where the company wants to go in the future, providing customer satisfaction and producing in a sustainable way while guaranteeing farmers in developing countries a decent income. Finally, the benefit for the customer is clear: they are buying an organic and fair trade product in tune with their values. Customers can trace their product right down to the village where the cocoa beans came from, if they want to.

Will this organic chocolate from Honduras have a distinctive brand? Do you have other similar brands?

von Weissenfluh: The Honduran cocoa will be specifically used for pralines, because of its exceptional quality. We expect to process about 30 to 40 tons next year, but the potential to process up to 800 tons of organic cocoa is there. It's only a fraction of our entire annual production, but we hope to be able expand this initiative to other countries as well. The end product will be labeled and we always strive to pass on to the customers our commitment to bring them a high quality product that is economically valuable, environmentally grown and fairly traded. We already sell similar products, all labeled by origin—Ghana, Peru, Ecuador.

How do you see the market for organic and fair trade chocolate evolving in the next decade?

von Weissenfluh: We believe that we're playing a major role in shaping the value chains of the future—we are committed to making things right, right at the start of the value chain. We work together directly with cocoa growers in South and Central America and Africa, developing measures to ensure quality and sustainability. Not only do we ensure that the quality of our most important raw ingredient remains consistently high, we do so while promoting the livelihoods of our partners. These people are not simply "suppliers" to us; they are partners in the whole process. We have developed a trustful relationship that goes two ways and finally the customer can perceive our values and what we stand for. In the future, I see more initiatives of this nature, which will also present greater opportunities for small-scale farmers in many regions of the world. Furthermore, the consumers will become increasingly aware that the purchase decisions they take are affecting the lives of others and they will make decisions accordingly. However, they will still demand high-quality products and will be the task of the industries to keep delivering quality in a sustainable way. We're very proud of what we have achieved so far, and our partners in Honduras are proud not only of how far they've come in such a short period of time, but they are especially proud to work with us.