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International Food and Agribusiness Management Review
Volume 11, Issue 1, 2008

Table of Contents

RESEARCH

International Food and Agribusiness Management Review
Volume 11, Issue 1, 2008

Executive Summaries

RESEARCH

Designing the Last Mile of the Supply Chain in Africa: Firm Expansion and Managerial Inferences from a Grocer Model of Location

David Weatherspoon and Anthony Ross

Retailers are recognizing the significant market potential of sub-Saharan Africa whose land mass is equivalent to three times the size of the U.S., and contains 66 cities with more than a half-million people. There are unique environmental complexities that emerging economies present for food retailers, in particular; where to invest and how much to invest? Firm managers must make these supply chain investments with little structural and demographic data and recognize that their primary competition is the informal market which is greater than 50% of food retailing in most of Southern Africa. The goal of this paper is to highlight the relevance of considering the informal sector in facility location modeling in emerging economies.

This paper presents a new conceptualization of market expansion in the retail sector of Zambia. It demonstrates the importance, and timeliness of considering market entry decisions for emerging economies using empirical and secondary data on formal and informal activities within an economy. A number of studies have examined the impact of foreign direct investment and market entry strategies in other regions of the world, but studies devoting attention to emerging economies in sub-Saharan Africa are only now emerging. This growing interest in the literature represents an opportunity for this study to present a creative and frame-braking line of thinking with an exploration of location decisions using a dataset describing living conditions, and other demographic data such as informal sector data to assess where retailers might locate their customer-facing stores—the last mile of their retail supply chain.

Assessing Input Brand Loyalty among U.S. Agricultural Producers

Anetra L. Harbor, Marshall A. Martin and Jay T. Akridge

U. S. agricultural input suppliers face a number of marketing challenges. For many suppliers, large commercial farm enterprises have replaced traditional smaller

farms as their primary customers and represent the majority of their sales revenues. One strategic response to the resulting marketing challenges is the development of a strong brand or preference for sale locations (dealers). The problem is to understand the determinants of brand loyalty, the role of dealer loyalty, and to identify effective strategies for reaching loyal customers. This research assists agribusiness managers in addressing these important issues.

Data was obtained from the 2003 Commercial Producer Survey conducted by the Center for Food and Agricultural Business (CAB) at Purdue University. Over 2,100 completed questionnaires were obtained from a sample of 14,301 mid-size and commercial producers across the United States. The survey collected information on producers' attitudes and preferences for branded expendable and capital input products. Information was also collected on respondents' loyalty to their dealer and farm and farmer characteristics. The data were primarily analyzed with logit regression techniques.

Results suggest that, for both capital and expendable items, some demographics are meaningful characteristics for distinguishing brand loyal customers. Preferences (purchasing the lowest priced inputs), attitudes and beliefs (such as believing that quality differences exist among brands) and other factors that are part of an individual's decision-making processes (use of media as a source of information) are more significant indicators of brand loyalty. Brand building strategies aimed at generating commercial producer loyalty should focus on the value that the producer can obtain through product quality, service, and relevant information.

Source Differentiated Mexican Dairy Import Demand

Miguel A. Ramirez and Christopher A. Wolf

Mexico is a destination of dairy product imports that attracts exports from many major dairy producing countries. Understanding Mexican import demand requires a model that accounts for substitutions and price interactions both across dairy products and source countries. This paper utilizes a source differentiated demand model to assess the Mexican market from 1990 through 2005. During this period, European Union export share of dairy products to Mexico fell while other destinations, especially the United States, became more important. We estimate that the United States would take 42 cents of every additional dollar allocated to dairy product imports in Mexico. Oceania, particularly New Zealand, takes 21 cents of that additional a dollar. Our estimates indicate that the European Union may continue to lose market share in Mexico. These estimates assume that everything else is equal and major world dairy market changes, such as a new World Trade Organization agreement or the weakening US dollar, would affect the relative competitiveness of dairy imports into Mexico.

Range and Limit of Geographical Indication Scheme: The Case of Basmati Rice from Punjab, Pakistan *Georges Giraud*

Basmati is well renowned as the most aromatic rice over the world. Its price is the highest for rice on trade and domestic markets. In spite of low yield, Basmati rice is interesting for all the commodity chain actors. Basmati fits well with very small farms. Basmati rice growing may be considered as naturally leading to a quite extensive agriculture.

Punjab province represents 90% of overall Basmati rice production in Pakistan. This area forms the genuine alluvial lands appropriate for Basmati cultivation, due to good water availability, high temperature, important sun exposure, at a low altitude. The first indication of a release of a pure line selection was done in Punjab, Pakistan in 1933.

New lines are developed now for yield improvement. The growing area is spread out of Punjab since decades. However, this rice doesn't offer similar qualities than Basmati from Punjab. Due to price attractiveness, some opportunist behaviors appear such as cropping Basmati variety out of Punjab, blending of polished long grain from other varieties, or attempt to private patent.

DNA tests are mandatory for export in Europe. They allow to authenticate the variety, but not the area where the variety was grown. The Basmati commodity chain is under corporate governance with high competition pressure. Rice "Basmati from Punjab" is a key issue as the Geographical Indication protection is still pending in Pakistan. The need of protection is clearly documented, but the registration will probably increase Basmati market shortages. A seed patent will protect Basmati lines and may allow them to be grown in enlarged area. A GI will not mislead export market but will enhance price pressure on domestic market. This article analyses Pakistani Basmati commodity chain with data issued from recent publications, completed by field study held in 2007 that allowed interviews of several local stakeholders.

Buyer and Seller Responses to an Adverse Food Safety Event: The Case of Frozen Salmon in Alberta *Leigh Maynard, Sayed Saghaian, and Megan Nickoloff*

Consumers receive conflicting health messages about fish consumption. On one hand, consumers hear that fish is a low-fat protein source high in omega-3 fatty acids. On the other hand, a 2004 report of elevated polychlorinated biphenyl (PCB) levels in farmed salmon generated concern among consumers and industry participants.

The purpose of this research is to evaluate how Canadian consumers and seafood processors reacted to these conflicting health messages. Demand system estimates and time-series analysis of ACNielsen 2001-2006 frozen meat scanner data in

Alberta, Canada showed an economically significant drop in salmon consumption following the PCB finding. Among seafood and poultry products in the freezer section, salmon's expenditure share in the months preceding the PCB finding was about 5%-9%, and the estimated reduction in expenditure share attributable to the event was about 2%.

Within five months, two seafood processors responded by introducing wild salmon products at low prices. The new wild products quickly outpaced sales of all non-wild salmon products and contributed to substantial demand expansion. The markedly lower prices of the wild products appear to be possible partly because of strategic competitive behavior between the two processors, and partly because lower-value species of salmon were used, which are generally associated with sacrifices in flavor. The rapid sales growth, however, suggested that consumers placed a higher priority on the wild products' health attributes and value pricing. The analysis illustrates how a food safety threat was averted, and even served as a catalyst for growth.

Industry-Academic Partnerships – Benefit or Burden?

Gregory A. Baker, Allen F. Wysocki, Lisa O. House and Juan C. Batista

There are many opportunities for collaboration between industry and academia in the applied field of agribusiness management. Some of the key areas for developing partnerships include research projects, sabbatical leaves with industry, consulting, outreach activities, student enrichment activities, and industry advisory boards. Effectively managing these partnerships depends on an awareness of the possibilities that these partnerships entail as well as the potential benefits and pitfalls.

One of the key areas in which faculty members may collaborate with industry is in the conduct of research. Many of these opportunities include traditional research projects, which may involve the faculty member directly in the research, or indirectly through student research projects. Sabbatical leaves with industry and consulting opportunities are other examples where faculty members may work on research projects with industry partners. The principal advantages of industry collaboration are the opportunity to work on current problems, and access to ideas, data, and resources. In collaborating with industry, academic researchers are often concerned with maintaining objectivity and the ability to publish research findings.

Collaboration with industry is crucial in developing student enrichment programs. All of these programs, including developing employment opportunities, site visits, internships, mentoring, and in-class visits, rely on cooperation with industry partners. Students often find student enrichment programs an invaluable addition to their classroom education. Such programs help prepare them for the working world, make career choices, and begin the process of networking with industry.

Industry advisory boards are an effective mechanism for engaging industry partners by securing their commitment to work in partnership with a department,

institute, or college. Advisory boards are particularly useful in getting industry members involved in activities such as curriculum review, fundraising, and student enrichment activities. An active industry advisory board provides many opportunities for faculty members to initiate partnership opportunities with industry members along many different dimensions.

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Designing the Last Mile of the Supply Chain in Africa: Firm Expansion and Managerial Inferences from a Grocer Model of Location Decisions[1]

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Abstract

The recent interest in the expansion of retail food chains and the perceived problems resulting from competition between these new, sophisticated supply chains and the most basic of food distribution networks in emerging economies have been greatly debated in the literature. This paper is a seminal approach to examining South-South food firm (grocer) foreign direct investment by incorporating data on the informal market into a facility location decision model. There are unique environmental complexities that developing/transitioning economies present. The unique finding of this model is that informal employment patterns, in both Agricultural and non-Agricultural sectors, influence the firm's location. Given the absence of data, South-South foreign direct investment managers perceive avid market transactions as indicators of demand and potential supply availability in formal and informal sectors. For example, Pick n' Pay's CEO stated recently that their growth in the Southern Africa supermarket business is a direct result of the informal market converting to the formal market.

Keywords: Supply Chain, Africa, Informal Markets, Facility Location Model

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Introduction

Over the last four years there have been numerous articles explaining the recent investment boom in modern retailing in developing countries and the implication of this investment which has primarily been foreign in its origins (Weatherspoon et al., 2003, Reardon et al., 2003 and Emongor et al., 2006). One of the most surprising results has been the diffusion of supermarkets and restaurant chains in Sub-Saharan Africa which admittedly lags behind other regions. Nonetheless, this literature has opened up vigorous debates among academics, governments, company executives, donor agencies and non-governmental agencies alike. The debates center on the struggle to create attractive investment climates regarding competitive policy, and the cultural and socio-political climate that attracts foreign companies. An attractive investment climate can lead to robust retail activity and other benefits. Modern retail expansion contributes to the economic growth of countries, although certain retail formats (and their supply chain infrastructure) work better than others. To this end, investment in public-private relationships and distribution infrastructure has increased dramatically from the donor agencies and foundations to address the perceived problems resulting from a new set of sophisticated supply chains. These new supply chains are competing against the most basic of food distribution networks and retail formats, and we will refer to them as informal markets throughout the rest of the paper.

In the literature, here are many predictions continued rapid growth in the retail sector. In order to realize such predictions, the agrifood system throughout Sub-Saharan Africa must be transformed into an efficient, responsive, yet highly sophisticated and capitalized agrifood supply chain. That is why this paper is important and timely to the region and to the understanding of how food/grocer companies are making investment decisions which amount to building entire supply chain infrastructure from scratch (i.e. bricks and mortar, transportation, cooling equipment, identifying suppliers and etc.). The second reason this research is germane to the future of the region is that currently, this diffusion and investment is dominated by one country and specifically one retailing firm from South Africa, the southern-most point on the continent. This begs the question of how can the retail sector, with a consumer region whose land area is equivalent to three times the size of the U.S. and contains 66 cities with more than half-million people, be dominated by a single food retailer and its newly minted supply chain? Although it may seem counter-intuitive, Shoprite Holding Ltd.'s supply chain is reportedly price competitive at the point of destination even though the costs of empty backhauling are included (Shoprite Holding Ltd. is located in 17 different countries in Sub-Saharan Africa and is the largest food retailer in Africa).

One key to understanding the growth in these supply chains is to decipher the role of the informal sector. Sean Summers, CEO of Pick n' Pay (the second largest supermarket chain in Africa) stated in a recent interview with CNCB (April 1, 2006)

that; "One of the fantastic growth [opportunities] for us in this market class as formal retailers is that retailing is formalizing a lot, so we [have] a growing market in this country (South Africa) -- just in terms of the sheer number of consumers and the sheer number of consumers that are converting from informal retailing forms to more formal retail patterns." This includes product that is purchased for resale by street vendors (also commonly known as Hawkers in Southern Africa). From this, we infer that retailers are recognizing the significant market potential in Africa. For some retailers, this market potential outweighs the definite risks, while for others the potential risks may seem insurmountable. Nevertheless, retailers recognize that the race into new markets—with the promise of large wealthy emerging markets—passes through windows of opportunity. Therefore, location and timing are the name of the entry game. Decision-makers targeting emerging retail markets must also weigh the importance of factors which drive personal consumption such as education, living conditions, among others.

This paper is a seminal approach to examining retail location expansion in the context of formal and informal sectors in a developing/transitioning economy. The challenges are enormous with respect to identifying and obtaining the appropriate data to help suggest where (consumer product) food firms should locate in Sub-Saharan Africa. To do this, we utilize the experience of South African food retailer, the Shoprite Holding Ltd. Company. The objectives of this paper are to: 1) understand the role that the informal market plays in firm location decision making within developing countries; 2) determine which socio-economic factors influence supply chain development in developing countries; and 3) compare the prescribed supermarket and related retailing growth in Zambia to actual growth. The next section outlines the context in which grocers are operating in Sub-Saharan Africa followed by the methodology and data. Model development, estimation results and then management implications sections conclude the paper.

Contextualization of the Problem

Historically, there has been a lack of foreign direct investment (FDI) flowing into countries of Sub-Saharan Africa in comparison to other developing regions of the world (Weatherspoon et al. 2001; Jenkins and Thomas, 2002; Roemer, 1996). In fact, South Africa has been one of the largest investors in the rest of Africa throughout the 1990's and early 2000's. One of the primary reasons for this is the fact that existing supply chains are disjointed or broken, and to build new supply chains is costly and terribly risky[1]. Shoprite Holding Ltd. was and remains one of the few food firms that believes it is profitable to market food and other accessories to poor people in Africa, having proven their point by generating 10% of its sales

[1] There are some new Southern African efforts to harmonize border crossings in terms of requirements and paperwork which include the Trans Kalahari Highway, Trans Caprivi Highway and the Trans Cunene Corridor) www.wbcg.com.na/wbcg/corridor/thecorridor.htm

volume outside of South Africa through more than 200 stores (Reed, 2006). Other food firms that help boost South Africa as the leader in FDI in the rest of Africa are: restaurant chains such as Steers, Nandos, Chicken Licken and Debonairs (www.southafrica.info/doing_business/investment/africainvest.htm, 2006), and numerous beverage companies (South African Breweries, KWV, Ceres and etc.) (Aykut, and Ratha, 2003).

When considering South-South FDI, retailers face a daunting task of determining where to locate their stores and distribution centers in Sub-Saharan Africa, given that there are no models to follow and little data to base sound business decisions upon. [2] Any existing competition is in the form of informal markets with no legacy information and very little current information on prices, quantities and consumer demographics. Hence, firms like Shoprite Holding Ltd. send their most seasoned people to the countries of interest to observe the food production levels, environmental conditions, demand for food and other products and preferences of the people. Therefore, the reality appears to be that practicing managers develop mental theories derived from their empirical observation. These mental theories then drive business decision-making. We hope to provide new insights to compare these past decisions to our prescriptive approach.

This paper is unique in that we attempt to factor the informal market into predictions of where a retailer should locate. Our field observations show that retail food firms consistently inquire about the prices of fresh produce that are being marketed on the side of the road by informal traders. The retailers know that they must keep their prices close to the street value since the supermarket's "higher quality" argument has yet to become generally accepted among consumers in this transitioning economy. By comparison, the recent experiences of Wal-Mart and Carrefour in Japan's retail sector provide empirical evidence that a one-size-fits-all decision can lead to failure, especially in retailing.

Retailing can spur a market economy through productivity improvements that have broad supply chain implications. Brazil and China are two recent anecdotal examples where the wave of market entry by retailers (Brazil) and manufacturers (China) contributed to productivity growth. The rationale is that as retailers experience market growth, their supply chains must then become more efficient and responsive to consumers. Local businesses and competitors then mimic these routines and practices which can lead to modernize distribution, efficient storefronts and other practices which drive down the transaction costs of doing business. In turn, savings from lower acquisition costs are passed on to consumers as lower retail prices. Opponents argue that it promotes the monopolistic power of large retailers and erects barriers to, for example, the informal sector and local

[2] In the automotive industry, for example, several studies have emphasized environmental munificence, technology and innovation-related variables (Drake and Caves, 1992).

retailers. We leave discussion of these important policy dynamics to work appearing elsewhere, given our stated objectives.

To further complicate this retail location problem, transport modes (namely rail, air, sea and most roadways) do a poor job of connecting the various African countries. This minimizes intra-regional trade opportunities (Onyeiwu and Shrestha, 2004). Several initiatives by the Southern African Development Community, the Common Market for Eastern and Southern Africa (COMESA) and other regional bodies have focused on synchronizing border standards to dramatically speed up border crossing. These efforts are resulting in formalized trading routes for distribution activities.

Despite all of these encumbrances, which result in numerous transaction costs, the agrifood supply chain is certainly becoming more organized with each new day. This study is a first step in identifying factors that influence food firms to invest in supply chains within a developing country context.

Theoretical Motivation and Data

In this section, we discuss firm location theory, describe the data collected and motivate our use of the selected methodology. The theory of locating manufacturing plants or various types of service facilities (such as retail stores, fire stations, airports, warehouses, etc.) is concerned with selecting the best site(s) in a specified region. There are many different kinds of location problems, so our goal is not to review these classes of problems. Many of these studies usually seek to optimize transportation costs or delivery time, and response time, among others, based on the locations of demands (Dearing, 1985). Many problem variants and solution methods have been proposed for the location of facilities, and they face a variety of computational performance challenges. The problem variety has included fixed operating costs (construction, overhead, etc.) and variable operating costs (maintenance, purchasing, and direct labor), in many instances. In other marketing channels scenarios, scholars have used data on trade areas (i.e. number of dwelling units, profiles of local/transient/commercial traffic, profiles of residential/commercial/industrial markets, income levels, and the number of automobiles, traffic counts on primary and secondary thoroughfares, extent of competition from major competitors, and bait-type factors which measure proximity to shopping centers) (Stern et al., 1989). Unfortunately, nearly all of the impressive work in this area has been focused on the industrialized world where the supply chain environment differs significantly from that of the emerging economies. As a result, the international business literature characterizes the challenge faced by the multinational enterprise as one of mastering the complexities of multiple markets (e.g. local tastes and local content) while leveraging resources and capabilities on a global scale. In today's environment, it is no longer prudent for decision makers to either judge foreign markets in terms of cultural "distance" from a focal country, or

in terms of classification as an emerging or transitioning economy. Such a view runs the risk of injecting a certain bias and limiting the consideration of the unique capabilities of the environment. Therefore, this highlights the relevance of considering endogenous variables of culture, economics and living standards, and represents an emerging lens with which to explore locating of facilities, or design of supply chains across borders.

The focal firm is Shoprite Holding Ltd. a large, global retailer that is expanding operations through acquisition and greenfield investment in Sub-Saharan Africa. We narrow our focus to the country of Zambia, given our access to operational data and the fact that Shoprite Holding Ltd. has more stores in Zambia (17 supermarkets and 1.5 distribution centers) than any other country outside of South Africa. [3] In fact, there is at least one Shoprite Holding Ltd. in each of the nine provinces in Zambia. During the course of recent research on the company, the researchers' experiences formed the basis of this line of academic inquiry. We became interested in exploring executive management's rationale for expansion decisions into other districts of Zambia as well as the rest of Africa. Such a study could lead to the development of models of retail facility location decisions that account for environmental conditions. Environmental, institutional, and cultural contexts are thought to be key drivers of doing business in developing/transitioning economies (Cavusgil et al., 2003; Brouthers, 2002).

The data gathered for this study comes from reports of the 2002-03 edition of the Living Conditions Monitoring Survey© (LCMS) of Zambian households, with the exception of the distance to the distribution center data which was calculated using an estimator located at www.mapcrow.info/cgi-bin/cities_distance.cg. These data were used to assess the attractiveness of the provincial districts of Zambia[4] to a food firm looking to establish a retailing unit there. It may be possible, then that one district may have such different operating or environmental conditions that traditional location models built for one province or district may not hold in others. Thus building a model for each individual district or province would be cumbersome, if not insurmountable. Another salient point of this study is that models built for one African country, may or may not hold for another country. Such is often the case when there are sizable informal markets, poorly developed utilities grids, wide disparities in income and education levels, and other environmental issues (Ghosh and Craig, 1984). Table 1 summarizes the variables identified from the Zambian LCMS for this research at the provincial district level. The means, standard deviations, minimums and maximums are given for each variable.

[3] Shoprite Holding Ltd.'s first investment outside of South Africa was in Zambia in 1995. At that time they acquired a retailing firm called Sentra, a central buying organization for 550 owner-manager supermarket members.

[4] There are a total of 9 provinces which consist of 72 districts.

Many of these variables have been linked to FDI when selecting among countries but we are not aware of an empirical study of FDI within a single country. The categories of data represented in Table 1 include population density (PopPropn), employment conditions (Empld, Infmlag and Infmlnoag), household food-related expenditures (FoodExp and PropGrProd), intensity of poverty conditions (Hcnt, Pvgap and Sevpov), access to basic utilities (ElecGrid1 and ElecGrid2), secondary education (Educ8-12), household incomes (Mincome and TotInc), and finally distance to the company's regional distribution center (DistDC) as a supply source to a Zambian district. Population density, household food-related expenditures and household incomes are indicators of the market size for the demand for food related products (Morrisset, 2000; Jenkins and Thomas, 2002). The level of infrastructure investment has always been debated concerning FDI when selecting among countries. Within Zambia, the infrastructure does vary and we have included these variables (access to basic utilities) for that reason (Jenkins and Thomas, 2002; Onyeiwu and Shrestha, 2004; Longo and Sekkat, 2001). Human capital levels are important when attracting FDI; we use secondary education as a proxy for human capital (Lindauer and Roemer, 1994; Roemer, 1996). As retailers explore market entry options, the labor pool deserves equal consideration, and each target market presents its own unique challenges and opportunities for companies. For example, one human capital issue in India is the availability of experienced senior managers, while China and Africa require the infrastructure to train and develop people. The distance to the company's distribution center, delivery lead time to consumer markets, and demand volume have commonly been used in marketing channels and supply chain-related studies (Dobson and Karmarker, 1987). We have included a group of variables that factor in the importance and magnitude of Zambia's informal sector. Those variables are included in the workforce variables, and the intensity of poverty variables.

Data on detailed demographics and consumption patterns are not available; hence firms must make decisions based on the data that exists such as the LCMS data and abstractions of managers' mental decision models. We believe these variables and data represent a reasonable set to use in this exploratory study. The next section describes the overarching approach to the analysis, presents our methodology of choice, guides the reader through our model building process, and concludes with a discussion of our results.

Logistic Regression

In the final analysis, the chosen methodology should support a two-level hierarchy of decision-making. In the first stage, a go/no-go decision process must evaluate the attractiveness of particular Zambian districts, as described in Table 1 for Shoprite Holding Ltd.'s expansion. This requirement makes traditional approaches to facility location less appropriate for our consideration in this study. Therefore, stage one of the analysis compares the provincial district living conditions and data

on existing Shoprite Holding Ltd. store locations with identical living conditions data collected for all other districts where there are no Shoprite Holding Ltd. supermarkets. Therefore, our outcome/decision variable is a discrete, dichotomous variable for predicting attractiveness of a district for a Shoprite Holding Ltd. supermarket operation. Thus logistic regression is used.

A binary logit regression technique was then selected because the dependent variable is dichotomous; locate store in Zambian district X, yes or no (Cox and Snell, 1989; Stokes et al., 2000). Logit analysis has been widely applied to assess competitive interaction in facility location scenarios (Green et al., 1977; Dobson and Karmarker, 1987; Robinson and Satterfiled, 1998). Left unaddressed in this related work is the exploration of environmental complexities that are unique to transitioning economies. We attempt to address this gap in the literature using logit analysis because the technique allows the analyst to tailor the approach to the specific environment (emerging country) being investigated.

The logit model then is specified as:

$$\pi(x) = \frac{e^{\beta_0 + \sum_i \beta_i x_i}}{1 + e^{\beta_0 + \sum_i \beta_i x_i}} \qquad (1)$$

where

$\pi(x)$ = the estimated decision of locating (not locating) a store in district X.
β_0 = logit model intercept.
β_i = beta coefficient describing the district's overall attractiveness on attribute *i*.
x_i = value of the attribute *i* for district x.

A transformation of equation (1) that is central to our use of logistic regression is the logit transformation (Collett, 1991; Allison, 1999). It is defined as:

$$g(x) = \ln\left[\frac{\pi(x)}{1-\pi(x)}\right]$$

or let

$$X_0 = \beta_0 + \sum_i \beta_i * x_i \qquad (2)$$

Table 1: Zambia Variables from the Living Conditions Monitoring Survey Data Set and the Distance Calculator with the Mean, Standard Deviation, Minimum and Maximums.

Variables	Description	Mean	Std. Dev.	Min.	Max.
PopPropn	Proportion of total population living in the district	0.1289	0.105	0.0136	0.779
Empld	Log of Total size of employed workforce	4.523	0.308	3.436	5.203
Infmlag	Log of Size of workforce in informal agricultural sector	4.378	0.379	2.851	5.167
Infmlnoag	Log of Size of workforce in informal, non-agricultural sector	3.810	0.365	2.911	5.063
FoodExp	Proportion of household income for food expenditures	0.70	0.095	0.460	0.790
PropGrProd	Proportion of households that grow and consume their own produce	0.410	0.174	0.070	0.620
Hcnt	Number of Head of Livestock	0.681	0.072	0.563	0.805
Pvgap	Poverty Gap	0.279	0.051	0.216	0.377
Sevpov	Severity of Poverty	0.144	0.033	0.109	0.211
ElecGrid1	Proportion of households using electricity for cooking	0.107	0.140	0.01	0.450
ElecGrid2	Proportion of households using electricity for other utilities (light)	0.142	0.156	0.030	0.470
Educ8-12	Proportion of children attending secondary school	0.252	0.111	0.140	0.470
Mincome	Log of Mean Income for the District	4.915	0.157	4.775	5.343
TotInc	Log of Total Income for the District	1.962	0.348	1.262	3.79
DistDC	Log of Distance from Main Distribution Center in Km (*we assume this would be Lusaka*)	2.526	0.411	0.301	3.00

Supply Chain Expansion Results

Using the variables in Table 1, our response decision variable is coded as 0 or 1, representing the absence or presence of at least one Shoprite Holding Ltd. store location in each Zambian district (72 in total). Fitting the logistic regression model in equation (1) to the data set described in Table 1 requires an estimation of the

beta-coefficients. To specify the model, we evaluated the Pearson correlation matrix and eliminated those variables that were nearly perfectly correlated and we utilized stepwise regression in SAS™ (version 9.1) programming. This produced estimates of beta-coefficients for those variables that agree most closely with the observed Shoprite Holding Ltd. data for Zambia in linearized form according to equation (2). We specified a step-wise regression model with a required significance level of 0.3 for entering a variable into the model, and a required significance level of 0.35 for a variable to remain in the model. These tolerances represent our strategy for assessing the adequacy of the model both in terms of its individual variables and its overall fit using a maximum likelihood estimation approach. More importantly, our strategy behind this stepwise approach is to focus our attention on a subset of the variables presented earlier, and to do so with some statistical support for their use. After twelve stepwise iterations, the results of the first-stage regression results appear in Table 2. The goodness of fit using the Hosmer-Lemeshow Test (Hosmer and Lemeshow, 2000) for the model was 0.8594.

Table 2. Results for Fitting the Logistic Regression to Shoprite Holding Ltd. Data and LCMS Data*

Variable	Coefficient	Std. Error	Wald Chi-Sq	p-value	Exp(β)**
Intercept	-98.598	32.319	9.307	0.0023	
Infmlag	6.359	3.444	3.408	0.0649	2.330
Infmlnoag	12.5	5.331	5.497	0.019	2.994
PropGrProd	23.55	10.764	4.788	0.0287	3.943
SevPov	-42.104	24.17	3.304	0.0815	0.0001
Educ8-12	49.169	18.605	6.984	0.0082	5.429
DistDC	0.007	0.005	2.254	0.13	0.1159

*Hosmer/Lemeshow Test statistic for fit: Chi-square=3.974 p=0.8594
**Data transformation included

Table 2 reports the results of the locate – no locate binomial logistic regression model. Five of the independent variables were significant: 1) the size of the workforce in informal agriculture (Infmla) at .06; 2) the size of the workforce in informal non-agriculture (Infmlnoag) at .01; 3) the proportion of households that grow their own food (Propgrprod) at .02; 4) the severity of poverty (Sevpov) at .08; and 5) the proportion of children attending secondary school (Educ8-12) at .00. All of the variables selected had signs as expected based on previous literature and will be discussed in detail later.

The unique finding of this model is that the informal sector, both Agricultural and non-Agricultural employment influence the firm's location. The direct interpretation is that as the size of the activities of the informal sector increases the more likely it is for Shoprite Holding Ltd. to locate in that district. This may be counter-intuitive to many economists; however, if a firm's manager observes avid market transactions in the street, then they may perceive that as an opportunity to offer a better product at the same price. In a recent interview with Pick n' Pay and

Shoprite Holding Ltd.'s (the two largest grocers in Africa representing 80% of Chain store business) CEOs, it was stated that much of their growth in the supermarket business has been due to the informal market converting to the formal market (CNCB, 2006). Given Zambia's large informal sector this result is encouraging that the model is working well.

The proportion of households that grow and consume their own produce is positively related to Shoprite Holding Ltd. locating in that district. Once again, this may seem counter-intuitive to many economists but as a manager surveys the landscape with nothing but traditional (informal) supply chains in existence, then they must start piecing together how to manage the first couple of years of operation with some imports and some local purchases until the local procurement/sourcing program is put into place. Hence, observing lots of production, no matter who is consuming it (informal market or own consumption) is encouraging to a firm expanding to a new region.

The severity of poverty is negatively related to Shoprite Holding Ltd. locating in a particular district as we would expect. As the level and severity of poverty increases, Shoprite Holding Ltd. and other food firms would choose to find other regions to locate.

The most significant variable for firm location was the proportion of children attending secondary school. On the demand side, Shoprite Holding Ltd. in South Africa markets their products to lower-middle to lower-upper classes and may be using the same relative approach in Zambia. In Zambia, as in most developing countries, those with higher levels of educational attainment have a tendency to try new food products as well as purchase their food from supermarkets versus open markets. On the supply side, Shoprite Holding Ltd. needs an educated work force for the management level jobs so this is another reason why this variable may be so significant.

Although not significant, the distance to the distribution center and total income for the district warrant a short discussion here. One reason why total income may not be an indicator is that the informal sector is so large in Zambia that official statistics cannot reliably capture the dynamics of this sector. We believe the distance to a distribution center will become significant in stage II of our research which is discussed briefly in the conclusions.

To further interpret the results, the significant explanatory variable odds ratios are calculated. The odds ratio for each effect parameter, estimated by exponentiating the corresponding parameter coefficient (β), is shown to equal Exp (β). As the variable changes by one unit, the probability of the Shoprite Holding Ltd. locating in that district changes by a factor of Exp(β). The general guideline is that if the odds ratio is greater than (less than) one, then we will experience an increase

(decrease) in the probability of targeting that district as a Shoprite Holding Ltd. expansion prospect. Our results warrant this interpretation of the regression from the view of odds ratios for the variables, as a form of robust sensitivity analysis. In estimating these odds ratios, we observe several findings in Table 2. First, severity of poverty seems to have no significant impact on the probabilistic decision. Further, proximate distance from a re-supply distribution center also had little influence. We did find that informal employment measures, agricultural (Infmlag) and non-agricultural (Infmlnoag), both increased the probability by factors of 2.33 and 2.994, respectively. As measures of economic activity in the informal sector of the economy, we infer that Infmlag and Infmlnoag reflect the intensity of agricultural and non-agricultural commerce in a given district and that they may indicate retail market potential in the region. We also found that the extent to which households "grow their own produce for consumption" (PropGrProd) increases the probability of a location decision by a factor of 3.943. As an indicator of produce consumption, PropGrProd also seems to resemble traditional measures of market potential. Finally, education levels (Educ8-12) also increase this probability by a factor of 5.429. As stated earlier, formal supply chains rely on some level of sophisticated consumption such that their retailing outlets are instantly adopted by consumers. In general, the relationships we discovered here for variables Infmlag, Infmlnoag, PropGrProd and Educ8-12 correspond with the discussion appearing in the traditional market diffusion and market entry literatures in business research (Bucklin, 1966), in that demographic factors seem to have a profound influence on predicting the viability of Zambian districts as potential sites for market expansion through the locating of retail facilities.

Market Entry Issues and Managerial Implications

Based upon the initial results presented in the preceding section, we find that when there are no formal or organized supply chains it is clear that the informal market matters. The informal market is a source of competition and supply. These findings are unique and are a direct result of where, demographically, the analysis was conducted. In comparison, it may be prudent in a future study to examine how companies such as Wal-Mart (USA) or Carrefour (EU and Asia) wrestle with similar location decisions in emerging economies. This is a South-South investment analysis, which we propose is different from a North-South managers' investment decision making process. For example, some of the excluded variables we analyzed such as degree of electrification, total income and distance from the distribution center[5] were not found to be significant in the South-South analysis but would most likely be key factors for North-South investment managers.

[5] Distance from the distribution center may be significant in a second stage analysis when locating the store relative to a distribution center, however, we are focusing on a macro level decision of selecting the target district. The next logical step is to look at cost, distance, time, and estimates of market share in a traditional facility location analysis.

Our first level of analysis, however, has yielded some interesting results. Shoprite Holding Ltd.'s managers, who have experience operating in poor regions and in fact specialize in marketing food products to the poor, appear to have made decisions based on other factors, factors that pertain to the demand side and the supply side simultaneously. When little data exists and the markets are primarily informal, one must make investments based on the basics, such as: are there clientele, suppliers, and skilled and unskilled workforce available. Once that set of criteria has been satisfied, and the go decision has been made, then the firm turns its attention to developing the rest of the supply chain over time. This management decision is intuitive but not without risks. For Shoprite Holding Ltd., the risks have been rewarded to the tune of 10% of sales volume a year originating from outside of South Africa and they have dominated formal food retailing in Sub-Saharan Africa since their initial investment outside South Africa in 1995 (www.Shoprite.co.za).

We believe that these preliminary results will be of use in the development of sourcing strategies for the last mile of the supermarket supply chain in Zambia and other regions of the world. Store formats (e.g. supermarkets, cash and carry) will certainly be of consequence as company managers time their entry into new markets and expand within their existing markets. Entering a declining or closing market means increased international competition, yet choosing the right format during the correct opportunity window could still result in reasonable opportunities.

Conclusions and Extensions

Most of the literature on retail facility location has been focused on the industrialized world where the supply chain environment differs significantly from that of the developing/transitioning economies. Zambia and other Sub-Saharan Africa countries represent challenging environments for firms interested in foreign direct investment. Although, in this paper we assumed that the firm is able to appropriately identify the governmental red tape for establishing a business in the country, experienced firms in the South still face unexpected delays. Firms like Shoprite Holding Ltd. send their most seasoned people to the countries of interest to observe the traditional supply chains and these practicing managers develop mental theories derived from their empirical observation.

The key finding of this study is that the informal (traditional) markets matter in determining where new firms locate their operations in developing/transitioning economies. Firm managers observe avid market transactions in the street and perceive that as an opportunity to offer a better product at the same price. The most important factors appear to be that the managers must ensure that there is adequate demand for their products and that the supply logistics for those products are not to onerous initially. Shoprite Holding Ltd. has been criticized for importing too many food products that can be produced locally in the first few years of

operation in the new countries of operation. However, it is fairly common to import product for the first couple of years until the local supply chain can be pieced together over a period of time.

This analysis informs managers, policy makers, and the donor community on the factors food firms consider when evaluating FDI in developing/transitioning economies. We believe this study could lead to the development of models of retail facility location decisions that account for environmental conditions, a key driver of doing business in developing/transitioning economies. This approach is generalizable to other countries and regions of the world where companies wrestle with the challenges of market entry.

Our results have some limitations, but offer several opportunities worthy of pursuit. The first limitation concerns the data. The analysis was guided by the specific data that was accessed. Other types of data may be available, and should be considered as it materializes. Second, we did not have free access to Shoprite Holding Ltd. data. This was a limited view of data. Third, this study stops short of proposing precisely where in each district Shoprite Holding Ltd. should locate. Our approach can be extended to this decision scenario, but will depend upon access to other operational data. Having chosen a logit modeling strategy and calibrated a predictive model, one useful extension would be to predict a Zambian district and store format combination. Though not our primary focus here, this would require additional market information and internal company data. Our results need to be viewed with these limitations in mind.

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Assessing Input Brand Loyalty among U.S. Agricultural Producers[1]

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Abstract

This study explores the prevalence and determinants of brand loyalty for agricultural input products. Results suggest that loyalty for both expendable and capital inputs is high among commercial agricultural producers in the United States. Producer attitudes, beliefs, and some demographic characteristics are useful identifiers of brand loyalty among commercial producers.

Keywords: brand loyalty, dealer loyalty, capital inputs, expendable inputs, farmer purchase decisions

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Introduction

U. S. agricultural input suppliers currently face a number of marketing challenges. For many agribusiness input suppliers, large commercial farm enterprises have replaced traditional smaller farms as their primary customers. Understanding changing relationship dynamics in this emerging market environment has become important for input supplier success.

In many instances, smaller farms behave like retail consumers. Relatively speaking, they wield little individual market power. On the other hand, larger farms have the ability to interact with input and output markets in a more business-like manner, taking advantage of powers of negotiation, economies of scale, and increased market access. As a result, the relationship between agribusinesses and their commercial farm customers is much different from that between agricultural firms and those operations that fit the historical farm profile (Akridge, et al., 2003).

The market interaction between commercial agricultural producers and their input suppliers has become similar to that observed in a non-farm business-to-business (B2B) environment. With this in mind, and given the changing structure of the U.S. agricultural sector, this study explores the prevalence and determinants of brand loyalty for agricultural input products.

In this study, brand loyalty is the commitment of a customer to choose to purchase a preferred branded agricultural input product or service now and in the future, despite situational changes and marketing efforts that may have the potential to cause switching. This definition is adapted from the description of brand loyalty proposed by Oliver, 1997. Brand loyalty should prove important to agricultural input firms because the literature suggests loyalty is prevalent among large businesses in general, the literature indicates loyalty is common among farm enterprises, and because loyalty has been found to be a determinant of, or at least correlated with, farm input purchase decisions (discussed below).

The market environment in which agricultural input suppliers operate is characterized by the following dynamics: 1) an evolving customer base resulting from structural change in the agricultural sector (increased concentration leading to fewer farmer customers managing larger commercial farms (2002 Census of Agriculture)); 2) continued consolidation within the agricultural input supply sector (King, 2001; MacDonald, 2000); 3) rapid technological advancements that allow for the frequent introduction of new products/techniques each year; and 4) a relatively high incidence of loyalty to input suppliers as well as to input brands (Akridge, et al., 2003). These market dynamics can present marketing challenges for agribusinesses that supply inputs.

One important strategy employed by these firms is the development of a strong brand for their products. Here, agricultural input suppliers face the problem of understanding the underlying determinants of brand loyalty and identifying effective marketing strategies to reach brand loyal customers. The objective of this paper is to assess the nature of brand loyalty for capital and expendable inputs among commercial agricultural producers in the United States. Specifically, the study seeks to: 1) determine and define who among U.S. commercial agricultural producers is brand loyal, and 2) offer insights to input suppliers or agribusinesses seeking to meet business objectives through effective branding.

Conceptual Model

For expendables and capital items, the buying process for agricultural producers includes those steps or activities undertaken in order to prepare for the purchase of the input. In this process, farmers also take into account a myriad of other factors, including their own perceptions, attitudes, and beliefs associated with the purchase. The decision-making process, or buying process, ultimately influences buying behaviors (observed as actual or reported purchases). Exhibiting brand loyalty illustrates a buying behavior, as certain producers choose to consistently buy particular brands of expendable or capital inputs. Understanding the factors that are part of the process that leads up to this behavior is a goal of this research. Unfortunately, the dissemination of research covering farmers' purchase decisions has largely been limited to extension publications, working papers, and a few theses from various universities. Many of these papers focus only on major farm machinery purchases, and very few specifically focus on the importance of brands and brand loyalty. Most public research in this area is quite dated. During the 1950's and 1960's, studies that addressed brand loyalty in agriculture were primarily conducted by researchers in the Midwest and Canada. The results of these studies were typically released through extension education departments or were contained within a Master's or Ph.D. thesis. The bulk of these publications were reviewed and summarized by Funk (1972). More recent work includes studies by Funk and Tarte (1978) on broiler feed purchases; Funk and Vincent (1978) on corn herbicide purchases; and Foxall (1979) on tractor purchases. The latest publication identified was published in 1997 by Kool, et al., and covered brand loyalty for capital and expendable inputs.

Although dated, previous research is relevant because it helps to form the basis for the paper's research model and for selecting variables found to be significant in determining agricultural input brand loyalty. The conceptual model of brand loyalty shown in Figure 1 is developed based on a review of the literature. The model is not all-inclusive, that is, not every factor that influences brand loyalty could be modeled given data and information availability. However, it does reflect a wide variety of factors suggested by previous research as important determinants of brand loyalty.

Historically, brand loyal farmer customers could be grouped based on demographic variables such as age, income, farm size, and education. Depending on the study, income negatively or positively impacted brand loyalty (Funk, 1972). Generally, it appears that age (also a proxy for farming experience or years farming) positively impacts expendable input brand loyalty (Funk and Tarte, 1976; Funk and Vincent, 1978; Funk and Tarte, 1978), but negatively impacts capital input brand loyalty (Gifford, 1956; Kohls et al., 1957). In a study that reported the impact of farm size and education, both variables appeared to negatively impact brand loyalty (Funk and Vincent, 1978).

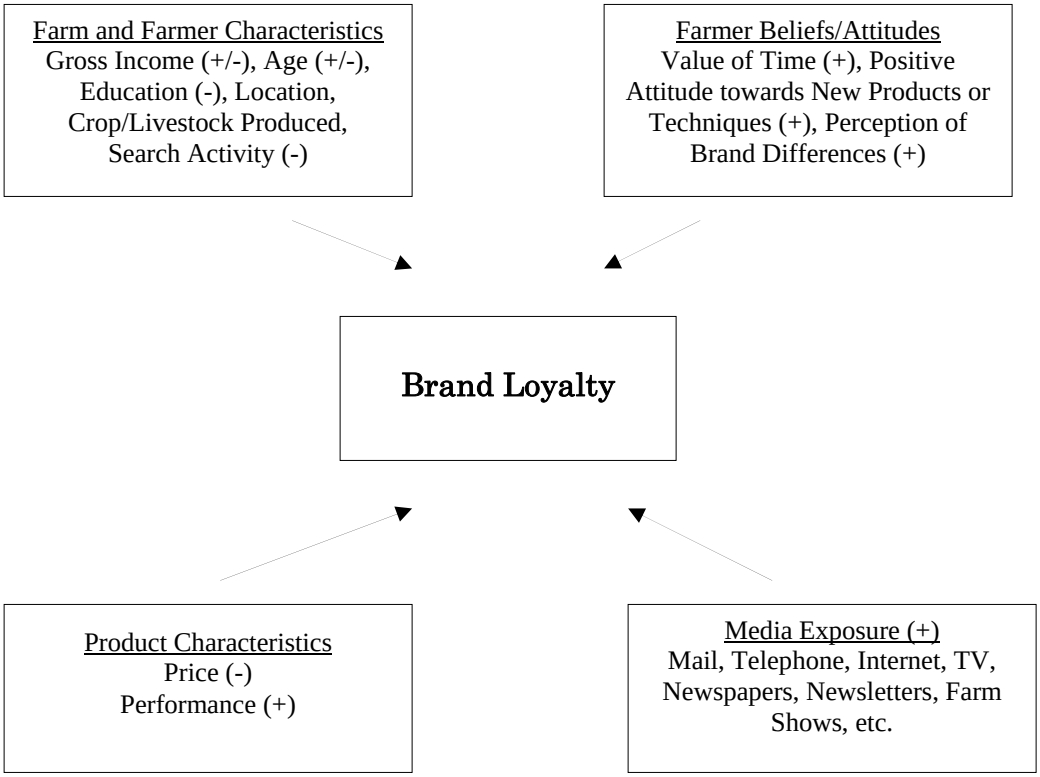

Figure 1: Conceptual Model of Brand Loyalty
Note: Expected signs of the relationship between variables and brand loyalty in parentheses.

Other demographic variables that might be important are geographic location and type of commodity produced. Within the United States, there is a concentration of specific production in particular regions. For example, corn and soybeans are prevalent in the Corn Belt states, while cotton production tends to be concentrated in warmer, Southern states. Inputs required for production by corn farmers differ from those of livestock or cotton producers. Thus, differences among purchase decisions may lead to differences in observed loyalty.

The current relevance of demographic variables is important to assess because of the evolving nature and structure of U.S. agriculture, changes in buyer and seller dynamics, and changes in behavioral and attitudinal characteristics of farmer customers. Farm size and income are reaching unprecedented levels, advanced education is much more easily accessible, and individuals are farming longer. Farm and farmer demographic characteristics may continue to play a role in predicting brand loyalty, but their role may not be as prominent as observed in the past. Further, the effect that these farm and farmer demographic characteristics may have on brand loyalty may differ from that observed previously.

Brand loyal farmers can also be characterized by those actions that are part of the buying process. For instance, those farmers who are willing to engage in search activities (for input purchase alternatives, lower prices, etc.) may be less likely to be brand loyal if their experience with their current brand has led them to search for alternatives. In previous studies, search activity consistently negatively impacted brand loyalty for expendable as well as capital inputs (Funk and Tarte, 1978; Funk and Vincent, 1978; Foxall, 1979; Kool, et al., 1997). The amount of time spent shopping for a capital input product is also negatively associated with loyalty (Kohls et al., 1957). Advances in information technology are important here. For example, if it is found that brand loyal producers more often search the Internet for information or alternatives, then the web can be used as an effective tool for communication, advertisements, orders, and the like.

Planned growth in farm size over the last two decades has created much interest in the purchase decisions of these commercial farmers. On the one hand, growth expectations can coincide with an increased focus on reducing costs, which could reduce interest in brands. Alternatively, as farm size increases, so does the value of a manager's time and making purchases based on brand name may reduce the time spent shopping. Because of these two opposing effects, no assumptions are made concerning the effect expected growth has on brand loyalty. In short, observing what farmers do or plan to do can be important when trying to predict loyalty. Farmer attitudes and beliefs can often indicate brand loyalty. For example, if time is perceived to be valuable, then producers who think that shopping or purchasing inputs is time consuming will more likely be brand loyal given that brands act as a signal for past experience and performance.

Other variables that capture farmer perceptions might include opinions about farming and the environment and the expressed willingness to try new technologies. The ability to relate to customers means that agribusiness must in a meaningful sense know and understand their customers. It is important to know what their customers value and in a sense support or validate their values. For instance, if customers are particularly concerned about the environment and are brand loyal, a business can exploit that opportunity by developing products that are environmentally friendly, or promoting those attributes which are environmentally

friendly to producers. Further, if farmers hold particular opinions about their managerial ability or the quality of information provided by suppliers, agribusinesses can cater to these concerns (product or not) through information services, meetings, etc. to meet the needs of their customers. For new product introductions, having a frame of reference about those producers who are likely to try the new products could prove useful for marketing programs. Early adopters may be more willing to take on the risk of trying a new product or technique and thus may be less inclined to be loyal to brands. Conversely, if brands convey information about quality, then early adopters may be more brand loyal. Product characteristics and/or favorable product experiences can impact the decision to consistently purchase a particular brand. Quality and service (Funk and Tarte, 1976), and performance (Funk and Vincent, 1978) have been shown to impact loyalty. Perceived brand differences often encourage brand loyalty (Funk and Tarte, 1976; Funk and Vincent, 1978; Kohls et al., 1957). For expendable inputs, cost (price) negatively impacts loyalty (Kool, et al., 1997), while for capital inputs, price positively impacts loyalty (Gifford, 1956). It is expected that quality, service, perceived brand differences, and input price should continue to have similar impacts on brand loyalty.

Farm managers operate in an age where media exposure is very high and the use of information technology for production, information, and other management activities continues to rise. There is much research covering the impact of advertising and media exposure on purchase behavior and general brand loyalty. Media exposure may prove to be an effective avenue for creating brand loyal customers and for enhancing relationships in agricultural markets. Research (very dated) has shown that loyalty tends to increase with a farmer's exposure to radio, television, and printed materials (Kohls, et al., 1957).

Data and Methodology

Data for the study were obtained from the 2003 Commercial Producer Project conducted by the Center for Food and Agricultural Business (CAB) at Purdue University. The survey was mailed to, e-mailed to, or conducted over the phone with a total of 14,301 producers across the United States during February 2003, and specifically targeted midsize and large commercial producers with annual gross sales in at least one enterprise of $100,000 or more. The database of producers was obtained from Farm Journal, Inc. Data used in this study covered six crop and livestock enterprise classes including corn/soybeans, wheat/barley/canola, cotton, dairy, swine, and beef. Over 2,100 surveys were returned, representing a response rate of 15%.

Of particular interest to this study are farmer responses to statements (discussed below) concerning their own perceived loyalty to purchasing branded capital and

expendable products. Loyalty to branded capital items may differ from that of expendable products given that service (repair and maintenance) is a major selling point for capital items. Also, capital items represent major purchases and are used for years while expendables are primarily used once. Information also was collected on farm and farmer characteristics, buying preferences, attitudes and behaviors, and management plans and activities.

Survey respondents were asked to respond to the following statements:

- I consider myself loyal to the brands of expendable items I buy, and
- I consider myself loyal to the brands of capital items I buy.

Producers responded to these statements using a 5-point Likert scale. Respondents indicated that they: 1) strongly disagreed, 2) disagreed, 3) neither disagreed nor agreed (undecided), 4) agreed, or 5) strongly agreed with each statement. Responses to each statement represent a discrete variable with five response categories. Responses to the brand and loyalty statements are collapsed into two categories. Strongly agree and agree responses are treated as one response. Strongly disagreeing, disagreeing, and neither agreeing nor disagreeing comprise the second (reference) category. This classification allows for a dependent variable with two discrete response categories. The binomial logistic model (BLM) is ideal for estimating and testing hypothesized relationships. Separate models are estimated for each dependent variable (as represented by the two statements of interest).

Dependent Variables

Dependent variables for this study are reflective of the focus statements described above. A total of 2,112 responses were obtained for the statement measuring expendable input brand loyalty. About 39% of respondents reported that they agreed or strongly agreed with the statement that they considered themselves loyal to the brands of expendable items that they buy (Table 1). A total of 2,069 individuals responded to the statement measuring capital input brand loyalty. Well over half (58%) of the individuals who responded to the question covering

Table 1: Dependent Variable List for BLMs Estimating Brand and Supplier Loyalty

Variable	Definition	Mean	Std Dev
BLOYALCAP	=1 if strongly agreed or agreed with statement that they are loyal to capital input brands purchased; =0 otherwise	0.5814	0.4934
BLOYALEXP	=1 if strongly agreed or agreed with statement that they are loyal to expendable input brands purchased; =0 otherwise	0.3902	0.4880

Explanatory Variables

Data obtained in the commercial producer survey that measures income, age, and education are very similar to those variables measured in previous studies. Selecting comparable measures for search activity, perceived brand differences, media exposure, shopping time, and risk aversion is not as straightforward. However, several variables from the commercial producer project survey reasonably capture the inherent meaning and intent of the non-demographic factors that have been found in the literature to influence input brand and/or dealer loyalty.

Explanatory variables (Table 2) are reflective of the factors proposed to influence loyalty in the conceptual model outlined. Demographic variables are self reported and the remaining variables are based on survey responses. Brand loyalty-related variables are captured in a binary manner with the exception of the variables measuring media exposure and dealer influence on purchase decisions.

Fifteen variables measure farm and farmer characteristics including: farm size, age, education, type of commodity produced, expected growth over the next five years, and use of the Internet to place online orders for agricultural inputs (see Table 2 for related statistics). Variables that measure farmer beliefs and attitudes captured respondents' perceptions of brand differentiation, the time needed to purchase

Table 2: Explanatory Variable List[1]

Variable	Definition	Mean	Std Dev
	---------*Variables Measuring Farm and Farmer Characteristics*----------		
SALES	Total annual farm sales in dollars	1,519,240	4,657,841
AGE35	=1 if under age 35; =0 otherwise	0.1375	0.3443
AGE54	=1 if aged 35-54; =0 otherwise	0.5159	0.4998
AGE55plus*	=1 if over age 54; = 0 otherwise	0.3431	0.4749
EDUC1	=1 if attended high school; =0 otherwise	0.0319	0.1757
EDUC2	=1 if high school, associate degree, or trade program graduate; =0 otherwise	0.4249	0.4944
EDUC3*	=1 if 4-year college attendee or graduate; =0 otherwise	0.5423	0.4983
CORNBEAN	=1 if produce corn/soybeans; =0 otherwise	0.6822	0.46575
WHTBARL	=1 if produce wheat/barley; =0 otherwise	0.1949	0.3962
COTTON	=1 if produce cotton; =0 otherwise	0.1635	0.3699
DAIRY	=1 if dairy producer; = 0 otherwise	0.2013	0.4010

[1](*) indicates a reference category.

Table 2: Continued

Variable	Definition	Mean	Std Dev
	---------- *Variables Measuring Farm and Farmer Characteristics* ----------		
PORK	=1 if pork producer; = 0 otherwise	0.2026	0.4020
CATTLE*	=1 if cattle producer; = 0 otherwise	0.2705	0.4443
GROWTH	Percentage change in primary operation size over next five years	0.254	0.491
ORDONLINE	=1 if place order for agricultural inputs online; =0 otherwise	0.1491	0.3562
	----------*Variables Capturing Farmer Beliefs and Attitudes*----------		
EXPSAME	=1 if believe expendable brands are more or less the same; =0 otherwise	0.2662	0.4421
CAPSAME	=1 if perceive capital brands are more or less the same; =0 otherwise	0.2258	0.4182
TIMECONS	=1 if believe that purchasing inputs is time consuming; =0 otherwise	0.5811	0.4935
VIEWBUS	=1 if view farming more as business than way of life; =0 otherwise	0.3379	0.4731
ENVIR	=1 if environmental regulations are important when making input purchase decisions; =0 otherwise	0.5831	0.4931
FOOD	=1 if food/security regulations are important when making input purchase decisions; = 0 otherwise	0.5266	0.4994
FIRSTADOPT	=1 if very first or among first to try new products, techniques; =0 otherwise	0.5980	0.4904
	-----*Variables Capturing the Importance of Product Characteristics*-----		
LOWPRICE1	=1 if buy lowest priced expendable products; =0 otherwise	0.2405	0.4275
PERFORM1	=1 if reported that branded expendable products offer a higher level of performance; =0 otherwise	0.3135	0.4640
LOWPRICE2	=1 if purchases the lowest priced capital input products; =0 otherwise	0.1928	0.3947
PERFORM2	=1 if reported that substantial differences exist across branded capital input products; =0 otherwise	0.5467	0.4979
	---------- *General Media Variable* ----------		
MEDINDEX	Index measuring reported media exposure ranging from 0 to 1	0.5795	0.0993

[1](*) indicates a reference category.

inputs, and farming as a way of life. In addition, these variables measure the importance placed on environmental and food regulations and attitudes towards new products and techniques. For both capital and expendable inputs, two variables captured the importance of price and performance attributes. Finally, a media index variable is developed to measure reported media exposure among respondents. [1]

Capital Input Brand Loyalty

Eight variables have statistically significant coefficients for the model predicting capital input brand loyalty (BLOYALCAP) (Table 3). Two "traditional" variables are statistically significant indicators of brand loyalty. Attending but not completing high school (EDUC1) and producing corn or soybeans (CORNBEAN) increases the likelihood of being brand loyal to capital inputs. Other variables that positively influence capital input brand loyalty include the reported use of media to obtain information useful for making input decisions (MEDINDEX), the perception that substantial differences in performance exist across branded capital input products (PERFORM2), and reporting that food safety/security regulations impact input purchase decisions (FOOD).

Respondents who perceive that capital input brands are more or less the same (CAPSAME) and respondents who report that they purchase the lowest priced inputs (LOWPRICE2) are less likely to be brand loyal. The same is true for respondents who report that they view farming more as a business than as a way of life (VIEWBUS).

Reporting the belief that shopping for inputs is time consuming (TIMECONS), reporting that they order products online (ORDONLINE), reporting that environmental regulations are important (ENVIR), reported growth (GROWTH), and being among the first to adopt new techniques and products (FIRSTADOPT) are not responses that distinguish capital input brand loyal producers from those who are not.

Marginal effects indicate education directly affects the likelihood of being brand loyal. Those who reported attending high school but did not graduate (EDUC1) are more than 15-percentage points more likely to be brand loyal. Corn and/or soybean

[1] Because there are a number of potential variables that capture reported media use when collecting relevant information for purchasing decisions, a media index (MEDINDEX) was developed that captured the relative importance of media for obtaining information. Respondents were asked to report how often they obtained useful information from twelve media sources (suppliers' meetings, direct mail, telephone contact, agricultural websites, television, radio programs, field days, general farm publications, newspapers, newsletters, and farm shows). Responses for each media source ranged from 1 (never) to 5 (always). The index is calculated by summing responses for the twelve media sources and then dividing by the highest possible sum. For example, if a producer reports a "1" for each media variable, their index assignment is 0.20 ((1x12)/60). This measurement provides the relative importance of media for individual respondents. The average index assignment is approximately 0.58.

Table 3: BLM Results Predicting Brand Loyalty for Capital Inputs (BLOYALCAP)[1,2,3]

	Coefficient (Standard Error)	T-Statistic	P-Value	Marginal Effect
CONSTANT	-1.3734	-3.733	0.0002	
	(0.3679)			
SALES	-0.0386	-1.610	0.1073	
	(0.0024)			
AGE35	0.1161	0.656	0.5120	
	(0.1772)			
AGE54	0.0041	0.032	0.9744	
	(0.1279)			
EDUC1	0.6870*	1.823	0.0682	0.1549
	(0.3768)			
EDUC2	0.0044	0.004	0.9969	
	(0.1133)			
CORNBEAN	0.2839**	2.265	0.0235	0.0698
	(0.1253)			
WHTBARL	0.1895	1.292	0.1965	
	(0.1467)			
COTTON	0.1457	0.872	0.3832	
	(0.1672)			
DAIRY	-0.0254	-0.171	0.8642	
	(0.1486)			
PORK	0.0174	0.126	0.8999	
	(0.1390)			
CAPSAME	-0.2402*	-1.838	0.0660	-0.0592
	(0.1306)			
MEDINDEX	0.0204***	3.513	0.0004	0.0050
	(0.0058)			
TIMECONS	0.1821	1.620	0.1053	
	(0.1124)			
VIEWBUS	-0.2858**	-2.475	0.0133	-0.0702
	(0.1155)			
ORDONLINE	-0.2397	-1.601	0.1095	
	(0.1498)			
ENVIR	-0.2703	-2.195	0.0282	
	(0.1321)			
FOOD	0.5162***	4.302	0.0000	0.1258
	(0.1200)			
LOWPRICE2	-0.2322*	-1.678	0.0934	-0.5727
	(0.1384)			
PERFORM2	0.4261***	3.827	0.0001	0.1040
	(0.1113)			
GROWTH	-0.0007	-0.619	0.5357	
	(0.1121)			
FIRSTADOPT	0.6824	0.603	0.5463	
	(0.1131)			
Log Likelihood	-994.04			
Restricted L.L.	-1040.43			
Chi-squared	92.79***			
Predicted Correctly	61.46%			

[1]Estimates measuring the likelihood agreeing that respondents are brand loyal; Observations = 1523
[2](*), (**), and (***) indicate significance at the 0.10, 0.05, and 0.01 level of significance, respectively.
[3]Marginal effects for statistically significant coefficients shown only.

producers are the most likely to be brand loyal; they are nearly 7-percentage points more likely to report loyalty. If a respondent believes that capital input brands are more or less the same, they are 6-percentage points less likely to be brand loyal. Viewing farming more as a business than as a way of life, and favoring the lowest priced inputs reduces the probability of being brand loyal by 7- and 6-percentage points, respectively. Reporting a perceived difference in performance among capital brands and reporting that food safety regulations impact input decisions increases the probability of being brand loyal by nearly 10- and 13-percentage points, respectively. On average, a one-point increase in the media index (which is scaled up from "0 to 1" to "0 to 100") increases the likelihood of being brand loyal by half a percentage point. Stated another way, an increase in the media index by 10-percentage points increases the brand loyal probability by about 5-percentage points.

In short, those who are more likely to be brand loyal to the capital inputs that they purchase are: 1) producers who attended high school but did not obtain a diploma; 2) corn and soybean producers; 3) producers who value information from media sources; 4) producers who believe food safety issues influence their capital input purchase decisions; and 5) producers who believe that substantial differences in performance exist across capital input brands.

Factors that influence brand non-loyalty are: 1) the perception that capital input brands are more or less the same; 2) viewing farming more as a business than a way of life; and 3) exhibiting a preference for the lowest priced capital input products.

What does this mean for agribusinesses that supply capital farm inputs? When multiple factors are considered, demographics are less meaningful characteristics that distinguish brand loyal customers. Behaviors (purchasing the lowest priced inputs), attitudes and beliefs (such as view of farming and a belief in brand differentiation), and individual purchase processes (use of media as source of information; considering food safety issues when making purchase decisions) are more significant indicators of loyalty.

Expendable Input Brand Loyalty

A logit model was estimated to predict the likelihood of reporting brand loyalty for expendable products (Table 4). Three demographic characteristics have statistically significant, negative coefficients (SALES, AGE54 and COTTON). An increase in reported gross sales corresponds with a decrease in the likelihood of being brand loyal to expendables. (A $1 million increase in reported gross sales decreases the probability of being brand loyal by about 1.35- percentage points.) Producers between 35 and 54 years old are less likely to be loyal to the expendable brands that

Table 4: BLM Results Predicting Brand Loyalty for Expendable Inputs (BLOYALEXP)[1,2,3]

	Coefficient (Standard Error)	T-Statistic	P-Value	Marginal Effect
CONSTANT	-2.0068***	-4.424	0.0000	
	(0.4536)			
SALES	-0.0578**	-2.035	0.0419	-0.0135
	(0.2844)			
AGE35	-0.1145	-0.639	0.5231	
	(0.1794)			
AGE54	-0.3721***	-2.880	0.0040	-0.0875
	(0.1292)			
EDUC1	0.3787	1.126	0.2601	
	(0.3363)			
EDUC2	0.1616	1.392	0.1640	
	(0.1161)			
CORNBEAN	0.1799	1.386	0.9513	
	(0.1297)			
WHTBARL	0.0567	0.373	0.7095	
	(0.1524)			
COTTON	-0.3002*	-1.682	0.0926	-0.0681
	(0.1785)			
DAIRY	0.0123	0.080	0.9366	
	(0.1555)			
PORK	0.1972	1.416	0.1568	
	(0.1393)			
EXPSAME	0.0140	0.109	0.9129	
	(0.1280)			
MEDINDEX	0.0167***	2.789	0.0053	0.0039
	(0.0059)			
TIMECONS	0.0070	0.061	0.9513	
	(0.1151)			
VIEWBUS	-0.4812	-0.403	0.6867	
	(0.1193)			
ORDONLINE	-0.4709***	-2.914	0.0036	-0.1049
	(0.1616)			
ENVIR	0.3499	0.861	0.3893	
	(0.4064)			
FOOD	0.4324***	3.528	0.0004	0.1001
	(0.1225)			
LOWPRICE1	-0.3633***	-2.675	0.0075	-0.0827
	(0.1358)			
TRADE	0.0250	0.210	0.8337	
	(0.1192)			
PERFORM1	0.9440***	8.002	0.9440	0.2256
	(0.1179)			
GROWTH	0.0006	0.532	0.5944	
	(0.0011)			
FIRSTADOPT	-0.0277	-0.240	0.8106	
	(0.1158)			
Log Likelihood	-965.25			
Restricted L.L.	-1044.16			
Chi-squared	157.83***			
Predicted Correctly	66.45%			

[1]Estimates measuring the likelihood of agreeing with being brand loyal; Number observations = 1565
[2](*), (**), and (***) indicate significance at the 0.10, 0.05, and 0.01 level of significance, respectively.
[3]Marginal effects for statistically significant coefficients shown only.

they buy by about 9-percentage points. Respondents who grow cotton are 7-percentage points less likely than those who raise cattle to express loyalty. Five other variables have statistically significant coefficients. MEDINDEX, FOOD, and PERFORM1 all have statistically significant, positive coefficients. This suggests that agreeing with the corresponding statements increases the likelihood of being brand loyal. Placing a higher value on the media for input information, reporting the importance of food safety and security issues when making purchase decisions, and perceiving that expendable brands perform better than generics are all indicators of expendable brand loyalty. Marginal effects for the three variables are 0.0039, 0.1001, and 0.2256, respectively.

Ordering inputs and replacement products online (ORDONLINE) reduces the likelihood of loyalty by approximately 11-percentage points, while reporting that they purchase the lowest priced input products (LOWPRICE1) reduces the probability by about 8-percentage points.

In summary, respondents who are loyal to the expendable products that they buy likely possess the following characteristics: 1) they place a higher value on information from media sources; 2) they take food safety and security issues into account when making input purchase decisions; and 3) they perceive that brands perform better than generics. Reporting a higher than average level of sales, being between the age of 35 and 54, producing cotton, placing orders for agricultural inputs and products online, and valuing low prices are factors which tend to indicate brand non-loyalty for expendable inputs.

Conclusions

The results of this study are obtained from analyzing information from a survey of producers responsible for making input purchase decisions. Respondents submitted information on their purchase habits, attitudes, preferences, and individual characteristics. Model results are consistent with those obtained in the literature covering consumer brand loyalty as well as those obtained in available (dated) literature covering farmer brand loyalty.

Results suggest that, unlike previous studies, demographic variables are not the strongest indicators of brand loyalty. Marketers should first assess what other factors are important in determining loyalty and subsequently determine if there is a link with demographic characteristics. What appear to be more important indicators of loyalty are those factors that influence the buying process – the attitudes, beliefs, and activities of respondents.

Based on empirical model results, it can be inferred that brand differentiation, media exposure, brand performance, and the ability to order online are issues that directly affect brand loyalty. These issues can be directly addressed by

agribusinesses seeking to build brand loyalty while operating in an evolving market environment. For example, this paper's results show that producers who order expendable inputs online are less likely to be brand loyal and are price sensitive. Expendable suppliers using online ordering and advertising should focus on building brand awareness and on stressing brand benefits in conjunction with offering price incentives.

The remaining factors that include attitudes and beliefs can be used as tools to identify potential brand loyal customers. These data can be obtained through the development of personal relationships or professional rapport with farmer customers, or assessed through market research. In addition, marketing strategies for building and reinforcing loyalty should focus less on price and more on the value that commercial producers can obtain through product quality, service, and providing relevant information.

As a practical application, agribusiness marketing managers can use this paper's results to develop profiles of those farmers most likely to be loyal to their specific products, and use one strategy to market to those farmers who fit the loyal profile and use another strategy to market to those who do not fit loyal profiles. For example, a strategy to build brand awareness and disseminate information about brand attributes would be useful when advertising to producers who do not fit the loyal profile. A strategy to maintain loyalty (a repeat purchase rewards program, for example) would be more useful when geared towards those customers that are loyal.

A limitation of this research is that the variables capturing loyalty were homogeneous measures of loyalty for an array of inputs. Capital inputs primarily cover farm machinery. A much larger number of input types are covered in the expendable input category (feed, seed, fertilizer, crop protection chemicals, fuel, etc.). In future studies it would be useful to have information that is brand or category specific. In addition, dependent variables captured a self-reported measure of loyalty. Data on survey respondents' actual purchase behavior was not available.

Little research specific to business-to-business relationships in the agricultural input sector exists in the literature. Previous studies that explored brand loyalty in the agricultural input sector are quite dated, with much work over two decades old. This research extends the current body of literature. The results from this study can aid agricultural input suppliers that operate in a B2B market environment to develop more effective marketing strategies. Hopefully, this research can also serve as a catalyst that leads to further research and discussion on the role of brand and dealer loyalty in U.S. agriculture.

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Source Differentiated Mexican Dairy Import Demand

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Abstract

Mexico is a major destination of dairy exports and is the single largest importer of US dairy exports. We use a restricted source almost ideal demand system to estimate the demand for dairy products imported into Mexico. The estimation facilitates an examination of the demand for dairy imports and the results have implications for exporting firms and countries. Our estimates indicate fierce competition for the Mexican market between the US, Oceania, and "other countries" primarily from South America.

Keywords: dairy trade, import demand, almost ideal demand system, source differentiation

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Introduction

Mexico is consistently one of the largest importers of dairy products in the world. Although domestic milk production has been growing, population demands continue to outstrip the ability of the domestic supply to meet the Mexico's consumption needs. Because of its size and proximity, Mexico has been the largest destination of United States (US) dairy product exports since 1990. In the ten-year period following 1994 implementation of the North America Free Trade Agreement (NAFTA), tariff rates for all US dairy exports to Mexico, with the exception of milk powder, gradually declined to zero. [1] Despite this advantage, the US continued to face fierce competition for the Mexican dairy export market from the European Union and Oceania.

Understanding the demand for dairy imports into Mexico has implications for dairy producers, cooperatives, processors, and exporters throughout the world as they make long-term investment and strategic decisions. This study utilizes a framework wherein Mexican importers are allowed to differentiate similar products by source of origin. This approach accounts for preferences and interactions between different dairy products, allowing an evaluation of market prospects for dairy exporters. The objectives of this paper are to: analyze dairy import demand in Mexico during the period 1990 through 2005; assess the import behavior and determine the demand elasticities for imported dairy products differentiating by source of origin; and, thus, to evaluate the Mexican market prospects for exporters.

The paper is organized as follows. In the next section, we briefly examine the dairy production, consumption and import situation in Mexico. Data are explained in the third section. The fourth section presents estimation results and implications. The final section concludes. The source differentiated AIDS model that provides the demand estimates is discussed in an appendix.

The Mexican Dairy Market

Mexican milk production has been steadily growing (Table 1) and several domestic government programs have discouraged dependence on imports. As a result, domestic milk production increased from 5.81 million metric tons in 1990 to 10.02 million metric tons in 2004. However, not all of the milk produced in Mexico can be effectively utilized to meet dairy product demand due to lack of marketing infrastructure (efficient supply chain, forward pricing and other risk management tools), as well as preferences for certain import products (Dobson and Proctor, 2002). Also, the cost of milk produced in Mexico is often higher than the price of subsidized

[1]The milk powder tariff is scheduled be eliminated for US milk powder into Mexico in 2008. Prior to that time, there is a non-tariff quota of 40,000 MT allocated to US Imports exceeding the quota are subjected to a 139% tariff. Under the NAFTA guidelines the US will be the only country capable of exporting non-tariff milk powder to Mexico in 2008.

dairy imports from abroad, especially milk powder, creating an incentive for processors and government social programs to procure dairy products from abroad. Fragmented geography and semi-tropical weather contribute to insufficient feed production and contribute to higher costs of milk production compared to dairy product imports.

Additionally, the mix of dairy imports to Mexico has changed in recent years from low-value commodities such as milk powder, to high-value products such as ice cream, specialty cheeses and protein fractions used in the manufacture of baby formulas, for which there are no domestic substitutes.

Table 1: Mexico Dairy Statistics, 1990 - 2004

Year	Production	Imports	Total consumption
	(million tons)	(million tons)	(million tons)
1990	5.81	2.73	8.54
1991	6.18	1.14	7.32
1992	6.38	2.45	8.83
1993	7.40	2.73	10.13
1994	7.32	2.29	9.61
1995	7.40	1.69	9.09
1996	7.59	1.91	9.50
1997	7.85	2.12	9.97
1998	8.32	2.02	10.34
1999	8.88	2.22	11.09
2000	9.31	2.31	11.62
2001	9.50	2.78	12.28
2002	9.80	3.21	13.01
2003	9.93	3.33	13.26
2004	10.02	3.63	13.65

Data source: The Mexican Secretariat of Agriculture and Natural Resources (SAGARPA) and the US Department of Agriculture Foreign Agricultural Service.

We categorize the major players in the Mexican dairy market as the US, European Union (EU), Oceania, including New Zealand and Australia, and a residual category entitled "Other countries" (e.g., India, Costa Rica, Argentina, Poland and Uruguay).[2] Import source categories are a necessity for the demand model we utilize. These particular categories were chosen because the US, EU, and Oceania have been the traditional major sources of dairy exports onto the world market. Figure 1 displays import shares of the main exporters to Mexico from 1990 through 2005. While there is a large degree of variation from year to year, it is clear that the EU share declined over that period while the US and "Other countries" became more important suppliers to the Mexican market.

[2] For our purposes, the EU refers to the EU-15. While Poland is now part of the EU, it was not at the beginning period we analyze and to be consistent it was included in the "Other countries" source category.

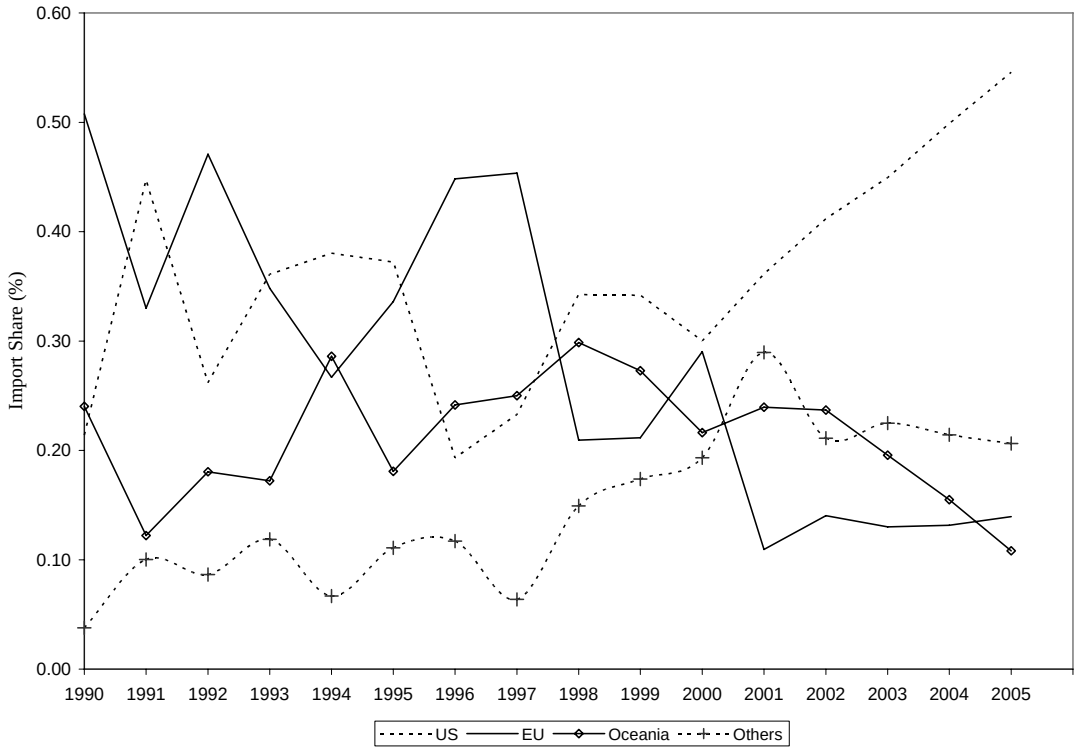

Figure 1. Mexican Dairy Import Shares (by value).
Data source: Mexican Secretariat of Economy.

Table 2 displays average product shares based on the value of imports exported to Mexico by source from 1990 through 2005. The US had the largest share in fluid milk, cheese, skim milk powder (albeit just slightly more than the EU), whey and other dairy imports to Mexico. The EU had the largest average share of milk powder imports while Oceania had the largest butter import share.

Table 2: Average Exporter Value Shares to Mexico by Product, 1990-2005.

	Fluid Milk	Cheese	Skim Milk Powder	Whey	Butter	Other Dairy*
			(percent)			
US	84.20	33.57	31.89	72.01	16.21	80.29
EU	0.49	25.31	30.84	12.95	31.58	13.08
Oceania	0.59	19.38	23.69	2.04	48.77	0.00
Other	14.72	21.74	13.58	13.00	3.44	6.64

Data source: Mexican Secretariat of Economy.
*Includes ice cream and yogurt.

Data

Data from the Mexican Secretariat of Economy on import monetary values and quantities for fluid milk, cheese, milk powder, whey, butter, ice cream and yogurt were utilized. Fluid milk, whey, butter, ice cream and yogurt were grouped to save degrees of freedom and classified as "other dairy products." Thus, the resulting

product categories were cheese, milk powder and other dairy. Cheese and skim milk powder were chosen as they were the largest product categories by value of imports during the period examined (Figure 2). Using the value and quantity information, unit prices and import shares from the respective sources of origin were derived.

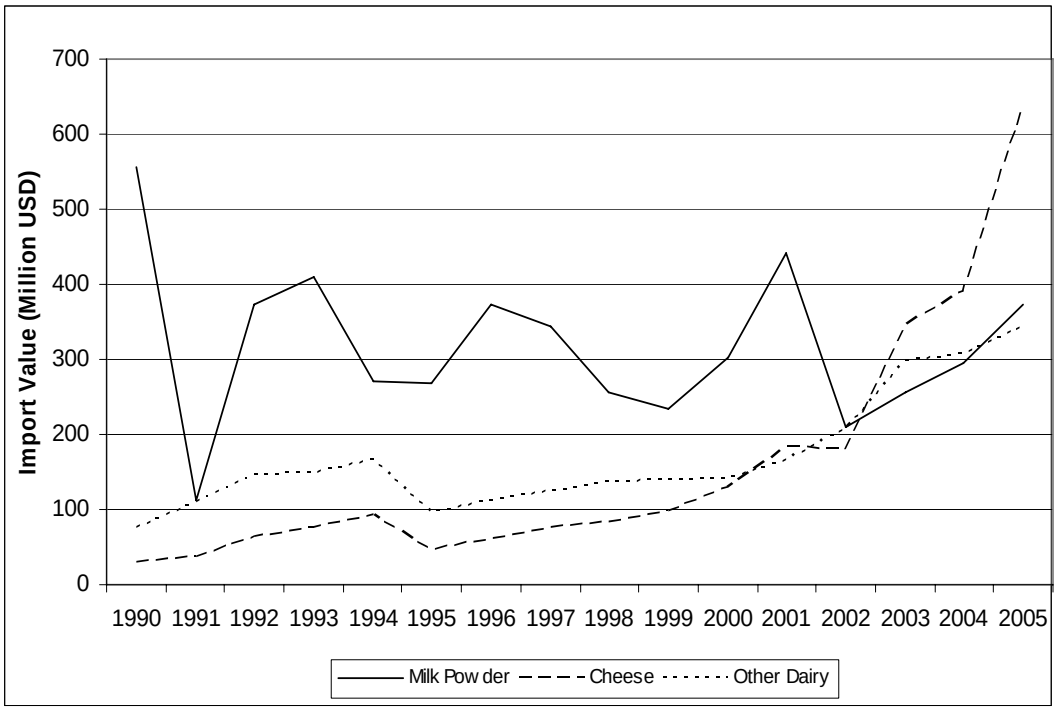

Figure 2. Value of Mexican Dairy Imports by Category, 1990-2005.
Data Source: Mexican Secretariat of Economy

Dollar export values were divided by their corresponding quantities to obtain the price importers paid in Mexico, which accounted for export subsidies and transportation costs. Prices were adjusted by Mexican import tariffs to better reflect the actual price in Mexico. Two different tariff schedules were applied to the prices, one for the United States specified under the North American Free Trade Agreement[3] (NAFTA) that considers the phasing out of tariffs in a 10-year period, and another tariff schedule for all the other countries. [4] Table 3 displays tariff schedules for dairy imports into Mexico. Another factor that was considered when calculating prices is the milk powder quota. Under the WTO and GATT guidelines, there was an 80,000 metric tons duty free quota for all the WTO countries exporting milk powder to Mexico. Quantities that surpassed the quota were subject to a 139%

[3] This schedule is only valid for the United States under the NAFTA guidelines. Canada excluded its dairy sector from the NAFTA negotiations.
[4] Even though a Free Trade Agreement with the European Union was signed in 2000, the dairy category was excluded from the negotiation because of the high level of subsidies utilized by the European Union.

tariff. For the U.S. under NAFTA guidelines[5], there was a quota of 40,000 metric tons of milk powder independent from the WTO quota, subject to the same tariff for exceeding quantities, but scheduled to be phased out over a 15-year period ending in 2008. The tariffs phased out by 24% over the first six years of the agreement and the remainder of the over-quota tariff were to be eliminated linearly over the remaining time period ending in 2008. These considerations were taken into account while calculating the import prices of milk powder by source country. Data on private consumption was obtained from the Central Bank of Mexico (Banxico).

Table 3. Mexican Tariff Schedules (products other than milk powder)

Product	WTO countries Tariff	NAFTA Tariff in 1993	NAFTA Tariff in 2003 (and later)*
		Tariff rate (%)	
Fluid milk	10	10	0
Yogurt	20	20	0
Whey	10	10	0
Butter	20	20	0
Cheese	20	20	0
Ice cream	20	20	0

Data Source: Mexican Secretariat of Economy
*These reflect the impact of NAFTA which linearly phased out tariffs over a 10-year-period ending in 2003.

As discussed above, the sources of origin for dairy products imported into Mexico were categorized as US, EU, Oceania, and "Other countries." Many of the countries in the "Other countries" category did not have a stable presence in the Mexican market. The "Other countries" that maintained relatively constant presence throughout the period of study were Argentina, Uruguay and Poland.

Estimation Results and Implications

The source differentiated almost ideal demand system (SD-AIDS) which was estimated is described in detail in the Appendix. The resulting coefficients reveal the response of quantity demanded for each product category to their own prices and prices of the other categories by source country.

Product demand results

With respect to demand for cheese, all own-price elasticities (on the diagonal of each block) were negative and at least unit elastic (Table 4). Demand for cheese from the EU was the least sensitive to its own price (-1.00). US cheese was sensitive to

[5] These guidelines under NAFTA started in 1993. Prior to that date, the U.S. was subject to the same WTO schedule.

Table 4. Marshallian Elasticities of Mexican Dairy Import Demand using the Restricted Source Differentiated AIDS Model

	Cheese				**Milk Powder**				**Other Dairy**			
Price	US	EU	OC	OT	US	EU	OC	OT	US	EU	OC	OT
P_{CHUS}	**-1.55***	-0.16	0.09	**0.36**								
P_{CHEU}	-0.23	**-1.00***	-0.24	**0.28**								
P_{CHOC}	0.26	-0.30	**-1.91***	**0.87***								
P_{CHOT}	**0.57***	**0.27***	**0.60***	**-2.65***								
P_{MPUS}					-0.51	**-1.05***	**1.11***	**-0.61***				
P_{MPEU}					**-0.63***	-0.42	**-0.41***	**0.81***				
P_{MPOC}					**1.25***	**-0.73***	**-1.12***	**-0.41***				
P_{MPOT}					**-1.33***	**1.60***	**-0.79***	**-1.10***				
P_{ODUS}									**-1.05***	**0.07***	**0.11***	-0.09
P_{ODEU}									**0.43***	**-1.04***	**-0.11***	-0.11
P_{ODOC}									**0.68***	**-0.19***	**-1.14***	-0.96
P_{ODOT}									-0.84	-0.23	-0.24	-3.26
P_{CH}					0.79	0.37	-0.18	-0.78	0.04	-0.04	0.13	-0.16
P_{MP}	**-2.48***	**-1.24***	-0.33	**-1.55***					0.04	0.22	-0.07	0.03
P_{OD}	**1.47***	**0.54***	0.02	0.70	**-0.77***	-0.01	0.10	0.42				
Expenditure	**2.27***	**1.87***	**1.39***	**2.07***	**0.97***	0.28	**1.17***	**1.74***	**0.89***	**0.74***	**0.92***	1.17
Marginal Share	0.17	0.09	0.05	0.10	0.13	0.02	0.14	0.12	0.12	0.01	.02	0.03

Notes: System $R^2 = 0.78$. Bold * denotes significance at the five percent level. P=price, Y=income; CH=cheese, MP= milk powder, OD= other dairy products; US= United States, EU= European Union, OC= Oceania, OT= Other countries.

changes in own-price as a one percent increase in price brings about 1.55 percent decrease in US cheese imports. Cheese imports from Oceania (-1.91) and "Other countries" (-2.65) were even more sensitive in changes to their own prices. These elastic own-price values indicate that all sources would increase revenues from cheese sales to Mexico by lowering cheese price.

Cheese cross-price elasticities revealed competitive relations among products. As US cheese price increased, more cheese from Oceania and "Other countries," and less cheese from the EU was demanded. The results indicate that US cheese directly competed in terms of price with Oceania and "Other countries" cheese.

The Mexican government imports milk powder for social programs and these government purchases are a substitute for domestic and imported products. Therefore, if milk powder prices were to rise, prices for other products such as cheese would increase, and importing more milk powder to produce a portion of these products domestically would be cheaper than importing the finished products. Traditionally, the US and EU have been the primary suppliers of subsidized milk powder to Mexico. This long-term relationship and the need for milk powder were reflected in the inelastic demand estimates for the US and EU. In contrast Oceania and the "Other countries" sources had elastic own-price estimates. This meant that the milk powder quantity imported from those countries decreased in larger amounts (more than one percent quantity change for a one percent change in price) when prices from these sources increased, suggesting that these sources were important when product was not readily available from the US or US price was above world price.

"Other dairy products" own-price elasticities suggest that demand for these products was price elastic from every source. In terms of price competition, the results suggest that one percent increase in other dairy products price from Oceania lead to a 0.68 percent increase in US imports. The US share of this import category similarly benefits from increase in EU price increases but lost large portions of "other dairy product" market share from price declines by those sources.

Projecting shares of additional imports

Mexico is projected to continue to import dairy products for many years to come (Dobson and Proctor). The estimates from this study have implications for how the Mexican dairy product deficit will be filled. To estimate how increases in income affect the demand for dairy imports, expenditure elasticities and marginal import shares were calculated following the approach of Seale, Marchant, and Basso (2002). Marginal shares are defined as $\beta_i + w_i^*$, where β_i is the expenditure parameter from the RSAIDS model and w_i^* is the average import share for source *i*.

The expenditure elasticity and marginal share are closely related. Expenditure elasticities estimate the percent change in quantity demanded when total expenditures increase by one percent. Marginal shares estimate how an additional dollar spent on dairy product imports would be allocated across products and sources. A country has strong potential in an import market if demand for the product is insensitive to price changes but increases with import expenditure (Yankg and Koo, 1994). Based on these measures and our estimates, it is possible to evaluate the potential for US dairy exports to Mexico by category.

All expenditure elasticities were positive and most were significant. Our results suggest that, if total expenditure on imported dairy products were to rise, holding all other factors constant, imported cheese demanded from the US would increase the most, followed by cheese from "Other countries," and Oceania. European cheese imports would be least favored.

In terms of import cheese market, if expenditure on imported dairy products in Mexico were to rise, *ceteris paribus* the demand for US cheese would increase by the estimate of expenditure elasticity (2.27) (Table 4). This increase was larger than the cheese demand response from any other source (although the "other country" category was close).

The marginal shares indicate how an additional dollar would be allocated. An additional dollar spent on dairy imports would include a total of 41 cents spent on cheese. US cheese would benefit the most by taking 17 cents of that dollar. Taken with the own product price elasticities, these results suggest that US exporters should consider price carefully to maintain an advantage in the Mexican market as US cheese imports were sensitive to price increases. In addition the results indicate that the real competition for the US in the Mexican cheese market came from "Other countries," with similar quality and characteristics at a lower price, more so than from the EU or Oceania.

In terms of the market for milk powder, the US was very competitive in the Mexican import market and this category was expected to grow as the NAFTA deadline for import quotas arrived. With respect to own-price elasticity, US milk powder exhibited an inelastic estimate (-0.51) as contrasted with the relatively elastic estimates for milk powder from Oceania (-1.12) and "Other countries" (-1.10). In terms of the marginal share, milk powder as a product category would collect a total of 41 cents of an additional dollar allocated to milk powder imports. Of this, milk powder from Oceania would take 14 cents of, followed by the US (13 cents) and "Other countries" (12 cents). These large estimates for the marginal shares highlight the constant need for milk powder in Mexico.

In the case of the "Other dairy" products category, the US faces a competitive market, but has positive market prospects. However, the US would receive the

largest share of an additional dollar allocated to dairy imports by taking 12 cents, by far the largest marginal share, posing a great advantage compared to other exporters, and demonstrating the strong presence of US dairy brands in Mexico.

During the period studied (1990-2005), the US became the main supplier of dairy products to Mexico surpassing the European Union. The analysis of the marginal shares suggests that the US would take 42 cents of an additional dollar allocated to dairy imports in Mexico. The results obtained in this study are consistent with opinions of analysts in the Mexican industry and point out that Oceania is a strong competitor that could represent a challenge to the US. Dobson and Proctor (2002) point out that the New Zealand Dairy Board, now Fonterra, is superior to any single American company operating in Mexico. The marginal share analysis suggests that Oceania would obtain 21 cents of an extra dollar allocated to dairy imports. The EU would receive only 12 cents of that dollar spent on dairy imports while "Other countries" would take 25 cents in total. In addition to increasing competition in the world dairy market, the decline in EU share over the period analyzed marks a shift away from direct production subsidies which necessitate dumping product on the world market towards decoupled payments leading to a smaller dairy surplus.

Implications for dairy firm managers

For managers of dairy cooperatives and other investor-owned dairy plants, the results have many implications for strategic decisions. These firms must make decisions as to what type of product facilities to invest in, which is a major long-term decision, as well as how much effort to put into expanding export market in the shorter term. The Mexican market is a major destination for dairy products but the key factor is clearly price and commodity products (and perhaps increasingly whey proteins), rather than higher prices specialty products, have been the major exports. The exchange rate will play a major role in determining which countries' products have the price advantage. For example, the weak US dollar in the past year has made US imports even more attractive. Traditionally, the US and EU have used the Mexican market to eliminate surpluses of dairy products. Growing a presence in the Mexican market as consumer incomes there rise will help result in a place for those countries premium dairy products in the future. Our results indicate that firms would increase revenues from lowering price on cheese exports to Mexico if possible and profitable. Milk powder from US and EU firms has some latitude to increase price but this is likely due to the subsidies on that product from those sources as the milk powder from Oceania, which is not subsidized, exhibited an elastic demand.

The results also have implications for policy preferences in the exporting countries. The US has utilized dairy export subsidies from the government and, in recent years, from industry cooperatives through a voluntary program. The weaker US dollar has meant that these subsidies are less or unnecessary as US products

become the low cost products. The EU has traditionally also subsidized exports and used markets such as Mexico to eliminate excess dairy stocks. In more recent years, however, the EU has moved away from direct market interference to have an agricultural policy that focuses more on factors such as the environment. Part of the decline in EU exports may reflect some of these policy changes. Oceania, in contrast to the US and EU, has had a long-term free market approach that has depended on being the low cost producer. A new World Trade Organization agreement would almost certainly result in even freer trade making price and cost of production of utmost importance in dairy export markets.

Conclusions

Despite a yearly milk production growth rate of over five percent during the 1990's, Mexican milk supply was not able to keep pace with domestic milk consumption. Therefore, imports continue to fill 20 percent or more of total dairy product consumption in Mexico. The Mexican market attracts many exporters and the US faces increasing competition from Oceania and South America. Using a demand model, we estimated the relationship of Mexican dairy product import demand both across product types and source of origin. We found that the US had a strong position that was enhanced by NAFTA, proximity, and export subsidies. "Other countries," which reflects a group of nations outside the traditional major dairy exporters, were also increasingly important sources of dairy imports during the period analyzed while the EU share declined precipitously. Our results indicate the US should continue to be a primary supplier in the Mexican dairy market by taking 42 percent of every additional dollar allocated to imported dairy products. Oceania, particularly New Zealand, would take almost 21 percent of the additional a dollar and "Other countries" would increase their shares as well, especially in the cheese market.

As income and population grow in Mexico, there will likely be demand for more dairy products and because of infrastructure and supply chain issues, domestic milk production will not be enough to cover the additional demand for some time. Therefore, dairy imports will continue to fill the gap between domestic production and total dairy demand, not only in low value commodities such as milk powder, but also in more sophisticated products such as whey proteins or specialty cheeses.

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Appendix: Source Differentiated Demand Model

The Almost Ideal Demand System (AIDS) model allows estimation demand relationships across different commodity categories (Deaton and Muellbauer). Empirical applications of the AIDS model to import demand typically assume product aggregation, under which the demand system does not differentiate products by source, which means the model consists of share equations for a good

from different origins, and does not account for different perceptions in quality and other preferences by source. An AIDS model based on only one product from different origins, in this case dairy products, assumes aggregation over products that is possible only if all prices move together by the same proportion, which does not hold true in international trade (Yang and Koo; Alston et al.). This aggregation, for example, ignores that Mexican importers may perceive US dairy products differently from European or Australian products. Thus, the marginal utility of consuming US cheese would not be affected by the consumption of European cheese. This aggregation would lead to modeling the demand for milk independently of the demand for cheese, and fail to represent the different interactions between the different dairy products. If these interactions exist, since goods compete for the same expenditure allocation, this assumption will bias elasticity estimates. We hypothesized that source differentiation is important in dairy import demand analysis and, therefore, utilize a Restricted Source Differentiated Almost Ideal Demand System (RSAIDS) based on the import value shares. This model has previously been applied to Japanese meat import demand (Yang and Koo), wine in British Columbia (Carew, Florkowski, and He), and Indonesian fruit imports (Andayani and Tilley).

The AIDS model is derived from a price-independent generalized logarithmic expenditure function (Deaton and Muellbauer). To incorporate source differentiation, this expenditure function is rewritten to approximate importer behavior that differentiates goods by origin. The expenditure function given utility level u can be written as:

(1) $$\ln E(u,p) = (1 - u)\ln[a(p)] + u \ln[b(p)]$$

where

$$\ln[a(p)] = \alpha_0 + \sum_i \sum_h \ln(p_{i_h}) + \frac{1}{2} \sum_i \sum_j \sum_h \sum_k \gamma^*_{i_h j_k} \ln(p_{i_h}) \ln(p_{j_k}),$$

and

$$\ln[b(p)] = \ln[a(p)] + \beta_0 \prod_i \prod_h p_{i_h}^{\beta_{i_h}},$$

where α, β, and γ^* are parameters (Yang and Koo). The subscripts *i* and *j* denote goods (*i, j* = 1,...,*N*) and *h* and *k* denote sources of origin (*h,k* = 1,...,*M*). Applying Shephard's Lemma provides the source differentiated share equations as:

(2) $$w_{i_h} = \alpha_{i_h} + \sum_j \sum_k \gamma_{i_h j_k} \ln(p_{j_k}) + \beta_{i_h} \ln(\frac{E}{P*}),$$

where *w* is the import share of a given product, *p* represents price of the product in question, *E* is expenditure on imported dairy products, and *P** represents an index of price for all imported dairy products from all the origins. M is the total number of dairy product categories and N is the total number of sources considered. The price index is:

$$(3) \qquad \ln(P^*) = \alpha_0 + \sum_i \sum_h \alpha_{ih} \ln(p_{i_h}) + \tfrac{1}{2} \sum_i \sum_h \sum_j \sum_k \gamma^*_{i_h j_k} \ln(p_{i_h}) \ln(p_{j_k}).$$

Stone's price index is a linear approximation of the price index defined as:

$$(4) \qquad \ln(P^*) = \sum_i \sum_h w_{i_h} \ln(P_{i_h}).$$

To avoid simultaneity problems in the expenditure share w_{i_h}, which is also the dependent variable in equation (2), average share was utilized.

The Source Differentiated Almost Ideal Demand System (SDAIDS) model in equation (2) is data intensive. With four sources and three products, there are a total of 14 coefficients for each equation and 16 years of Mexican dairy import data available. Therefore, following the approach of Yang and Koo, we estimate a restricted model that incorporates the following assumption:

$$(5) \qquad \gamma_{i_h j_k} = \gamma_{i_h j} \forall k \in j \neq i.$$

This assumption is "block substitutability" and means that cross-price effects of commodity *i* from origin *h* are the same for all commodities *j* regardless of their origin. In this analysis, this assumption means that Mexican demand for US cheese imports exhibits the same cross-price response to milk powder from Europe as to milk powder from Oceania.

Substituting (5) into (2) results in a restricted model:

$$(6) \qquad w_{ih} = \alpha_{ih} + \sum_k \gamma_{i_{hk}} \ln(P_{ik}) + \sum_{j \neq i} \gamma_{i_h j} \ln(P_j) + \beta_{ih} \ln(\frac{E}{P^*}),$$

where $\gamma_{i_{hk}}$ is a cross-price response parameter for the same good for different origins, and the parameter $\gamma_{i_h j}$ is the block substitutability cross-price parameter. The restricted model in (6) has fewer parameters (only eight total coefficients) to estimate which is important given data constraints.

Marshallian price elasticities for model are:

$$(7) \qquad \begin{aligned} \varepsilon_{i_h i_h} &= -1 + \frac{\gamma_{i_{hh}}}{w_{i_h}} - \beta_{i_h}, \\ \varepsilon_{i_h i_k} &= \frac{\gamma_{i_{hk}}}{w_{i_h}} - \beta_{i_h}(\frac{w_{i_k}}{w_{i_h}}), \\ \varepsilon_{i_h j} &= \frac{\gamma_{i_h j}}{\gamma_{i_h}} - \beta_{i_h}(\frac{w_j}{w_{i_h}}). \end{aligned}$$

While the expenditure elasticity is:

(8) $$\eta_{i_h} = 1 + \frac{\beta_{i_h}}{w_{i_h}}.$$

Consistent with demand theory, and to facilitate estimation, the following conditions were also imposed:

(9) adding-up: $\sum_i \sum_h \alpha_{i_h} = 1; \sum_h \gamma_{i_{hk}} = 0; \sum_i \sum_h \gamma_{i_h j} = 0; \sum_i \sum_h \beta_{i_h} = 0,$

(10) homogeneity: $\sum_k \gamma_{i_{hk}} + \sum_{j \neq i} \gamma_{i_{hj}} = 0$, and

(11) symmetry across sources for a given good: $\gamma_{i_{hk}} = \gamma_{i_{kh}}$.

Because of block substitutability, symmetry conditions among goods are not applicable; symmetry is applied only within each good from different origins. This means that the cross-price response of US milk to EU milk is the same cross-price response from EU milk to US milk. (Yang and Koo). Finally, we impose separability between domestic and import products as is common in other examinations of import demand (Yang and Koo).

Elasticities between and across products and with respect to income were calculated from the estimated model parameters. The significance of the elasticities was tested following the approach of Chalfant (1987) by calculating the standard errors (SE), as a function of the average share (w_i) and the β_i parameter from the regressions, and testing their significance with the Wald statistic.[1]

[1] The Wald test statistic is $SE(\varepsilon) = (1/w_i)SE(\beta_i)$.

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Range and Limit of Geographical Indication Scheme: The Case of Basmati Rice from Punjab, Pakistan

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Abstract

Basmati is well renowned as the most aromatic rice over the world. Populated urban markets are prone to accept a premium to Basmati, whom price is the highest for rice on trade and domestic markets. Punjab province represents 90% of overall Basmati rice production in Pakistan since immemorial times. This area forms the genuine alluvial lands appropriate for Basmati cultivation. Due to its price premium, some opportunist behaviors appear such as cropping blending of polished long grain from other varieties. The need of protection is clearly documented, but the registration of a Geographical Indication, will probably increase Basmati market shortages.

Keywords: Basmati rice, Marketing, Commodity chain, Geographical Indication, Pakistan

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Introduction

"Basmati is a premium long grain rice. Its high value comes from its characteristic aroma in both the raw and cooked state, and the grain is a distinctive shape, which on cooking elongates to almost double its length whilst its width remains the same. In addition to having unique eating qualities, Basmati rice is reported to be a good source of slow releasing carbohydrates (i.e. it has a low glycaemic index compared with other rice)" Burns et al., 2004.

Basmati rice (*Oryza sativa* race *Indica*) is generally judged by three main factors: appearance, aroma and taste. Basmati rices are characterized by superfine grain, pleasant aroma, soft texture and extreme grain elongation with least breadth-wise swelling on cooking (Singh et al., 2000-a). The Basmati rice has traditionally been grown in the north and north-western part of the Indian sub-continent for centuries. Basmati grows best and produces best quality grains under warm, humid, valley-like conditions (Singh et al., 2000-c).

Basmati rice is a staple food for people from Indian sub-continent and for their ethnic communities in the European Union (EU), especially in United Kingdom (UK). Although mainly eating wheat as cereals, people from Pakistan express strong links related to Basmati rice as a cultural heritage. Basmati rice is increasingly becoming an important food for the EU as a whole. In recent years sales of Basmati rice have increased by around 12% annually; and are expected to overtake sales of other long grain rice shortly. Currently, Basmati rice accounts for around 38% of the dry rice market oriented towards direct food consumption, while the main market for coarse rice varieties is the transformation process used in the food and drink industry, and the pharmaceutical sector as well.

Basmati rice attains a higher price than non-Basmati rice in both wholesale and retail markets. It is the highest price on world export market. This price premium attracts lot of players and increases competition between domestic and trade markets. It may probably also foster fraudulent blending. Known as both the best aromatic rice over the world and rooted basis of cultural identity on Indian sub-continent, Basmati rice appears as a good candidate for Geographical Indication. The present article offers an overview of the Basmati rice commodity chain in Pakistan with successive issues focusing on the economy, the intrinsic attributes and the progress on the way of Geographical Indication scheme. This article uses data issued from broad literature review of recent scientific publications, completed by field study held in April-May 2007 that allowed interviews of several local stakeholders.

The Economy of Basmati Rice in Pakistan

Economic Value

In spite of low yields compared to other varieties, Basmati is interesting for all the commodity chain actors thanks to its price premium. Basmati is measured as the only crop which gained acreage in Pakistan due to the globalization of commodities market (Ishtiaq et al., 2001). Basmati is known for its low yield 2.8 tons per hectare (T/ha) for Basmati 370, the oldest variety, although it was noticed 3 to 4 T/ha in experimental plots with Pusa or Haryana Basmati (Chaudhary et al., 2003). Basmati is well renowned as one of the most aromatic rice over the world, if not the best one (Weber et al.,2000). The aromatic varieties such as Basmati and Jasmine represent around 10% of world wide traded rice (von Braun and Bos, 2005; Childs, 2001).

In Pakistan, Basmati production represents 2920.4 thousand tons (KT) which means 52.6% of overall rice production in 2005-06 campaign, and 63.3% of rice acreage (MINFAL[1] 2007-a). Basmati represents 22.7% (839.0 KT) of quantity but 41.4% (28714.1 million PKR[2]) of value of overall rice exportations from Pakistan, while rice is 25.1% (value) of agricultural commodities exported and 4.7% of overall Pakistani exports in 2005-06. Exports represent 28.7% of Basmati crop but 108.5% of other varieties production[3].

This situation is peculiar, as it is reported that the international rice trade is estimated between 25 to 27 million tons per year, which corresponds to only 5-6 % of world production (Mendez de Villar, 2006). In 2005, world import of rice is estimated 29.8 million tons which represent 4.7% of 632.9 million tons of the world paddy production (FAO, 2007). At a world level, rice trade is a minor issue compared to self-sufficiency for producer countries (Wailes, 2003 ; Calpe, 2005). Rice is the only one commodity whose export value increased (+59.4%) in last decade for Pakistan (Chand, 2005). Basmati rice from Pakistan is mainly exported in Saudi Arabia and EU. Recently Iran became a player for Basmati importation, this increased prices on market places. Basmati rice is of paramount importance for both Pakistani exports and domestic consumption.

According to FAO, international export free-on-board price of Basmati is the highest one, reaching 516 USD /ton in 2006, which is 65.9% higher than Thai 100% white rice, 31.0% higher than US long grain 2.4% broken, and 108.9% higher than India 25% broken (FAO, 2007). International export free-on-board price of Basmati

[1] Ministry of Food, Agriculture and Livestock of Pakistan

[2] Pakistani rupee, 100 PKR = 1.21 EUR and 1.65 USD on 10 September 2007.

[3] According to MINFAL (2007-a), other varieties of rice than Basmati represent production of 2626.8 K tons and exportation of 2849.7 K tons in 2005-2006, indicating that some stored rice was exported out of Pakistan later than the year of its harvest.

increased from 68.0% since 2002. Basmati price is the highest on export market, but its increase is not exceptional according to other rice prices (see table 1).

Table 1: Rice export prices according to variety, USD/ton free on board

	Thailand 100% white	US long grain 2.4%*	Thailand 25%*	India 25%*	Pakistan 25%*	US California medium grain	Pakistan Basmati	Thailand Fragrant
2002	197	207	171	140	159	271	366	306
2006	311	394	269	247	230	512	516	470
March 2007	325	424	293	260	264	551	615	537
2007/2002	165%	205%	171%	186%	166%	203%	168%	175%

* % broken grains
Source: FAO

Monthly wholesale prices of Basmati (385 new) (PKR /40 Kg) vary from 865 in Multan to 927 in Rawalpindi in August 2006 and increased of 46.7% since August 1996 (MINFAL, 2007). Compared to another rice variety (Irri-6), Basmati costs +45.4% in Hyderabad, +60.5% in Lahore, +62.7% in Peshawar, +71.7% in Rawalpindi and +73.7% in Multan. Populated urban markets in Pakistan are prone to accept a premium to Basmati price. In April 2007, Basmati price ranges from 51 to 58 USD per 100 Kg on the wholesale market of Karachi, while other varieties rang from 23 to 36 USD per 100 Kg. Limited availability of good quality rice in Pakistan results in strong price increases (FAO, 2007).

On the final European market, consumer net prices of Basmati rang from 1.33 EUR /Kg (Distributor brand) to 4.63 EUR /Kg (Strong brand, pre-cooked, microwaveable), to 5.37 EUR /Kg (Fair Trade labeled), while common rice is sold around 1.54 EUR /Kg (data collected in April 2007).

Sustainability and Agronomic Value

According to Khush and de la Cruz (in Chaudhary et al., 2003), *"all the Basmati varieties are tall (150-160cm), very weak-stemmed and have light green and droopy leaves. They invariably lodge at maturity and are thus difficult to harvest. Because of their weak stems and taller growth habit, they are not responsive to inputs. Thus their yields cannot be increased by fertilizer applications beyond 30-40 kg /ha. Under higher fertility level, lodging may occur during the grain-filling period resulting in poorer yields".*

It was found that the agronomic response of Basmati rice growers in Punjab to the green revolution during the 1970s was to increase the use of fertilizers (Farooq et al., 2001 ; Mubarik, 1989). As the increased yields was directly correlated to the increase of fertilizer-use, the benefits for Basmati growers are questionable, due to the high price of fertilizers.

The Basmati varieties do not offer high agronomic value compared to Irri or other hybrid varieties. According to von Braun and Bos (2005), the yields of long grain rice range from 2.2 T/ha in Thailand (rainfed fields) to 7.0 T/ha in USA (irrigated fields), while for Basmati varieties, the yields range from 2.5 T/ha for Taraori to 4.0 T/ha for Haryana (Singh et al., 2000-a), and is reported to vary around 2.0 T/ha +/- 0.2 in Pakistani Punjab (Moazzam, 2004).

Pakistan has cultivated for a while Basmati, and other rices as well, under the irrigated ecosystem, due to the limited rainfall (von Braun and Bos, 2005). According to MINFAL (2007-b), rice crop used 2621 thousand hectares acreage where Basmati represents 63.3% in Pakistan in 2005-06.

The irrigation system was achieved in early 1900s in the Indus basin (Janjua, 2006). But the water-use efficiency of irrigated rice is low. Von Braun and Bos (2005) estimate that rice growing requires about twice as much water as other crops such as maize and wheat. This is why the water management for rice-wheat system is welcome, in order to reduce water-use by sowing rice on bed instead of flat, while tubewells are still considered as expensive for small farmers (Niaz Rai, 2006; Mobin ud Din et al., 2007). More generally, environmental impact of rice cultivation and processing is a new raising issue for Basmati rice cultivation (Morrissey et al., 2005).

Crop rotation is well installed in Punjab with wheat during Rabi (wet season, winter from November to April) and rice during Kharif (dry season, summer from May to October). Basmati rice is sown in June, and transplanted by hand in irrigated or water-flooded fields in July under 45-47°C temperature. Traditional Basmati varieties are tall growing (up to 170 cm) and highly photosensitive (Singh, 2000). The harvest occurs usually in November, five months after sowing and 35 days after 50% flowering with average moisture content of 21%. As no-tillage technique is now introduced, some farmers adopt direct sowing. Although there is no experimental evidence, farmers say that there is better aroma in direct sown rice crop than in transplanted ones (Singh et al., 2000-a).

In spite of high labor intensive pressure, the risk of switching from Basmati to other rice varieties with higher yield is considered as very low due to the high competitive advantage offered by Basmati price premium at farm gate and all along the commodity chain (Riaz-Mann, 2002). In such a way, Basmati fits well with small farms (less than 2 ha) which make up the farm population in North Punjab (Mubarik, 2005 ; Safdar Baloch, 2004), while the rice farms in Sindh and Baluchistan provinces are larger and cultivate only other rice varieties; those of North West Frontier Province (NWFP) are smaller than Punjabi ones and located in mountain area.

It was reported that western Punjab (Pakistan) is closer to sustainable rice growing than eastern Punjab (India), both in terms of cropping pattern diversity (diversification index: 0.72 vs 0.60), use of pesticides, fungicides, weedicides and fertilizers (Kg /ha: 183 vs 338), and other low inputs indicators (tractors /thousand ha: 19 vs 96), while the increase of yields is 3.73% vs 0.34 % /year from 1990s to 2000s, although at a still huge difference (ton /ha: 1.53 vs 3.47) (Sidhu and Bhullar, 2005). Behind the discussion on the trade-off between sustainability and post green revolution agriculture, it was found that Pakistan Punjab is still far-off from intensification (Murgai et al., 2001). Thus, Basmati rice growing in Pakistan Punjab may be considered as naturally leading to a quite extensive agriculture. Yield is reported 1721 Kg /ha in 2005-06 in Punjab for Basmati crop (MINFAL, 2007-b).

The first trials of transgenic Basmati variety were reported by Khurram et al. (2004) and show significant differences in the different aspects: agronomy, insects resistance and cooking properties. However, farmers are likely to be reluctant to start genetically modified (GM) Basmati rice cultivation, due to previous experience on the cost of patented seeds.

Local stakeholders, including the Government and the farmers' associations unanimously declare their opposition to GM Basmati cultivation. Nonetheless, an up-to-date overview indicates that several GM lines of Basmati rice have been successfully developed with resistance to different biotic and abiotic factors such as pest, fungi, bacterial blight, drought, cold, salinity (Bashir et al., 2007). GM Basmati is likely to be ready, but not yet released on the market due to the strong reluctance against GM food expressed by consumers, especially in Europe.

Basmati Rice, a Consumer-Oriented Food Product

Consumption

The major rice users at the world level are the food and drink industries (e.g. pasta and bread factories, beer and other liquor distilleries), as well as the pharmaceutical industry (Mendez de Villar, 2006), they use coarse rices. This is not the case in Pakistan, where Basmati rice is reported to be a major production, obviously devoted to direct food consumption by final consumers from domestic or overseas markets, like other aromatic rices.

Wheat represents 89% of cereal direct monthly intake per capita (9.23 Kg) in Pakistan in 2004-05 and rice 11%. However, rice is a staple food in Pakistan. Rice consumption per month in rural areas is 1.08 Kg /capita, 0.93 Kg /capita in urban areas. Pakistan is self-sufficient in rice production with availability of 15.72 Kg /capita /year in 2005-06 (MINFAL, 2007-a). There is no procurement of rice by Government in Pakistan since 1995 (MINFAL, 2007-a).

FAO estimation is 2148 KT for domestic use of all rice varieties in Pakistan in 2005 (FAO, 2007). The overall production of Basmati is 2920.4 KT in 2005-06, according to the estimation of seed and wastage (6% = 175.2 KT) and exports (839.0 KT), the final availability of Basmati is around 1906.2 KT for domestic market (MINFAL, 2007-a). Including 156.77 million inhabitants, it means around 12.16 Kg per capita /year. Basmati is likely to represent 88.7% of Pakistani rice consumption. Due to the increasing world demand for Basmati, some competition occurs now between trade and domestic markets (Qayyum Mohsin et al., 2006).

Both demanding for Basmati rice, domestic and export markets are segmented by mean of use of different rates of broken grains, which is the present way for quality grading. Export market only accepts top quality (0 to 5% broken kernels), while domestic one is more likely to be open to high-medium quality (5-15% broken). In Pakistan, Basmati rice deals with festive occasions of eating: ceremony, reception of friends or relatives, dinner for birthday, wedding, funeral. Basmati rice may be considered as a conspicuous food used when offering best quality is a signal of both social status and high consideration of guests.

In Europe, Basmati is the only segment showing increased sales on a rice saturated market. As the pre-cooked ready to eat and seasoned packages of rice are increasingly sold nowadays in Europe, it is questionable if the European consumers will be always able to identify or remind the genuine and distinctive aroma of Basmati. It may be confusing for both the consumers and Basmati itself to keep the trend for ready-to-eat coming so familiar that the original aroma of rice would be covered by seasoning.

Up to now, none consumer survey was identified indicating whether Basmati is sought for its aroma and cooking qualities or for its presumed origin from west Asia. Two markets are co-existing, according to previous publications (Chaudhary, 2003 ; Bhattacharjee et al., 2002):

- The domestic market where the salient attributes for Basmati recognition are aroma, even for dry rice in bag, and shape as an additional proof. These experiential and intrinsic attributes involve consumers' knowledge and familiarity to be used.

- The export market, mainly located in Saudi Arabia and Europe, where the salient attributes for Basmati recognition are the word Basmati, the brand name as a guarantee and shape in a minor extent. These attributes are extrinsic and market-driven, they do not need consumers' knowledge and familiarity to be used. In Muslim countries, such as Saudi Arabia, Kuwait or Iran, Pakistani exporters are likely to use specific distribution channels which involve trade relationships based on trust in neighborhood.

Organoleptic, Cooking and Nutritional Values

Basmati rice has very interesting cooking qualities. It is a non-waxy, non-glutinous rice and does not stick on cooking. It cooks flaky and remains soft on cooling and has a high volume expansion. Its elongation after cooking is also measured as the longest one, while its width remains the same (Bhattacharjee et al., 2002).

It is reported for a while that Basmati emits specific aroma in the field at harvesting, in storage, during milling, cooking and eating (Jefferson, 1985). Several listed publications pointed out the peculiar aroma of Basmati, which is claimed to be one of the most specific characteristics of this rice. Surprisingly, only two of them indicated documented sources on the characterization of Basmati aroma. Basmati rice was analysed by using gas chromatography in order to identify the spectrum of its volatile components. It was found that about 100 volatile compounds are responsible for Basmati flavour (Bhattacharjee et al., 2002). Previous works identified 29 volatile flavour components in Basmati (Weber et al., 2000). The profile of concentration of major volatile compounds is quite different for Basmati compared to other aromatic rices (Weber et al., 2000). It was also interestingly reported that *"when grown outside the Punjab region in Pakistan, Basmati is not aromatic"* and not so much elongated after cooking (Bhattacharjee et al., 2002).

Antioxidant properties were assessed in Basmati from Pakistan (Iqbal, 2005). Basmati compares well with common rice varieties with respect to protein content, ash content and crude fibre (Bhattacharjee et al., 2002). The fatty acid composition of the triglycerides of Basmati lipids has been reported to be slightly higher than for common rice varieties, the same does not occur for amino-acid profile whom no significant difference has been reported yet (Bhattacharjee et al., 2002).

Food Safety and Certification

Mandatory for export, the certification procedure for Basmati rice comes from two major issues: authentication and food safety.

The authentication of Basmati rice is an important topic since its price is the highest on trade market. The privatization of rice trade started in 1988 in Pakistan and was achieved in 2001. This opened rice trade to several players, sensitive to the market pressure increasingly demanding Basmati rice, while the production does not always follow this trend. Nowadays, DNA tests are mandatory for export in Europe.

A survey was carried out in 2002-03 by the British Food Standards Agency in order to measure the sincerity of labeling Basmati on rice packages sold in UK (Burns et al., 2004). The survey employed a novel DNA test which was developed by the Agency. Approximately one-third of the 363 samples, collected from a range of retail

outlets and catering suppliers, were labeled as from India, one-third from Pakistan, and the final third were not labeled with the country of origin. A small number of samples were labeled as mixed origin.

Although not required by law, 68 samples displayed a Basmati varietal name (Super and/or Kernal) on their packaging. Analysis found that only 19 of these samples were comprised wholly or mainly of the variety claimed. In the remaining 49, the declared variety was either a minor component of the mixture, or was not present. 18 samples were labeled as 'Super Kernal', which is not an approved varietal name, and could be confusing to consumers as it mentions two individual varieties "Super" and "Kernal".

All samples claimed to be Basmati rice as written on their labeling. While 196 (54%) samples were found to contain only Basmati rice, non-Basmati rice was detected in 167 (46%) of the samples analyzed (Burns et al., 2004). In around 24% of these samples, the non-Basmati rice content was relatively small i.e. less than 10% (and below the limit of measurement in 10% of these samples). However 63 (17%) samples had a non-Basmati rice content greater than 20%. Of most concern were the 31 (9%) samples that were found to have a non-Basmati rice content greater than 60% (Burns et al., 2004).

These very interesting results, obtained in the main European importing country for Basmati rice, highlight the advantage of a robust method available to check variety and non-Basmati rice addition. They also give suitable orientation for the revision of the export standards for India and Pakistan, and for the updating of EU importers Code of Practice as well. Clean and fair practices should be promoted within the rice commodity chain in order not to mislead consumers.

In view of the higher price of Basmati, the EC Rice Regime grants a restricted list of certain Basmati rice varieties a refund of 250 EUR /T on presentation of certificates of authenticity. Hence in the interest of preventing fraud, only those varieties which are eligible should receive the refund. The Regime has recently been amended to limit the receipt of refund to a more restricted list of varieties, which comes into force after March 2004 (Burns et al., 2004).

However the authentication of Basmati variety does not indicate clear origin or provenance. On the domestic market, the aroma is reported as the major cue used to testify Basmati. However, there is no scientific publication on the way used by stakeholders for this purpose. It is questionable to measure how strong is the capability to authenticate Basmati by means of olfaction by local consumers and stakeholders. In other words: Which rate of blending are human testers able to discriminate?

DNA test, as shown above, is able to testify the given sampling is coming from a certain variety, here Basmati. DNA is a technique used for variety authentication. Notwithstanding, DNA cannot certify the area where the variety was grown. Thus DNA test should not be considered as a substitute of certificate of origin or provenance. In such a way, efficient traceability may cope with both origin certification and food safety control.

Few sanitary dangers are associated to rice, aflatoxin is one well known since many years. Some peculiar conditions, ie humidity and high temperature, during last maturation of rice favour the development of certain fungi such as Aspergillus, then production of aflatoxin is possible. When lodging at maturity, Basmati rice may be infested by aflatoxin due to its stay on soil.

Shipping aflatoxin-free rice is mandatory for importation in EU as aflatoxins lead to the production of acute liver carcinogens in the human body (Otsuki et al., 2001). The EU aflatoxin standards are around two times more stringent than those admitted by Codex Alimentarius. The import certification process is very strict and limits the provenance of Basmati rice coming in Europe from millers which are able to guarantee this aflatoxin zero level, such Guard Rice Ltd, a private company based in Lahore.

The laudable intention to guarantee food safety is not questionable, notwithstanding leading to higher entry barriers in Europe for Basmati from Pakistan. Rice exports from Pakistan drop frequently due to quality problems, caused by heavy rainfall at harvest time and lack of proper storage (FAO, 2007). Thus the Government of Pakistan, now conscious of the importance of rice as a trade earner, is launching an awareness campaign to raise the quality of the grain produced, including the most remunerative market of Basmati rice.

The importers are encouraged to have vigilant inspection criteria to collect aflatoxin-free rice from Punjab. It is also possible that some would be prone to collect rice in areas where it may probably be more aflatoxin-free, these areas are probably not located in Punjab. Thus, harvest is less prone to be subject to aflatoxin infestation. This move of rice crop for export in areas where the combination of water and temperature is different from Punjab, is a paradoxical effect of food safety control against aflatoxin.

Aflatoxins are deemed to be mainly located in dust and chips extracted from grain by polishing cargo rice. De-husking, polishing and drying processes reduce the rate of aflatoxin (Vasanthi and Bhat, 1990). As the import duty is zero for husked Basmati rice, but not for milled one (Muhammed and Pirzada, 2005), trade tariffs on rice in EU do not seem to be driven by food safety, and are likely to actually protect added value of European millers, which are mainly based in UK.

Nonetheless, the narrowing of the duty differential between husked and milled rice will reduce the protecting effect on the EU milling industry (FAO, 2007). The positive effect of this trade policy looks like a way of selection and improvement of exporters. Those from Punjab who are still able to export in Europe, comply with high standards of quality control. This capability is likely to come from their higher level of education (managers and staffs) (Moazzam, 2004). These private stakeholders show proof it is possible to control aflatoxin infection in Basmati rice harvested in Punjab and to comply with sanitary and phytosanitary mandatory conditions for exportation in Europe.

The longer commodity chain which occurs from this trade regulation may confuse consumers by offering them an aflatoxin-free rice, called Basmati but not coming from the region of origin. Rice milling industry gathers only 228 millers in Pakistan which account for 2.3% of value of agro-based production (MINFAL, 2007-a). The location in Punjab of added value created through Basmati commodity chain seems perfectible.

The threat of making Basmati rice a generic resource is not so far. Nonetheless Basmati seeds sown out of Punjab don't give rice with the same quality characteristics. This rice should not be labeled as Basmati rice due to its non provenance from the region of origin.

Basmati rice and Geographical Indication

Region of Origin

The Pakistani Punjab consists with the region so-called the Indus basin in the foothills of Himalaya range. The Basmati growing area is in North Punjab, while South Punjab acreage is devoted to cotton fields, and Sindh province welcomes other rice varieties growing. Balochistan province is almost salted desert, although some districts located in Indus basin intend to develop agriculture and rice production (Safdar Baloch, 2004); NWFP and Gilgit regions are quite mountainous areas, still some districts are minor rice crop areas. Punjab province welcomes 55.6% of overall population of Pakistan (Census 1998) and 60.5% of agriculture share in 2005-06 (MINFAL, 2007-a).

Punjab represents 90.5% of overall Basmati rice production in Pakistan in 2005-06 (2920.4 KT), Balochistan 8.6% and NWFP 0.9% (MINFAL, 2007). In Punjab, Basmati represents 83.0% of all rice crop in 2005-06. In almost all districts, Basmati or Irri varieties are exclusive for rice crop. Among the most important Basmati producing districts (more than 50 KT), 16 up to 17 are located in Punjab province.

In old Urdu language, Punjab means *punj* (five) *aab* (water). It is located between the five rivers coming from Himalaya range: *Indus, Jhelum, Chenab, Ravi* and *Sutlej* (from north-west to south-east). This area forms the genuine alluvial lands appropriate for Basmati rice cultivation, due to good water availability, but not marshland, high temperature and important sun exposure, at a low altitude.

It is also worth mentioning that growing the Basmati plant is possible anywhere, but the specific characteristics are linked to production of rice in the specific districts of Punjab. The rice produced from the same seed but in different environments of area does produce rice but not Basmati.

In spite of its name, the Indian region Haryana was included in ancient Punjab, before the partition done in 1947 by the Authorities of the British Empire for the independence of India and Pakistan. Thus, old Punjab is likely to include present Pakistani Punjab, Indian one, and Haryana. All these areas formed the old Punjab before partition and are reported to be the Basmati belt, including the plain below Dehra Dun in Uttarakhand (former Uttaranchal, created in 2000, India).

The homogeneity of these districts of the Himalayan foothills is questionable as the paedo-climatic conditions, altitude and landscape as well, are very different and impact on Basmati characteristics. However, these districts belonged to Punjab in ancient times. The present relative share for Basmati is 87% of total rice acreage in Pakistani Punjab (MINFAL, 2007), 30% in Haryana, 3% in Uttaranchal[4] and 5% in Indian Punjab (Bhattacharjee et al., 2002).

Historical Origin and Symbolic Value

The word Basmati has been derived from two Sanskrit roots: *vas* (aroma) and *mayup* (deep-rooted). While combining, *mayup* changes to *mati* making *vasmati,* pronounced as Basmati (Singh, 2000). The etymology of Basmati is linked to the generous aroma of this original rice. The historical origin of Basmati rice is known to be written in Urdu in *The Adventures of Hir and Ranjha* (Shah, 1767), which was translated into English around 1910 by Usborne. The purpose is a tale of love in Punjab. The second paragraph of chapter 16 describes several foods displayed for a wedding: *"… all kinds of varieties of rice, even Mushki and Basmutti*[5] *and Musagir and Begami and Sonputti"*. The Urdu version was dated from 1767 according to Orsini (2006). Thus the first written proof of location of Basmati rice in Punjab is old[6]. This document is used for the justification of intellectual property rights (IPR) on Basmati rice by MINFAL. It is also interesting to highlight that Basmati rice

[4] quoted as Uttar Pradesh in Bhattacharjee *et al*., 2002.
[5] The historical name varies: *Bansmatti*, *Bansmutty*, *Bansmati*, *Bansmuttee*, *Bansmatee* in Punjab, and *Basmoti* in Bangladesh (Singh, 2000).
[6] Compared to what is usually documented in Europe for Geographical Indications, 1767 is a very old date.

consumption is genuinely linked to festive occasions, which is nowadays one of the common features of GIs all over the world.

More recently, the first indication of a release of a pure line selection was done by the Rice Experimental Farm in Kala Shah Kaku (Punjab, Pakistan) in 1933 as Basmati 370 (Chaudhary et al., 2003). The majority of pure line selections were carried-out in the same Institute since this time. Nowadays, several lines of Basmati are developed for yield improvement. The growing area is spread out of Punjab since decades, due to price attractiveness, in spite off low yields and labor intensive cultivation. Basmati-based hybrid rices are now sown in Pakistan, India, Bangladesh, Sri Lanka and United States of America. They are encouraged to be under trial for adaptation and selection in several Asian countries with support of IRRI[7] (Singh et al., 2000-a). Albeit coming from cross-breeding of Basmati pure lines, these Basmati look-alike rices do not offer similar aroma qualities than Basmati from Punjab (Bashir et al., 2007). However, far-off consumers, particularly in Europe, are likely to pay more attention to the name of rice, instead of aroma characteristics which also depend of the cooking skills of final consumers.

Finally this means that selling Basmati rice in present market doesn't allow to guarantee the genuine quality linked to *terroir* of Punjab. These elements may explain why Pakistani stakeholders are likely to be very sensitive to the origin of Basmati rice, although not often acting as first players on Basmati worldwide market.

Intellectual Property Protection in Pakistan

IPR in Pakistan is an old story since Patent Act (1911), Trade Marks Act (1940), or Copyright Ordinance (1962). The new Intellectual Property Laws were published in 2000, including Registered Design Ordinance, Layout and Design Ordinance and Patent Act. The major change is the creation of a unique and powerful office for intellectual property protection (Urbany and Allah, 2006). Intellectual Property Organisation of Pakistan (IPO) was created in April 2005, it is under the direct authority of Prime Minister[8].

Up to now, the legal framework for IPR is based on *trademarks* protection regime in Pakistan, with special focus on *well-known marks, certified marks* and *collective marks.* Pakistan is on the way of achieving the translation of TRIPS in domestic Law. However, this process is not finished yet, as some aspects of TRIPS such as biodiversity and genetic property are still discussed.

[7] International Rice Research Institute.
[8] It means IPO is not depending on Ministry of Trade nor Ministry of Agriculture nor Ministry of Industry, in order to avoid any conflict of interest.

The regulation for geographical indication (GI) protection, which is still in circulation within the different stakeholders, is based on *"Geographical Indication of Basmati as a collective mark "Basmati", according to section 82 of the trade marks ordinance, 2001".* The Trade Marks Ordinance was promulgated in 2001 and came into force in 2004 (Quasim Shah, 2004). Recently, the application of registration of GI Basmati was filed in December 2005, under section 82 of this Ordinance. However, this registration is not yet granted, due to some opposition coming mainly from traders.

Claiming for GI label should lead to better identify and locate the relevant supply chain and the stakeholders as well. The most salient trait of GI products is the management of added value between farmers and local processors, before the long or short supply chain, which makes a huge difference with usual, although local, agricultural commodities. Claiming for GI label should also active the selection of who complies with code of practices and high quality standards and who doesn't. This process of quality management has a cost that should not be ignored by GI candidates.

Presently, the different recognized lines of Basmati in Pakistan are: Basmati 370, Basmati 385, Super Basmati, Basmati 198, Pak (Kernel), Basmati 2000 and Shaheen Basmati, according to the project of regulation. All the above-mentioned varieties are registered under Seed Act 1976 by Federal Seed Certification and Registration of MINFAL. However, it is questionable when the list of native and indigenous lines of Basmati will be closed according to the project of GI. Basmati 370 was identified in 1933, but Super Basmati was developed in 1995 (Bashir et al., 2007). Although derived from traditional cross-breeding from Basmati 370 and IR661, this line is recent and its inclusion as a candidate for the GI package may keep the list open for registration of any recent developed line of Basmati variety like Basmati 2000 or Rachna Basmati, not always showing strong links to Punjab. In such a case, Basmati from Texas or Basmati from Nepal may find a kind of justification.

More generally, the long list of Basmati lines may confuse non skilled stakeholders and consumers as well. At least 60 lines of Basmati rice are released on the world seed market. The list includes the name of the major pure lines and various hybrid as well (see Table 2).

Of the largest aromatic germplasm maintained at IRRI, about 86 are described by the name Basmati irrespective of grain dimensions and intensity of aroma: Pakistan (67), India (9), Nepal (7), Bangladesh (2) and Sri Lanka (1). Comparing these with Basmati standards, only 18 qualify as Basmati (Singh, 2000). A harmonious combination of minimum kernel dimension, intensity of aroma, texture of cooked rice, high volume expansion during cooking made up by linear kernel elongation with minimum breadthwise swelling, fluffiness, palatability, easy

digestibility and longer shelf life qualify a rice to be Basmati in consumers' and traders' view (Singh, 2000).

Table 2: Released Lines of Basmati Rice

Major lines (also known as XX)	Other varieties (list not complete)		
Basmati 370	Baldhar B.	B. 6141	Kasturi
*Dehraduni B.**	B. 106	B. 6187	Local B.
Type 3	B. 107	B. 6311	New Sabarmati
Punjab B.	B. 123	B. 6813	Pakistani B.
B. 386	B. 134	B. 93	Punjab B. 1
Taraori B.	B. 136	B. D	Rachna B.
Karnal local	B. 208	B. Sufaid 100	Ranbir B.
Amritsari	B. 217	B. Sufaid 106	Sabarmati
HBC 19	B. 2000	B. tall	Seond B.
Haryana B.	B. 3708	Basmoti	Shaheen B.
Pusa B.	B. 388	Champaran B.	Tapovan B.
B. 198	B. 5833	Chimbal B.	
B. 385	B. 5836	Early B.	
Super B.	B. 5875	Guarav	
B. Pak	B. 5877	Hansraj	
Kernel B.	B. 5888	Kashmir B.	

* B = Basmati
Source: (Singth et al., 2000-b; Bashir et al., 2007)

As Basmati price premium is the highest on trade market, some opportunist behaviors appear such as:

- cropping Basmati variety out of Punjab, creating a claim for identification of region of origin (Chandola, 2006 ; Chatuverdi, 2002)
- blending of polished long grain from other varieties (Burns, 2004), pushing importers into a clearer code of practice (British Retail Consortium, 2005)
- collusion between brokers leading to higher price (Banerji and Meenakshi, 2001), calling for market regulation by Government
- attempt to patent Basmati by private company leading to protection scheme of common living resource (Sarfraz, 2001 ; Nair and Kumar, 2005).

The Attempt of Private Patenting

Basmati rice issue proved in 1997 to be a watershed development for Pakistan when an American Texas-based company RiceTec Inc. was granted an international patent on Basmati. Once the patent was granted, RiceTec did not only label its rice

Basmati within the US, but also exported it as Basmati all over the world. This company, developed an American-grown aromatic rice and obtained a patent in 1997, for new lines of Basmati rice, from the United States Patent and Trademark Office (USPTO), marketed under the trademarks *Texmati* and *Kasmati.*

The company claimed to have produced a superior variety of Basmati, with semi-dwarf long-grain traits of photoperiod insensitivity, high yielding, disease tolerant and a dwarf plant, by cross-breeding Pakistani Basmati varieties with American long-grain rice varieties. The patent was titled "Basmati rice lines and grains". It was claimed that the plants thus bred were of semi-dwarf variety, substantially photo-insensitive and high-yielding. The patent had 20 claims.

The patent details the history of Basmati grown traditionally in India and Pakistan and the difficulty of growing such varieties in other areas, in order to justify the breeding of traditional Basmati varieties and semi-dwarf varieties locally adapted. Seen from India and Pakistan, the issue resides in qualifying theses varieties as Basmati, generating the confusion with the varieties grown in these countries. The claim had given RiceTec monopoly to sell, market and import into the US rice grains having the claimed features, irrespective of the place where they had been grown. This claim, without any territorial limitation, contents a serious risk of infringement against importation and sale of Basmati rice, from India and Pakistan, in the US.

The Indian and Pakistani Governments filed a petition against the patent in 2000, challenging the claims having none limitation of territory. The USPTO examiner issued a long notice to RiceTec in 2001 asking the company to justify the issuance of the patent without any territorial basis (Nair and Kumar, 2005). RiceTec replied by surrendering all the broad-based claims relating to the plant, method and the seeds. It was left with a truncated patent with five minor claims.

RiceTec also applied to register the trademark *Texmati* in UK in 1999 for its rice. The word *Texmati* is a compression of Texas and Basmati. In 2000, opposition against the application raised on the ground of deceptiveness due to its similarity with the word Basmati and its use for rice grown in the US. RiceTec objected that Basmati did not mean any GI for rice grown in the Indian sub-continent but any rice which is aromatic and can be grown anywhere in the world. The opponents shown many evidences, from UK stakeholders and rice end-users, to demonstrate that Basmati was understood in the UK as referring to long grain aromatic rice grown in the Indian sub-continent. The company decided to withdraw the trademark application (Nair and Kumar, 2005).

RiceTec applied again to register the trademark *Kasmati* for its rice. It was US grown rice sold in package with a labeling including a caricature of the Taj Mahal[9] and the expression "Indian style Basmati Rice". The word *Kasmati* is a compression of Karnal and Basmati. The opponents immediately sought the cancellation of the trademark as it used Indians symbols on labeling and none of the specific traits of Basmati rice was assessed in the product. Finally the company opted not to contest and completely surrounded the trademark registration.

The RiceTec dispute convinced the Government of Pakistan, and India as well, and many stakeholders of the rice commodity chain about the need to protect Basmati through GIs system. Thus these actors may have will to agree the extension of article 23 of TRIPS into products under article 22 regulation (Chatuverdi, 2002 ; WTO, 2003).

The RiceTec patenting attempt has provoked lot of well documented publications (Chandola, 2006; Lightbourne, 2003; Mulik, 2004; Nair and Kumar, 2005; Rangnekar, 2005; Sarfraz, 2001; Sattar, 2005). Nowadays, the international patent of RiceTec Corp. for Basmati is broken, but the national one is still valuable for the US market. This trial of private patenting natural living resource, cultivated by small farmers from time immemorial, stimulated the process of GIs protection in Pakistan.

Discussion

It was found during this overview that, due to the specific organoleptic qualities of Basmati rice, populated urban domestic and overseas markets are prone to accept a premium to its price. Basmati rice deals with festive occasions of eating. Thus it is of paramount importance for both Pakistani exports and domestic consumption. Punjab province represents 90.5% of overall Basmati rice production in Pakistan and is documented as its *terroir* of origin.

However, the growing area is spread out of Punjab since decades, due to price attractiveness. This rice, sawn out of Punjab from Basmati seeds, doesn't offer similar qualities, especially aroma, than Basmati from Punjab. However, it may be less sensitive to aflatoxins than the genuine variety harvested in the region of origin. Millers and exporters, closer to the final markets, are responsive to the demand of rice called Basmati, not necessarily grown in its region of origin.

The Pakistani regulation for GI considers Basmati as a collective mark. A mark, even collective, can be produced everywhere, so the IPR of Basmati rice are not strictly located in the region of origin. Thus, the *Basmati* commodity chain seems to

[9] The Indian monument most visited by foreign tourists, but not located in Punjab. Out of India and Pakistan, it is a salient image, typical of Indian sub-continent, although coming from Muslim culture and not Hindu one.

be under corporate governance with high competition pressure, used by traders and some millers to slower the process of GI protection against the growers' wishes[10].

As two different markets co-exist for Basmati rice, the question of GI appropriateness raises. The domestic market uses aroma as a means for authentication of Basmati. Thus the supply for domestic market comes from Punjab. Domestic market does not need any GI and is price sensitive. The export market is more prone to look for Basmati name *per se* than for its intrinsic qualities and is paying more attention to food safety control. The supply of this export market partly comes from Punjab and also from other cropping areas offering a less aromatic and more toxin-free rice than Basmati from Punjab. The export market is less price sensitive but needs authentication of Basmati rice and possibly an indication of provenance from Indian sub-continent.

Actual Basmati market is apparently efficient, although often facing to shortages. The split is leading to rather satisfactory regulation for both domestic and export markets. They both accommodate with shortages by high price and conspicuous consumption. However, the very high level of Basmati price is attractive for stakeholders of this specific commodity chain. Some players seem to adopt opportunist behaviors. Cropping Basmati variety out of Punjab is usual, blending polished long grain from other varieties with Basmati is also proved, collusion between brokers leading to higher price is noticed and attempt to patent Basmati by private company occurred recently. These different actions provoke a claim for identification of region of origin, push importers into a clearer code of practice, and create a need for market regulation by Government, leading to protection scheme of common living resource.

Thus, the threat of making Basmati rice a generic resource or a private one is real. The arrival of a new player will destabilize the Basmati commodity chain for sure, as it was shown during the RiceTec attempt of private patenting Basmati rice. Nonetheless, the registration of a Geographical Indication, will probably increase Basmati market shortages due to strict delimitation of growing area. It is questionable whether the Punjabi farmers' interests, and those of rice growers in the Indian sub-continent, should have to be unsettled by the stated interest of European consumers for a GI *Basmati from Punjab*.

The will of Punjabi farmers and Basmati stakeholders to work together and better organize their commodity chain should be better taken into account, once clearer expressed. Up to now only the Government's voice seem to be audible, despite that the privatization of rice trade was achieved in 2001. However, the need of protection is clearly documented for Basmati rice. The question is: What is the most

[10] via Basmati Growers Association vs Rice Exporters Association in Pakistan, such conflict of interest is likely to be extended in Ministry of Agriculture vs Ministry of Commerce.

convenient way, Geographical Indication or Seed Patent according to Intellectual Property Rights?

A seed patent will protect Basmati lines and will allow Basmati to be grown in enlarged area, for sure. It may lead Punjabi rice growers to disappear or to switch to other crop, as the local yields are low and toxins risk, even minor, is still present. This will also bring higher production available on market with expected prices dropping. The DNA variety control will be a key issue, as new varieties will be introduced and probably some GM ones.

A Geographical Indication will not mislead export market but will enhance price pressure on domestic market. Basmati rice production will be limited to the harvest originating from Punjab. Present crop areas out of Punjab will probably move to other long grain varieties, still valuable rice production. The need of variety control will be very high as the inflated prices will be very attractive. The yields improvement will be a key issue, encouraging the development of new lines which may not fully comply with GI regulation. Market release of GM Basmati might be tried despite the present unanimous declared rejection.

In Europe, the EU regulation 510/2006 allows GI registration for product originating from third countries (European Community, 2006). The first extra European application of GI regulation is coffee from Columbia. In the case of rice, cropping under GI is not significant in EU. Only very small productions are under PDO[11] label in Valencia (Spain) and Vercelli (Italy). More noticeable, albeit still small production, is the PGI scheme used for rice from Verona (Italy), Tarragona (Spain) and Camargue (France). The PDO scheme is very strict with a clear and certified location of both production, processing and packaging in the area of origin. This is why the PGI scheme fits better with Basmati crop from a specific area of origin and allows exportation of paddy for de-husking in foreign millers for rice still complying with GI regulation. It is worth noting that, while PDO-PGI scheme allows good price premium for labeled products, European PDO and PGI labeled rices are sold at a lower price than Basmati on the Community market.

A costs/benefits analysis applied to possible GI Basmati pinpoints the following foreseen issues:

- In case of no GI application, the Basmati market could be soon under brand regulation promoted by strong trade companies. This will allow to increase production on the basis of enlarging cropping area far from the region of origin. The price at farm gate will drop but not necessarily the in-store price due to persistence of high demand. Aroma will not stay longer a salient attribute of Basmati as the rice will come from miscellaneous regions,

[11] PDO = Protected Designation of Origin, whereas PGI = Protected Geographical Indication.

including Bangladesh, Nepal, Texas and even Italy[12], where Basmati seeds do not provide the full Basmati qualities. Hence the most salient attributes will be the long shape of grain and the name Basmati per se. Based on the appearance, Basmati identification may be a bit confusing for end consumers.

- In case of application for GI Basmati from Punjab in Pakistan, the Basmati market could be more under farmers' influence. Market shortages may be more frequent as the certified origin will not allow to enlarge cropping area. The issue of increasing yields through new lines release will be pending as the introduction of GM would not be expected in case of GI label oriented to European market. Aroma will stay a salient attribute of Basmati and all prices (farm gate, store, domestic, export) will increase for sure, allowing a better share of the premium along the commodity chain. End consumers will not be confused thanks to GI label. However, the application of GI Basmati from Punjab in Pakistan will provoke reactions from neighbors. Attracted by high price, GI applications for Basmati may come from other cropping areas, including other countries, as seen above. Thus, Basmati market segmentation will occur, depending on the aroma sensitivity, as this attribute seems to be the only one varying according to the cropping area, with strong advantage to Basmati from Punjab.

- In case of join application GI Basmati from India and Pakistan, the Basmati market could be better under flexible control, complying with both EU regulation and international trade habits. The larger definition of Punjab, including ancient Punjabi districts in India, will allow to increase production and yields in a minor extent. High price will encourage borderline behaviors, then quality and traceability controls will be a key issue. Hence, the split of Basmati market may be foreseen into Europe more sensitive to PGI label, and Asia more sensitive to aroma due to consumers' experience. This scheme may be compatible with the previous one, allowing a core GI Basmati from Punjab coexisting with broader parentage coming from different provinces of India, Pakistan or from other countries.

Conclusion

In case of Geographical Indication, the issue of the territorial delineation becomes crucial. The historical Punjab is wider than the two present Pakistani and Indian ones. In that respect, a join application for GI is still pending for the Pakistani and Indian Governments. According to present state of join discussion, this will be a big challenge.

[12] Basmati rice (organic) from Italy is already sold on the European market.

Separate application of Basmati from Pakistan and/or Basmati from India will probably facilitate in future an application of Basmati from any place like Texas or Nepal. This issue should be considered consequently, as Basmati growing area may move since the water supply in Punjab will suffer of announced melting of Himalayan glaciers from 2050. However, global warming is supposed to hamper rice world wide production as yields would dip 10% for every 1° C increase in minimum temperature during the growing season (Basmati on-line, 2007). Hence, the competitive position of Basmati among other rice varieties may not be too much affected, despite probable more frequent shortages. This change may probably reinforce the Basmati market governance by traders, as "Punjab" benefits from a very good unaided recall among consumers, when thinking about Basmati.

Further research works may explore the Indian side of this key production in Asia. An other major issue would be to explore how marketing Basmati may operate with different protection schemes such as seed vs GI, and where the added-value may emerge among the Basmati rice commodity chain with e-auction system. It was recently demonstrated that the competition-auction system creates added-value for growers of specialty coffee (Donnet et al., 2007). Will it be similar for specialty rice such as Basmati?

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Buyer and Seller Responses to an Adverse Food Safety Event: The Case of Frozen Salmon in Alberta[1]

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Abstract

Fish is a low-fat protein source high in omega-3 fatty acids, but in 2004 consumers also heard that farmed salmon had high levels of polychlorinated biphenyl (PCBs). This research evaluated how Canadian consumers and processors reacted to the conflicting health messages. Demand estimates and time-series analysis of 2001-2006 frozen meat scanner data in Alberta, Canada show a significant drop in salmon expenditure share following the PCB finding. The industry responded by launching low-priced wild salmon products, which contributed to significant demand expansion. The analysis illustrates how a food safety threat was averted and even served as a catalyst for growth.

Keywords: salmon, scanner data, food safety, demand, directed acyclic graphs

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Objectives and Background

When a January, 2004 article by Hites et al. in *Science* reported dramatically higher levels of PCBs in farmed salmon versus wild-caught salmon, the Canadian salmon farming industry braced for a sharp downturn in sales (Simpson, 2004). The industry mounted a strong counter-attack on the methods and conclusions of Hites et al., and eventually introduced new wild salmon products to win back consumers.

The purpose of this study is to test the extent to which the health scare impacted supermarket sales of frozen salmon in Alberta, Canada, and to examine the strategic response of salmon processors. The quantitative analysis consists of demand system estimation, directed acyclic graphs and historical decomposition analysis. Alberta was chosen as the least geographically aggregated region for which product-level scanner data were available, because its residents consume salmon at a rate similar to the Canadian average, and because it is not itself a salmon producing region. The interaction of conflicting health and environmental issues on seafood demand is fascinating, yet we are not aware of any previous studies performed on retail-level seafood scanner data, especially at the level of product disaggregation emphasized in this study.

Medical experts encourage people to eat fish because it tends to be low in saturated fat, high in protein, and high in omega-3 fatty acids. Salmon is of special interest because it follows shrimp and canned tuna as the third most popular seafood in the U.S. (Knapp, Roheim, and Anderson, 2007), it leads seafood consumption in Canada (Statistics Canada, 2003), and only sardines and herring have comparable omega-3 content (Kris-Etherton et al., 2002).

Consumers also hear negative messages about fish consumption. In 2002 and 2004, respectively, health agencies in Canada and the United States advised consumers to limit consumption of seafood species found to be high in mercury, most notably tuna. The NPD Group (2006) found that 67% of U.S. consumers surveyed were concerned about mercury in seafood, although many intended to increase consumption in light of its dietary benefits. Examples of other negative issues that might reduce seafood demand include widespread environmental destruction attributable to shrimp farming (Naylor et al., 1998), transmission of parasites from escaped farmed salmon to vulnerable wild salmon stocks (Krkošek, Lewis, and Volpe, 2005), and trends toward collapse of major ocean fisheries (Worm et al., 2006).

In this study we focus on the demand impact and industry adaptation stemming from a particular negative message: the Hites et al. (2004) findings of high PCB levels in farmed salmon. Farmed salmon from Scotland and the Faroe Islands had the highest PCB levels, followed by Norway, East Canada, West Canada,

Washington State, and Chile. Even the least contaminated Chilean farmed salmon contained significantly higher PCB levels than wild salmon. Judged by U.S. Environmental Protection Agency (EPA) thresholds for safe fish consumption set in 1999, the results suggested that consumers should eat no more than one meal per month of farmed salmon. While the EPA regulates recreationally caught fish, salmon sold commercially is regulated by the U.S. Food and Drug Administration (FDA). The FDA standards allow PCB concentrations about 500 times higher than the EPA standards, but were set in 1984, and the wide disparity between the two standards is the subject of considerable debate.

As with previous allegations of high PCBs in farmed salmon, salmon farming industry representatives immediately criticized the study as flawed, alarmist, reckless in its disregard for salmon-dependent local economies, damaging to consumers' health by discouraging salmon consumption, and even elitist in recommending consumption of higher-priced wild salmon (see, e.g., Salmon of the Americas, 2004). Common themes in rebuttals of the study were that farmed salmon PCB levels were lower than FDA standards, avoiding salmon would sacrifice other important health benefits, PCBs were not conclusively shown to be a human cancer agent and that cooking the fish with the skin removed would eliminate most of the contaminants. The motives of the Pew Charitable Trusts, sponsors of the Hites et al. study, were criticized by industry supporters on both sides of the Atlantic.

In February, 2004, ACNielsen survey data showed that about a third of respondents planned to avoid farmed salmon due to cancer concerns, almost half believed moderate consumption was warranted, and 13% felt the PCB claims lacked credibility (Lempert, 2004). Almost half of the respondents said they asked if salmon was wild or farmed when buying in the supermarket, and over a third said they asked when buying salmon in a restaurant. Industry fears of reduced salmon demand seemed justified.

Using data from dietary questionnaires, Oken et al. (2003) showed that pregnant women reduced intake of finfish by about 20% after the release of a 2001 federal mercury advisory. The results were interpreted as evidence that consumers responded to health advisories with a clear message, but noted that recent media coverage of dietary benefits from fish was making the health messages more complex. Roosen et al. (2006) found that French consumers' memory of high-mercury fish species was flawed, and that mercury warnings led to weak reductions in total fish consumption, but not in the high-risk species. Consumers reacted more strongly to information about health risks than health benefits. The public health message was deemed ineffective due to its complexity. Shimshack, Ward, and Beatty (2007) found similar results among U.S. consumers. Based on two-week self-reported food diaries, more educated consumers and those who regularly read print media reduced canned fish consumption following mercury warnings directed at

pregnant women and children, but many households not deemed at-risk also reduced fish consumption.

Food marketers and public health agencies routinely use complex health messages, and evaluations of consumer reaction are both business- and policy-relevant. The analysis presented here relies on revealed preferences from supermarket food purchases, providing an alternative to the choice experiments and self-reported behavior analyzed in the previous literature.

The Empirical Models and Data

The Data

The analysis was performed on ACNielsen scanner data for frozen boxed meat sales in Alberta, Canada. The data represent 4-weekly periods from December, 2000 to September, 2006, and reflect sales at supermarkets with more than $2 million in annual revenues. In the U.S., such retailers comprise about 50% of dollar sales of food purchased for at-home consumption (Caffarini and Cavanaugh, 2007). The frozen boxed meat category, which contains seafood and chicken products, but not red meat products, is part of a meat scanner data purchase by the Consumer and Market Demand Network based at the University of Alberta. Frozen poultry sales comprise about 28% of total poultry sales in Canada (Soy 20/20, 2005). Sadly, ACNielsen advises us that it does not collect any data on refrigerated seafood sold at the fresh meat counter, and details are not available on individual private label products. Conclusions should thus be tempered with the knowledge that we only observe a portion of supermarket seafood sales. Using available U.S. figures for 2000-2004 salmon consumption as a guide (Knapp, Roheim, and Anderson, 2007), fresh salmon sales are likely to be about three times higher than frozen sales.

The raw data are highly disaggregated at the product level, with price and quantity information on 1,561 branded products. Prices and expenditures are denominated in Canadian dollars. Based on keyword searches of product names, products were aggregated into four categories expected to be substitutes: (1) salmon, (2) finfish other than salmon, (3) shrimp, and (4) chicken products. Salmon products not containing the word "wild" were most likely farmed, according to Knapp (2007). More importantly, consumers would be unable to distinguish them from farmed products, and they are therefore designated as "non-wild" products in this analysis. Up to 26 products in each 4-week period did not fit into these four categories, but were too diverse and comprised too small a share of expenditures to justify including in the analysis.

Table 1 shows descriptive statistics of the prices, quantities, and expenditure shares of each product category. Finfish and shrimp had average expenditure shares exceeding 30%, followed closely by chicken products, with salmon having by far the

lowest share at 8%. Average price per pound ranged from $3.24 for chicken products to $9.90 for shrimp. Coefficients of variation showed that variability in prices, quantities, and expenditure shares was high compared to many retail food products. For example, scanner data on U.S. frozen dairy products (Maynard and Veeramani, 2003) suggested price coefficients of variation of only 3%-6%, and prices in Vickner and Davies' (1999) analysis of spaghetti sauce scanner data had coefficients of variation of 4%-11%, compared to values of 7%-25% shown in Table 1. High variability in prices is often beneficial for explanatory power in demand estimation.

Table 1. Descriptive Statistics: Frozen Meat Products, Dec. 2000 – Sept. 2006.

		Mean	Std. Dev.	Coeff. of Variation	Min.	Max.
Expenditure Shares	Salmon	8%	3%	39%	2%	16%
	Finfish	37%	9%	25%	20%	58%
	Shrimp	31%	12%	40%	2%	54%
	Chicken	25%	5%	21%	17%	41%
Prices ($/lb)	Salmon	$6.68	$0.94	14%	$4.68	$8.37
	Finfish	$4.35	$0.29	7%	$3.65	$4.81
	Shrimp	$9.90	$2.49	25%	$6.28	$15.53
	Chicken	$3.24	$0.51	16%	$2.18	$4.02
Quantities (lb)	Salmon	32,292	23,117	72%	3,206	91,136
	Finfish	193,565	41,198	21%	108,087	309,334
	Shrimp	94,340	61,359	65%	2,494	190,733
	Chicken	175,687	27,931	16%	114,655	269,255

Quantity graphs revealed spikes in shrimp sales during the holiday period at the end of each year. Frozen salmon and other finfish sales, however, often increased dramatically in the early months of the year (contributing factors may include New Year's resolutions and Lent), with a slump in late summer when the fresh salmon season peaks and the grilling season is still active. Figure 1 shows nonlinear trends in the expenditure shares of all four product categories. Salmon's share was stable during the early years of the study period, but then trended upward. Shrimp grew strongly but tailed off later in the study period, and finfish and chicken products lost expenditure share.

The Empirical Models

Demand System

A demand system consisting of four equations was estimated, with dependent variables representing frozen salmon products, other frozen finfish products, frozen shrimp, and frozen chicken products. As with most analyses of products with very

small budget shares, a conditional demand system was specified, requiring a weak separability assumption (loosely, this implies that price changes in goods outside the system affect total system expenditure, but not substitution relationships among the goods within the system). Following Lee, Brown, and Seale (1994), a synthetic demand system nesting four alternative specifications was first estimated, with the results suggesting that the data were most consistent with an Almost Ideal Demand System (AIDS). A system-wide Durbin-Wu-Hausman test (McGuirk et al., 1995) failed to reject exogeneity of prices, supporting the use of a quantity-dependent demand system.

A linear approximate AIDS model in levels (Deaton and Muellbauer, 1980) was subsequently estimated, using a Paasche index in place of the Stone Price Index (Moschini, 1995) and lagged expenditure shares to avoid simultaneity (Eales and Unnevehr, 1988). Dummy variables representing four-week periods of the year were included as regressors to capture seasonal fluctuations in demand. Linear and quadratic trend terms were included to capture gradual, unspecified sources of structural change.

Two health-related regressors were included in the model. One was a mercury dummy variable equal to one during the 12 weeks following the May 29, 2002 release of a Health Canada advisory on mercury levels in tuna, shark, and swordfish (Health Canada, 2002). Although none of the frozen products evaluated in the present study were among the high-mercury species, Roosen et al. (2006) showed that many consumers might not discriminate among species, thus justifying a mercury control variable. The primary health-related variable was a PCB dummy variable equal to one during the 12 weeks following publication of Hites et al. (2004). A common alternative to dummy variables in measuring food safety demand shocks is a media index (see, e.g., Verbeke and Ward, 2001; Henneberry, Piewthongngam, and Qiang, 1999). A media index was initially used in estimation, but the PCB coverage spiked so dramatically in early 2004 that it produced the same results as the simpler dummy variable specification. Compared to alternative PCB dummy variable durations, the 12-week period offered slightly higher explanatory power, and encompassed over half of the post-2003 newspaper articles associated with the keywords "salmon" and "PCB" in the two major Alberta dailies, the *Edmonton Journal* and the *Calgary Herald.*

The estimated demand system was thus:

$$w_{it} = \alpha_i + \sum_j \gamma_{ij} \ln p_{jt} + \beta_i \ln (x/P)_t + \sum_{k=1}^{12} \lambda_{ik} (4-week\ dummy)_{kt} + \tau_i\ trend_t + \delta_i\ trend^2{}_t + \psi_i (Mercury\ dummy) + \phi_i\ (PCB\ dummy)_t + \varepsilon_{it},$$

where w_{it} denotes expenditure share of the i^{th} product category at time t, p_{jt} denotes price of the j^{th} product category at time t, x_t denotes total expenditure at time t on the four product categories, $\ln P_t = \sum_j w_{j,t-1} \ln\left(\frac{p_{j,t}}{p_j^0}\right)$, $p^0{}_j$ denotes the mean price of the j^{th} category, and the 13th 4-week period of the year serves as the basis of comparison for the remaining 12 periodic dummy variables indexed by k. The *Mercury* and *PCB dummy* variables equal one during the 12 weeks ending August 10, 2002 and during the first 12 weeks of 2004, respectively.

The same regressors appeared in each of the four equations, implying that the system added up by construction, and requiring that one equation (chicken) be omitted for the system to be identified. The theoretical restrictions of homogeneity and symmetry were tested and not rejected at the .05 level, and were thus imposed on the system to save degrees of freedom. Theoretical restrictions of the model were as follows:

adding-up: $\sum_i \beta_i = 0, \sum_i \alpha_i = 1, \sum_i \gamma_{ij} = 0 \; \forall \; j, \sum_i \lambda_{ik} = 0 \; \forall \; k, \sum_i \tau_i = 0 \, , \sum_i \delta_i = 0, \sum_i \phi_i = 0,$

homogeneity: $\sum_j \gamma_{ij} = 0 \; \forall \; i$

symmetry: $\gamma_{ij} = \gamma_{ji} \; \forall \; i \neq j$

.

After correcting for autocorrelation in the finfish equation, the system-wide joint conditional means test [$F = 0.10$ vs. $F^c_{.10}(54,102) = 1.34$] and the joint conditional variance test [$F = 0.09$ vs. $F^c_{.10}(21,196) = 1.45$] suggested by McGuirk et al. (1995) were not rejected at the .10 level, implying the absence of severe econometric violations relating to parameter stability at the first and second moments, autocorrelation, a RESET test of functional form, static heteroskedasticity, and autoregressive conditional heteroskedasticity.

The results of primary interest are those concerning the statistical and economic significance of the *PCB* dummy variables, the signs and significance of the time trend variables, the significance of the price parameters, and the compensated price elasticity matrix, each element of which is calculated as $\varepsilon_{ij}^h = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} + w_j$, where $\delta_{ij} = 1$ if $i=j$ and 0 otherwise.

Directed Acyclic Graphs and Historical Decomposition

While traditional demand models are commonly used to investigate the impact of food safety incidents, dynamic techniques are required to reveal the more complex interrelated effects among the variables under study. For this purpose, we utilize a co-integrated vector error correction (VEC) model, directed acyclic graphs and historical decomposition analysis. Directed graphs, in particular, allow the errors among the endogenous variables to be incorporated into the forecasted effects of PCB market shocks over time, and will complement the demand analysis with information about changes in dynamic causal relationships when the negative health information emerged. We trace the dynamic effects of the PCB event on retail-level series over time to see if these changes are consistent with the results of our demand system estimations.

The first step is to test if the series are stationary by using the Augmented Dickey-Fuller (ADF) test. Johansen's co-integration test is performed to determine whether the series are co-integrated (Holden and Perman, 1994). If the series are integrated and co-integrated, then a VEC Model is appropriate to characterize the multivariate relationships among the variables (Engle and Granger, 1987; Enders, 1995). The VEC model uses both short-term dynamics as well as long-term information; it has a co-integrating equation which captures the long-run relationship among the variables due to the presence of co-integration.

The covariance matrix of the VEC model is then used to investigate the causal relationship among the variables using directed acyclic graphs as in Bessler and Akleman (1998). Finally, historical decompositions break down the series into historical shocks in each series to determine their responses in a neighborhood (time interval) of the PCB event (Chopra and Bessler, 2005).

The Results

Table 2 contains the LA/AIDS parameter estimates. Explanatory power was indicated by respective adjusted *R2* values of 0.79, 0.87, and 0.90 in the salmon, finfish, and shrimp equations. Most parameters were statistically significant at the .05 level, with a noteworthy exception being the finfish own price coefficient (note that an own-price parameter of zero implies an own-price elasticity of -1). The only significant parameters with unexpected signs were the shrimp/finfish and shrimp/chicken cross-price terms. The signs of the linear and quadratic trend parameters were consistent with Figure 1, and all but one trend parameter was statistically significant. Parameters for the chicken equation were calculated from the adding-up restrictions.

Table 2. LA/AIDS Parameter Estimates.

	Equation						
	Salmon		*Finfish*		*Shrimp*		*Chicken*[a]
Intercept	0.72224	***[b]	2.3352	***	-3.93412	***	1.87666
	(0.20740)[c]		(0.49920)		(0.55940)		
ln(P salmon)	-0.09251	***	0.11939	***	-0.00799		-0.00993
	(0.02490)		(0.03000)		(0.01270)		
ln(P finfish)	0.11939	***	0.03890		-0.12297	***	-0.03532
	(0.03000)		(0.06790)		(0.03140)		
ln(P shrimp)	-0.00799		-0.12297	***	0.20593	***	-0.07497
	(0.01270)		(0.03140)		(0.03300)		
ln(P chicken)	-0.01889		-0.03532		-0.07497	***	0.12918
	(0.02120)		(0.04390)		(0.02160)		
ln (real expenditure)	-0.04325	***	-0.12594	***	0.26863	***	-0.09944
	(0.01430)		(0.03490)		(0.03900)		
weeks 1-4	0.03433	***	0.04989	**	-0.12099	***	0.03677
	(0.00896)		(0.01960)		(0.02470)		
weeks 5-8	0.02506	***	0.06349	***	-0.12306	***	0.03451
	(0.00936)		(0.02190)		(0.02590)		
weeks 9-12	0.02788	***	0.08214	***	-0.11416	***	0.00415
	(0.00876)		(0.02070)		(0.02410)		
weeks 13-16	0.01841	**	0.04780	**	-0.07062	***	0.00441
	(0.00872)		(0.02060)		(0.02400)		
weeks 17-20	0.02556	***	0.03390		-0.10029	***	0.04082
	(0.00859)		(0.02030)		(0.02380)		
weeks 21-24	0.02213	**	0.02146		-0.06532	***	0.02173
	(0.00865)		(0.02050)		(0.02390)		
weeks 25-28	0.00778		-0.03058		0.00462		0.01817
	(0.00885)		(0.02110)		(0.02440)		
weeks 29-32	-0.00085		-0.02102		0.00311		0.01876
	(0.00895)		(0.02150)		(0.02470)		
weeks 33-36	-0.00358		-0.03342		0.02140		0.01560
	(0.00892)		(0.02140)		(0.02440)		
weeks 37-40	0.01145		0.04085	**	-0.05552	**	0.00323
	(0.00858)		(0.02020)		(0.02350)		
weeks 41-44	0.01078		0.03627	*	-0.03840		-0.00866
	(0.00901)		(0.02100)		(0.02460)		
weeks 45-48	0.01646	*	0.06172	***	-0.09385	***	0.01568
	(0.00892)		(0.01910)		(0.02430)		
trend	-0.00034		-0.00531	***	0.00920	***	-0.00355
	(0.00051)		(0.00121)		(0.00122)		
trend squared	0.00001	***	0.00005	***	-0.00009	***	0.00003
	(0.00000)		(0.00001)		(0.00001)		
mercury (Jun-Aug, 2002)	-0.02087	**	-0.04086	*	0.02027		0.04146
	(0.00935)		(0.02390)		(0.02540)		
PCB (Jan-Mar, 2004)	-0.01935	**	-0.00712		0.02116		0.00531
	(0.00964)		(0.02440)		(0.02590)		
Adjusted R^2	**0.79**		**0.87**		**0.90**		

[a] Parameter estimates in the chicken equation obtained from adding-up restrictions

[b] *, **, and *** denote statistical significance at the .10, .05, and .01 levels, respectively

[c] Standard errors in parentheses

Compensated own-price elasticities, presented in Table 3, ranged from an extremely insensitive value of -0.03 for shrimp to -0.53 for finfish to a highly elastic value of –2.14 for salmon. Shrimp cross-price elasticities were economically insignificant, suggesting that consumers do not view shrimp as having close substitutes in the freezer section. Salmon and other finfish were economically and statistically significant substitutes, as expected. Expenditure elasticities, not to be confused with income elasticities, were highest for shrimp (1.86), and inelastic for salmon (0.43) and other finfish (0.66).

Table 3. Compensated Price Elasticity Estimates.

		Equation			
		Salmon	*Finfish*	*Shrimp*	*Chicken*
Price	Salmon	**-2.14**	0.40	0.05	0.00
	Finfish	1.94	**-0.53**	-0.02	0.22
	Shrimp	0.21	-0.02	**-0.03**	0.01
	Chicken	-0.00	0.15	0.01	**-0.23**

The parameters on the *mercury* dummy variable were statistically and economically significant in the salmon and other finfish equations, even though none of these species was identified as high in mercury. Salmon and other finfish expenditure shares dropped by 2% and 4%, respectively, during the three months following the Health Canada advisory. This result complements the Roosen et al. (2006), and Shimshack, Ward, and Beatty (2007) findings that consumer reaction to complex health messages may be broader than intended.

Of primary interest was the statistically significant parameter on the *PCB dummy* variable in the salmon equation, which shows a 2% loss of salmon expenditure share attributable to the three-month period following publication of Hites et al. (2004) and subsequent media coverage. Given that salmon's expenditure share in surrounding months was only 5%-9%, a 2% decline is economically significant. The impact is visible in Figure 1 as an uncharacteristic break in the seasonal pattern of expenditure share growth early in the year. Table 2 shows the characteristic pattern as positive and statistically significant seasonal parameters for the first 12 weeks of the year, relative to the final 4 weeks. Only in 2004 was there a drop in expenditure share between late December and mid-March, the period corresponding to the heaviest media coverage of elevated PCB levels in farmed salmon.
The OLS unit-root test results for the quantity series of salmon, finfish, shrimp, and chicken appear in Table 4. The second column shows failure to reject the null hypothesis of zero first-order autocorrelation using the Durbin-Watson bounds test for salmon and shrimp series, given the MacKinnon critical value. The right-most column shows ADF results when the series are first differenced. The null hypotheses are rejected at the 1% significance level for all variables after first differencing.

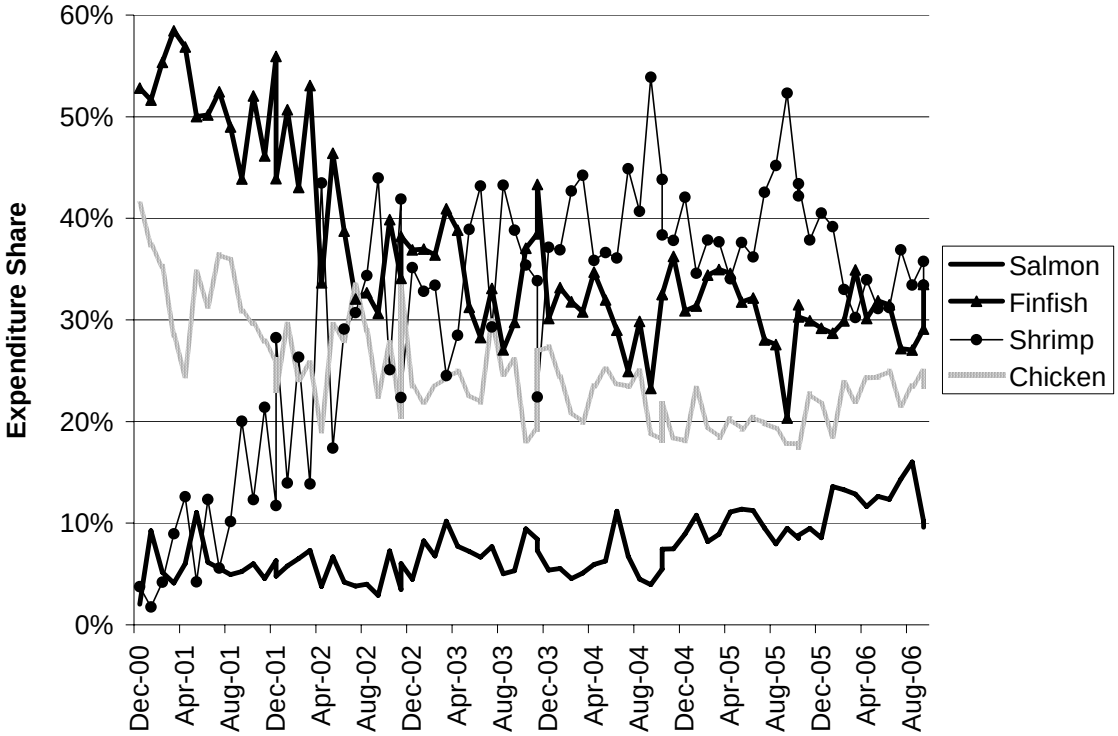


Figure 1. Frozen Shrimp and Salmon Expenditure shares Grew in Alberta, While Other Finfish and Chicken Shares Fell.

Table 4. Augmented Dickey-Fuller (ADF)[a] Test Results.

Quantity Variables	Test Results for Variables in Levels	Test Results for Variables after First-Differencing
Salmon	2.34	7.65*
Finfish	3.94*	9.28*
Shrimp	1.29	14.51*
Chicken	5.61*	10.38*

Note: * 1% significance level.
[a] Test statistics are in absolute value and compared to MacKinnon (1996) one-sided p-value.

Table 5 contains the co-integration test results for the quantity series. The null hypotheses of co-integrating ranks $r = 0$, $r \leq 1$, and $r \leq 2$ are rejected at the 5% level of significance, indicating that the co-integrating rank of the system is at most 3. Long-term relationships therefore exist among the variables, which supports use of the VEC model in determining the directed graphs and causal patterns for quantities.

Table 5. Johansen Cointegration Test Results for the Quantity Variables.

Null Hypothesis[a]	Trace Statistics	5% Critical Value	Eigenvalue
$r = 0$ *	66.17	47.86	0.37
$r \leq 1$ *	33.42	29.80	0.19
$r \leq 2$ *	18.05	15.50	0.17
$r \leq 3$	3.84	4.46	0.06

[a] r is the cointegrating rank, MacKinnon-Haug-Michelis (1999) p-value.
* 5% significance level.

Contemporaneous innovations are reflected by the VEC model's residual correlation matrix. The innovations are orthogonalized using TETRAD IV software to obtain historical decomposition functions from the endogenous variables in the system, indicating the causal patterns of the quantity series on innovations (Spirtes et al., 1999; Spirtes et al., 2000). Figure 2 shows the directed acyclic graphs of these causal structures. Only edges that are significantly different from zero at the 5% significance level are included. The results show that innovations in salmon, shrimp and chicken variables directly affect residuals in finfish, and the residual relationship among salmon, shrimp and chicken quantities is indirect through the finfish.

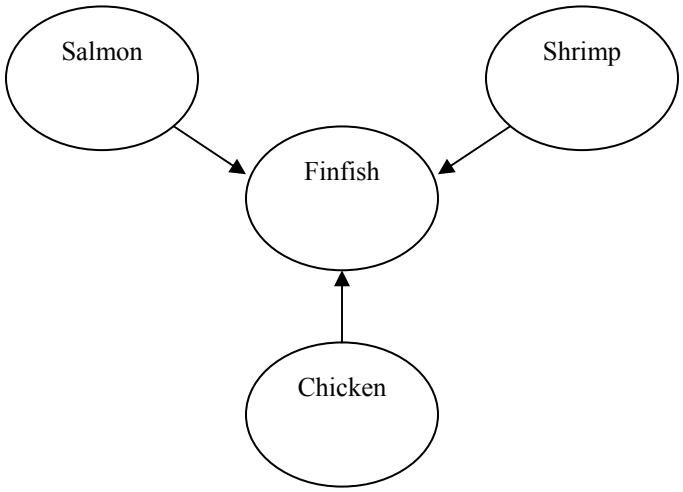
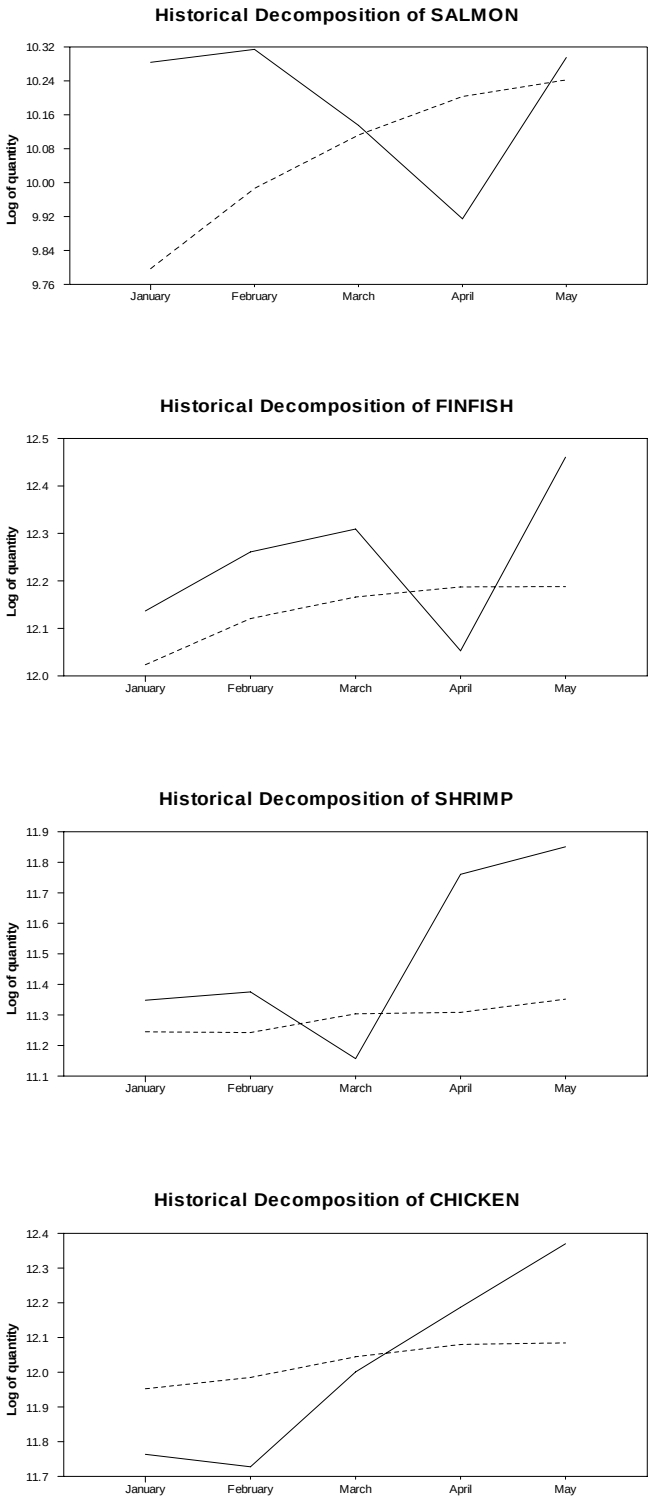


Figure 2. Directed Graph on Innovations from the Quantity Series.

Figure 3 shows the historical decomposition results for the endogenous variables from the PCB report over a five-month horizon, chosen to explore the immediate post-event dynamics before the accumulation of other events obscures their impacts. The PCB historical decomposition graphs showed a negative impact on the consumption of frozen salmon beginning with February 2004, consistent with the results of the demand system, and concurrently, the consumption of chicken began to rise. Seemingly, consumers reacted negatively to the PCB news and substituted chicken for salmon.



Actual Price: ——————————

Forecasted quantity before the event: - - - - - - - - - - - - - - - - - -

Figure 3: The PCB impact on the Quantity Series (pounds in log-form).

Among the four products under study, salmon took the largest hit with the PCB event and reached its lowest point by April 2004. Figure 3 shows pre-shock estimates for the product quantities (the dashed line) with projections associated with the PCB shock. It is estimated that salmon consumption dropped some 10% from its forecasted values due to the adverse food safety report by April. In contrast, the positive impact on chicken consumption above its forecasted values was estimated to be about 8% by April, and for shrimp consumption was close to 5%. On average, the PCB had little impact on finfish consumption. In contrast to the Roosen et al. (2006) results showing haphazard consumer responses to a complicated health recommendation, these results show the expected response when the health message is less complicated. Alberta consumers reacted positively toward chicken and shrimp and less negatively against finfish. Purchases of frozen salmon, finfish, and shrimp rose soon after April, consistent with previous research indicating declining concern over time, though some anxiety may endure (Mazzocchi, 2005).

Discussion

Vehement industry criticism of Hites et al. (2004) suggested that salmon producers and processors expected a strong negative consumer reaction to the PCB issue, and the results of our analysis support that expectation, at least in the short-run. The industry's strategic response and subsequent consumer behavior, however, produced a much different outcome.

About five months after Hites et al. (2004) was published, a prominent seafood processor referred to here as "Brand 1" introduced a "Wild Salmon Chum Fillet" product with potential to ease consumers' fears of PCBs in farmed products. Chum and pink salmon are generally viewed as low-cost, low-quality species compared to chinook, coho, and sockeye salmon (Franz, 2006). As shown in Figures 4 and 5, the frozen wild product was introduced at a much lower price ($4.34/lb.) than the pre-existing, presumably farmed salmon products, and the initial quantity demanded exceeded that of all other salmon products combined.

Faced with the tremendous success of the product in its first month, Brand 1 raised the wild product's price to as high as $7.43/lb. during the next 16 weeks. In September, 2004, however, a dominant competitor referred to here as "Brand 2" introduced its own "Wild Pacific Salmon" product at a very low price of $4.87/lb. Brand 1 immediately retreated until it undercut Brand 2's price in the following month. Brand 1 made one effort to raise price again (to $6.06/lb.) in November, 2004, but Brand 2 did not follow the price increase. Brand 1 then reverted to a low-price strategy, and maintained a lower unit price than Brand 2 for the duration of the study period. Both wild products were consistently priced $2-$3/lb. lower than the pre-existing farmed salmon products.

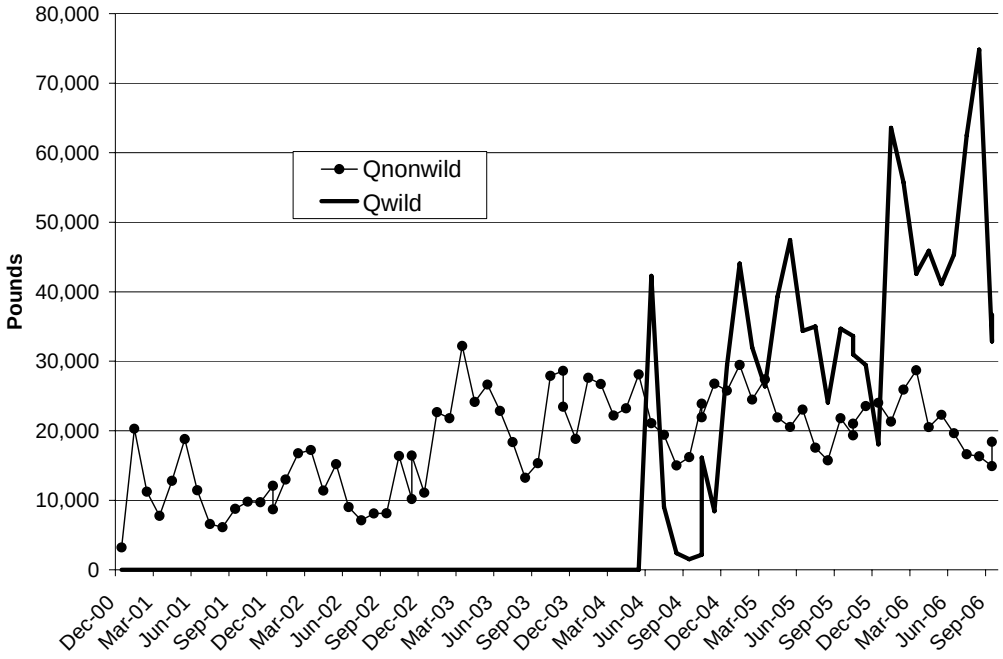


Figure 4. Wild Salmon Quantity Demanded Soon Overtook Non-Wild Salmon.

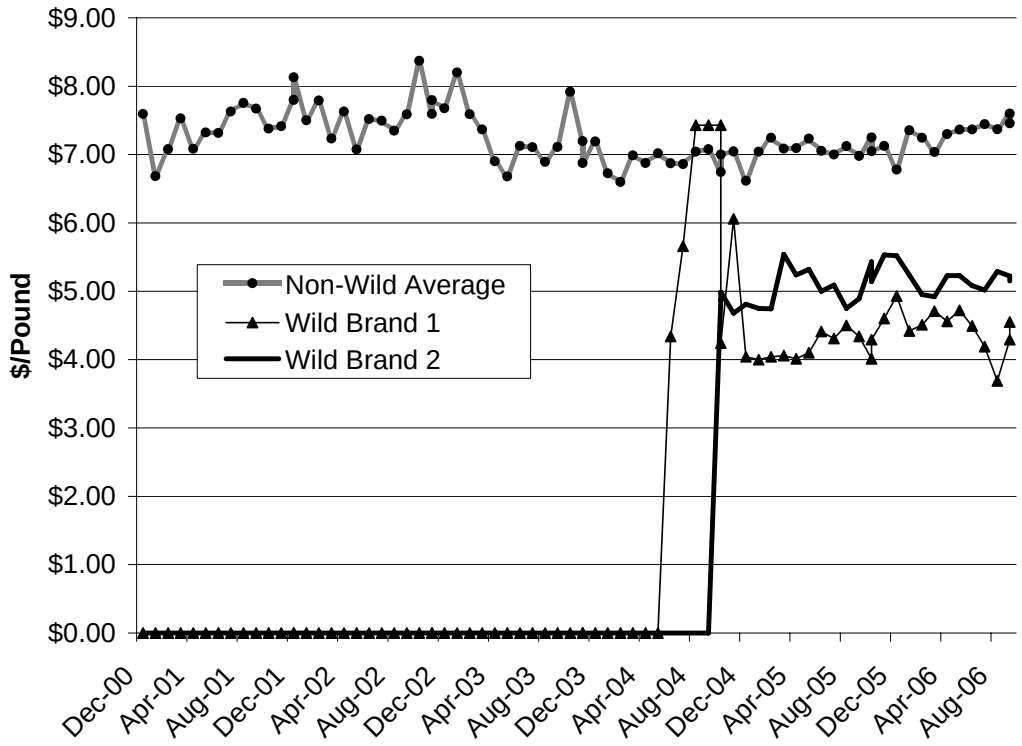


Figure 5. Strategic Price Interaction between the Two Main Wild Salmon Brands.

In retail fish markets, wild salmon commands a price premium not only because of perceived health benefits, but because of perceived superior flavor. The persistently low prices of the processed frozen wild salmon products analyzed in this study were therefore puzzling. Knapp (2007) suggested that these wild frozen products are likely to be lower-value chum and/or pink salmon (Brand 1's product is labeled as chum). An especially low-cost marketing channel involves exporting chum and pink salmon to China for processing, then re-importing the value-added product.

As shown in Figure 4, the quantity demanded of the low-priced wild products quickly outstripped that of the pre-existing farmed salmon products, and remained on an upward trajectory through the end of the study period. The farmed products were often flavored or breaded, and one brand's products accounted for almost 91% of the farmed salmon quantity sold. Overall salmon expenditures and expenditure share grew during the study period, with the fastest growth occurring after the industry introduced the wild salmon products in response to the PCB scare.

The popularity of wild salmon, combined with the visual similarity of wild and farmed salmon (farmed salmon are fed an extract from corn fermentation to achieve the pink color associated with wild salmon), led to incentives for unethical business practices. Burros (2005) reported test results showing that salmon being sold at a premium as "wild" by six of eight New York City retailers were in fact farmed. When confronted with the results, some managers suspended supplier relationships, increased source verification requirements, and implemented spot tests to regain consumer trust.

By actively influencing the information reaching consumers, and by adapting the product mix to changing preferences, the salmon industry appears to have transformed a food safety threat into a growth opportunity with respect to the products evaluated in this study. Technological efforts to eliminate the source of higher PCB levels in farmed salmon are ongoing and, if achieved, will be a final beneficial outcome stemming from the alarm sounded by Hites et al. (2004).

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Industry-Academic Partnerships – Benefit or Burden?

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Abstract

In an applied discipline such as agribusiness management, there are many opportunities for collaboration between academia and industry. This article highlights opportunities for industry-academic partnerships through research, sabbatical leaves, consulting, outreach, student enrichment activities, and industry advisory boards. The principal benefits and pitfalls associated with each type of collaboration are discussed along with tips for managing industry-academic partnerships.

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Introduction

Historically, the field of agribusiness is rich with cooperation between agribusiness firms and universities. Universities offer well-educated graduates, new research and ideas, and highly specialized faculty members. Agribusiness firms offer employment opportunities, data for research projects, and industry expertise. Despite the natural opportunities for collaboration, there are many pressures at work to limit cooperation between the two groups. Industry managers face intense pressure to safeguard company secrets and to focus their efforts on tasks that increase company profits. Likewise, rewards for academics tend to be for specific outcomes, such as publishing research, teaching, or service or outreach activities. The result is that universities and agribusinesses and may miss mutually beneficial opportunities to work together.

The objective of this paper is to present an in-depth discussion of opportunities for industry-academic partnerships. We focus on those opportunities with the greatest potential benefit for both organizations. The discussion centers on the primary benefits and pitfalls associated with each type of cooperation. This paper will be of greatest interest to academics in the early stages of their careers who are interested in exploring collaboration with industry partners. Experienced academics and administrators who may wish to develop a particular type of industry partnership may also find our experiences and insights useful.

The opportunities presented in this paper and the ensuing discussion of the benefits and burdens of developing partnerships between universities and industry are the product of our combined years of experience. The four authors of this paper have worked in many environments, including as faculty members and administrators in private and public universities, industry, and as consultants. As faculty members we have been engaged in research, instruction, service and outreach activities. We draw on our experience with both the successes and challenges of the many types of partnerships to present a robust discussion of the opportunities for industry-academic partnerships, what to expect from them, how to get the most from them, and the pitfalls that may occur.

Research Projects

In this section we address the various ways that universities and industry may collaborate on research projects. We distinguish between faculty and student-centered research. We further distinguish between student research that is primarily long-term, such as research leading to a thesis, and student research that is short-term, such as a class project. The key dimensions of the various types of industry-academic partnerships are summarized in Table 1 *(see Appendix).*

Joint and Industry Sponsored Research Projects

There are various forms that joint and industry-sponsored research may take. In this section of the paper, we highlight the Center for Food Distribution and Retailing (CFDR) at the University of Florida as an example of joint and industry sponsored-research. The CFDR facilitates research and education on the food distribution chain from growers to consumers, disseminates science-based information on the impact of the entire distribution chain on the final quality and safety of the food products on the shelves of food retailers' stores, and provides support to the food industry in the State of Florida as well as at national and international levels. Information on the CFDR may be found at http://cfdr.ifas.ufl.edu/.

The CFDR is built upon a multi-disciplinary approach to research, in true partnership with industry. Currently, there are 28 faculty members across seven departments and two Research and Education Centers (Agricultural and Biological Engineering/Packaging Science, Animal Sciences, Family Youth and Community Sciences, Food and Resource Economics, Food Science and Human Nutrition, Horticultural Sciences, Plant Pathology, Indian River Research and Education Center, and the Tropical Research and Education Center) that collaborate on projects ranging from temperature control in the cold chain to the implementation and economics of radio frequency identification tags in retail grocery stores.

The stated objectives of the CFDR are to: 1) facilitate research and education in the multidisciplinary area of the food distribution chain from growers to consumers; 2) disseminate science-based information about the impact of the whole distribution chain on the final quality of the food products (temperature sensitive products) on the shelves of a retail store; 3) increase the scope of existing undergraduate and graduate programs at University of Florida by increasing the content in food distribution and retailing; and 4) provide support to the food industry at national and international levels.

The CFDR allows faculty members access to industry issues, expertise, and data. For example, a recent project involved studying the use of radio frequency identification tags on fresh produce from California and Central America to a grocery chain in central Florida. Representatives from grower/shippers, the retailer, technology providers, and faculty members collaborated on this research. The result of this project was a web-based interface that suppliers and retailers could use to track temperatures of fresh produce in transit in real time.

The CFDR relies heavily on industry funding to carry out industry-driven research. This funding can be in the form of "in-kind" contributions such as retail-store refrigerated cases or in the form of money to support graduate students, research

design, or data collection. The CFDR has received over $2.2 million in industry funding in the last two years.

Joint and industry-sponsored research benefits both the university and industry. Faculty members receive funding for research (e.g. for graduate students, equipment, travel, etc.) and access to information. This enables faculty members to work on the cutting edge of issues facing industry. Industry benefits by gaining access to the knowledge base available from a major land grant university. Given the complex nature of issues facing industry, the multi-disciplinary approach of the CFDR is a critical component of the center's ability to deliver usable products in a timely fashion to industry. Industry also benefits from the fresh perspective that university researchers provide.

A potential downside to joint and industry-sponsored research is that industry may be concerned about protecting proprietary information. There are also concerns about the difficulties of remaining unbiased in a research project that is sponsored by industry. The center and its industry-based advisory board have been careful to insist on sharing research results with the entire industry in a timely manner. An additional downside to joint and industry-sponsored research is that work on industry projects may not lead to published journal articles. However, this problem is often overcome with a little creativity. [1]

Long-term, Student-Centered Projects with Industry

There are a broad range of opportunities for industry-university research that is led by students. Projects range from long-term, in-depth, higher cost projects with high exposure and benefits for both students and industry, to short-term, simple projects that focus on exposing students to industry. In this section we focus on long-term, student-centered research projects.

The most in-depth experiences for both industry and student researchers are long-term research projects, traditionally conducted by graduate students, focusing on an industry-identified project. In this case, the company partner often pays the university for the costs of research, including a stipend for the graduate (or undergraduate) student. In return, the student focuses his or her research (e.g. a thesis) on a problem identified jointly by the company and the student's faculty mentors. In addition to thesis projects, other examples of long-term research projects include independent study and undergraduate research projects. The focus on undergraduate research is an emerging trend at many top U.S. universities.

[1] For more information on industry sponsored research, see the article entitled "How Agricultural Economists Increase the Value of Agribusiness Research" (Knight, House, and Wysocki).

The company benefits from in-depth exposure with a potential future employee, as well as having a problem examined by a fresh set of eyes and the prospect of utilizing applications and analyzed with the latest methods. For the amount of time and effort the student invests in a research project, particularly if it is a thesis or dissertation, the company will receive a more in-depth analysis than if they had worked with a consultant, usually for less expense. Not only do they get the expertise of the student, but usually the expertise of at least one, if not more, faculty advisors as well.

However, there are drawbacks for the industry partner. Though they may not be paying as much as they would for a consultant, this approach to research is not without cost. The cost of hiring a student, sometimes including tuition and indirect cost, is not trivial. Moreover, the largest cost may come in time. A consultant hired to work on a project will have a set, and usually relatively fast, timeline. However, students typically work at a much slower pace, conducting their research and studies over a period of a year (or more). Hence, the type of project that the industry partner would need to choose for this experience would be more of a long-term planning project, and less likely to be a pressing operational problem. There also is a risk in the quality and variability of the output from student research. However, faculty members typically oversee and contribute to student research, which tends to minimize the downside risk. Finally, consultants often have industry-specific knowledge and expertise that can be drawn on when tackling industry-specific issues.

The student benefits from the partnership by gaining exposure to a potential employer, having the opportunity to determine if the employer would be a good fit, access to data and information for a research project, and "real-world" experience that would enhance a resume. Through this process, the student may also gain from access to expertise that exists in the industry. Additionally, the faculty members working with the student often benefit from this exposure to industry problems.

Potential drawbacks for the student include working with a non-traditional thesis project, the potential difficulty in gathering all of the information needed to complete the analysis, and possible conflicts with publishing proprietary data. This also holds true for the faculty supervisor, who may find working with industry more time consuming than traditional research projects and who may find that the research may not be published. However, the faculty member gains from the exposure to the industry and access to data, issues, and expertise.

An example of the type of collaboration discussed above is a thesis created by Paul Jaramillo at the University of Florida (Jarmillo, 2004). For his thesis research, Paul worked with a private company on developing a strategic plan. During this process, both the student and company experienced many of the above-mentioned benefits and drawbacks. From the student's perspective, the project was of interest because

of the exposure to a company, its employees, and the current nature of the issue. However, the student was frustrated by the difficulty in defining a research project that was both satisfactory for his thesis requirements and of value to the industry partner. The company partner paid the cost of one year of the student's assistantship and, in return, received an in-depth analysis on strategic planning in the company. The original request from the company was to examine market expansion opportunities, but during the process of defining the research project, it was jointly decided that internal issues (i.e., succession of company leadership) in the company were more pressing. This change in topic added to the initial frustration for the student, but through a series of focus groups conducted within the firm, the student was able to learn from the experience of identifying internal issues within the firm that were impacting market growth. The company has identified the benefits of the partnership as receiving the strategic planning document created as part of the research and having an increased exposure to students. One result of the project was a case study on the company that is now used in classrooms, giving an even greater exposure of the company to potential future employees and customers. The company also identified drawbacks as the length of time needed to complete the project and the cost of supporting the student. It should be noted that this company was willing to fund this graduate student's research based on the successful results of a previously completed graduate term project

Short-term, Student-Centered Projects with Industry

There are many opportunities for short-term student projects with industry involvement. These include individual or group class projects, company visits, and management interviews. Class projects, often group projects, are probably the most common means of exposing students to industry. In this case, a group of students works with an industry partner on a specific project, which may be defined by the instructor, students, company liaison, or some combination of the three. Class projects are usually considerably less involved than a graduate research project, but are completed on a shorter time horizon, thus making it more appropriate for certain decisions within a firm.

Many of the benefits discussed in the previous section accrue to the company and students, albeit on a smaller scale. Industry members are exposed to a fresh set of ideas (now coming from more than one student) and the latest information being taught in the classroom. The cost to the company for this alternative is lower than with a sponsored research project. Firms may commit to cover only expenses the students incur in completing the project (including travel to and from the company) if they cover any expenses at all. An additional benefit to the company is exposure to multiple students and in some cases the industry partner may get to meet the entire class, not just those students involved in the project. Drawbacks for the

company include variability in quality (arguably greater for a class project than a research thesis) and the commitment of time to work with students.

Students gain from exposure to a company and potential employer, as well as access to current issues, data, and expertise. Drawbacks for students on an industry class project include lack of ability to have access to all needed data and possible conflicting desires between a class professor and a company. The faculty member teaching the class must consider the cost of coordinating multiple class projects. However, there are many benefits from assigning industry projects including access to issues and information and the exposure to multiple companies for potential future collaboration.

The following examples illustrate how an industry class project might work. The first is an example from Mississippi State University, where students in the capstone class for the Master of Agribusiness often work with companies for their term projects. In one particular class, a group of students worked with a firm called Bainbridge Festive Foods. In this project, the students benefited from having exposure to the issues and data (or lack thereof) faced by a business recently purchased by new owners. Students experienced the problems generated when quality issues from a previous owner impact the new owners, and the importance of full disclosure at the time of purchasing a small business. The new business owners enjoyed the expertise of the students and faculty members in solving problems for their newly acquired business. In this case, the faculty members involved also benefited through the publication of a case study on the company and the possibility of future collaboration with the new owners. In this case, few drawbacks were identified. The students, although they did not consider employment with the company, did benefit from exposure to a company they would not have known about otherwise. Indeed the company became a client of one of the students involved in the project. On the downside, students did express frustration with the lack of financial data available to solve the problems. However, this problem but was due to lack of availability, not lack of access, and served as a useful learning experience for the students.

Another example of successful collaboration with industry on short-term projects is drawn from the Santa Clara University's agribusiness MBA program (http://www.scu.edu/business/fai/). In the capstone strategy class student groups were required to select a client-firm for their term project. The firm had to agree in advance to give students access to the required data, to allow the students to interview company employees, and to have at least one executive attend the final presentation. The pressure of having to develop a report and presentation to be delivered to senior management of the company served as a great motivator for students. From the companies' perspective, the ability of students to think "out of the box" was often mentioned as the single greatest benefit.

The two examples of class projects described above both focused on capstone classes. Other examples of classes that lend themselves particularly well to class projects include marketing, operations, and sales classes. In addition to class projects, company visits may be included as a component in most classes to allow students to learn about an industry or to illustrate the application of a specific technique. Management interviews also provide exposure to industry at a very low cost, both in terms of time and money and may be included as a component of many agribusiness classes.

Sabbatical Leaves with Industry

In a 1999 study, the American Association of State Colleges and Universities (1999) conducted a comprehensive study on building faculty for the future. For this report they reviewed sabbatical policies for 50 colleges and universities across the country (four year public research, four year regional public, four year private and two year community college). Many of the sabbatical policies shared common characteristics. The offering of sabbatical leaves to full time faculty members (usually every seven years) was the most widespread practice. It is a widely held belief that the knowledge and reinvigoration gained from spending time away from regular faculty routines improves faculty performance upon their return to their regular responsibilities.

The Merriam-Webster online definition of sabbatical is "a break or change from a normal routine (as of employment)." Why do university faculty members take sabbaticals? While there are many reasons, they generally fall under the following categories: (1) to catch up on work such as writing journal articles, finishing book manuscripts, or carrying out research (Fogg, 2006; McClain, 2005, 2006; Wilson, 1999); (2) to re-tool, that is learn new things, and improve teaching (AASCU, 1999; Fogg, 2006); (3) to rejuvenate and to cure burn out (McClain, 2006; Wilson, 1999); (4) to do something the faculty member has never done before, such as travel and thereby globalize their perspective (Fogg, 2006); (5) to plant the seeds of future work (McClain, 2006); and (6) to attend to personal matters like aging parents (McClain, 2005; Treckel, 2004).

Traditionally, sabbaticals have afforded faculty members the opportunity to travel. Today, an increasing number of faculty members are taking sabbaticals without leaving their home. Advances in technology and the increasing cost and hassle of sabbatical arrangements (e.g. arranging for a house sitter) have made work-from-home sabbaticals more practical and commonplace (Wilson, 1999).

Interestingly, more businesses are recognizing the benefits of employees who take sabbaticals. Companies are using sabbaticals to prevent costly employee burnout and to attract the best workers (Chura, 2006; Overman, 2006). These sabbaticals can create a sense of company loyalty. However, the Society for Human Resource

Management estimates that only about five percent of companies offer sabbaticals (Jenkins, 2007; Overman, 2006).

Another recent trend is the use of sabbaticals to gain additional work experience. Institutions such as Longwood College, Southwest Missouri State University, and West Virginia University allow faculty members to work for a corporation or non-profit group to gain experience relevant to their discipline (Wilson, 1999).

Faculty members who take sabbatical leaves away from their university most often visit another university, a government agency, or a research institute. Faculty members within the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida follow a similar sabbatical pattern. Over the last two and a half years, 26 faculty members in IFAS applied for sabbatical leaves. During this time, no assistant professors applied, while six associate professors, and 11 full professors sought sabbaticals. The most likely reason that no assistant professors applied for a sabbatical is that assistant professors have approximately seven years to get promoted and tenured, and that most sabbaticals are not granted until after seven years of employment. There were two agent II extension agents (similar to an assistant professor position in extension), three agent III extension agents (similar to an associate professor position in extension), and 4 agent IV extension agents (similar to a full professor position in extension) who applied for a sabbatical.

Of these 26 faculty members applying for a sabbatical, only one extension faculty member mentioned working indirectly for a company as part of their planned sabbatical experience. The other 25 faculty members listed other universities (e.g., Earth University in Costa Rica, the University of New Zealand, etc.), and government agencies and research institutes (e.g., U.S. Forest Service, The Sports and Turf Research Institute of New Zealand, Beijing Institute of Genomics, The National Park Service, etc.). It should be noted that the majority of Agent II and Agent III applicants listed attending a university to complete an advanced degree as required to attain Agent IV status. Interestingly, none of the faculty members applying for sabbaticals indicated plans to work at home.

Industry-based sabbaticals are an alternative to university-based sabbaticals. A sabbatical spent with industry can expose faculty members to a wide range of issues facing agribusiness firms, issues that can be used to update faculty members' knowledge and experience. Industry-based sabbaticals may advance research agendas and provide new insights for teaching and extension programs. Moreover, working with industry might provide faculty members with access to information that would otherwise be proprietary. In some cases, faculty members may gain access to data sets, such as those provided by Nielson, that can be cost-prohibitive to university researchers.

The benefits of taking a sabbatical with industry may spread far beyond the individual faculty member. The host company may also benefit from the skill set of the faculty member and their rigorous research methods. Collaboration may also lead to closer ties between the company and university with benefits for students, other faculty members, and programs.

Given the reported benefits of taking a sabbatical within industry, why don't more faculty members choose this focus for their sabbaticals? Perhaps it is the absence of industry ties that makes arranging a six to twelve month sabbatical difficult. Possibly, the benefits of such sabbaticals are not widely known or it may be perceived as risky to take a non-traditional sabbatical. While most faculty members are highly regarded by industry, there is a considerable amount of apprehension on the part of business regarding how to best utilize the skills of faculty members. Additionally, there may be cautiousness on the part of industry to share business secrets with academics for fear that these secrets will become knowledge that competitors could access.

Perhaps one of the most significant reasons that more faculty members don't consider industry-based sabbaticals is the pressure to be promoted in the academic system. Faculty members often choose sabbatical activities that will directly contribute to success in the promotion process, such as writing grants, carrying out research, and finishing publications. A faculty member must carefully consider whether an industry-based sabbatical will enhance his or her performance given the existing reward system.

Consulting

Faculty members at universities have a unique opportunity to share their intellectual property with industry because they bring value through their in-depth investigative techniques, rigorous methods, and objectivity. Industry consulting is attractive because it allows faculty members to supplement their salary and gain industry expertise at the same time, a valued asset in agribusiness programs.

To describe some of the pros and cons of industry consulting, we use as an example a consulting project conducted by the four authors and another researcher and reported by Batista (2005). The team consisted of four researchers from four different universities and a private consultant. The client for this project was Galaxy Nutritional Foods International, a publicly-traded, Florida manufacturer of natural foods and non-dairy cheeses with annual sales of approximately $40 million. The firm's major problem was that it was losing money. The company's CEO hired the team to conduct consumer research for the purpose of re-staging the company's brand as part of a turn-around strategy. At the time the group was hired, the CEO indicated that there were several key reasons for hiring a consulting team made up primarily of university researchers; he thought it was a cost-effective way to

conduct the research; the team brought a level of objectivity and thoroughness the CEO felt was lacking from alternative consultants; and they injected a fresh perspective that he believed was necessary for the turn-around.

Of all the benefits of consulting, monetary compensation probably ranks at the top. Faculty members can often earn substantially more on an hourly basis than what they earn from their university position. Because faculty salaries are typically lower than industry salaries, many faculty members are drawn to consulting because of the money. For some people, it is a means for them to pursue their passion of teaching and research and still maintain an acceptable standard of living.

A key benefit of industry consulting is that it is often a means to professional development. Consulting provides faculty members with the opportunity to practice and refine what they are teaching in the classroom. Instructors often find that their teaching is enhanced because they are able to supplement the teaching of theory or methods with practical industry examples. A faculty member's ability to share his or her experiences and lessons with his or her peers, students, and other businesses is a significant practical benefit from a consultancy. Case studies, lectures, conference papers and posters, are ways to share the experience. In agribusiness management, these vehicles add tremendously to the discipline's body of knowledge. The Galaxy project also benefited several students who were involved in the project and who were able to see first-hand the application of methods they had learned in the classroom.

Researchers benefit from industry consulting because it deepens their understanding of the industry, how businesses operate, and the problems companies face, and thus encourages the development of innovative methods to address difficult problems. The Galaxy marketing project illustrates these points. The CEO and key shareholders were motivated to work with the consulting team to identify practical solutions to the company's marketing problems and return it to profitability.

Industry consultancies may also provide direction to a research program. A researcher who is unclear as to his or her research agenda, may find direction by working with industry. Researchers who need company or industry data may also improve their access to such data through the relationships they cultivate by consulting. There is a strong tradition in business schools of collaboration between business faculty members and companies. Agribusiness researchers could benefit by following their lead to enhance their professional skills and research programs.

An often-overlooked benefit of consulting is that consultancies may be a good way to promote faculty members and their universities to companies. One consultancy may lead to another through the interactions among the professionals who participate in

the project. The Galaxy project led to another similar project with one of the nation's largest food manufacturers.

A key disadvantage of consulting is that it can detract from a faculty member's other responsibilities. Some faculty members have been criticized because they are perceived as spending too much time consulting and as a result have neglected their research or teaching responsibilities, or both. Another disadvantage of consulting is that it is often not possible to directly share the results or experience gained from the project because the information is considered proprietary. Galaxy was the leading merchandiser of non-dairy-cheese products in grocery stores' produce departments. Because of competitive concerns, the results of the project could not be published to avoid compromising the firm's competitive advantage.

We should also note that ethical questions are sometimes raised concerning faculty members consulting. Two issues that are commonly raised concern the use of university resources for personal gain and the amount of time that faculty members should be allowed to consult. Furthermore, most universities have policies in place that provide guidelines for faculty consulting. These policies often address issues such as potential conflicts of interest, use of university resources, and required reporting. Extension personnel are often subject to additional restrictions.

Outreach

We use the term outreach to encompass those opportunities to "reach out" to the agribusiness community. In the field of agriculture, outreach has been common practice through the Cooperative Extension Service, founded in 1914. The purpose of extension is to "extend" information developed at land grant universities to those who need it. Many faculty members have extension appointments in addition to a research and/or teaching appointment. Because extension outreach activities are very broad they are outside the scope of this article. However, there are many outreach opportunities for faculty members without extension appointments, including conferences, seminars, workshops, speaking engagements, executive education programs, and other programs that are useful to agribusinesses. In the following paragraphs we highlight a few of these opportunities.

One of the principal ways that departments connect with graduates and agribusiness firms is through conferences and seminars. These programs may be repeated on an annual basis, as is done with outlook conferences, or with a different theme for each program. Many such programs have a long, distinguished history. Conferences and seminars often take advantage of a faculty member or department's expertise and offer an opportunity to bring a natural constituent base to campus. This can have a high payoff in terms of developing and strengthening relationships and providing opportunities for interaction. Conferences and seminars

are often offered on a cost basis, whereby the sponsoring institution prices the program so that it hopes to recover the direct costs of running the program.

In recent years, many institutions have developed executive education programs to extend the boundaries of traditional teaching and research activities. Executive education programs are many and varied. Some target specific audiences, while others are more topic-oriented. They typically vary in length from one or two days to week-long programs. Executive education takes advantage of the knowledge base possessed by universities and offers participants the opportunity to learn and interact with a group of their peers. Such programs offer faculty members and departments many advantages including additional income, opportunities for collaboration on research projects, closer ties to industry, and potential consulting opportunities. They can be very profitable for the sponsoring institution. However, such programs can be very time-consuming to organize.

Student Enrichment Activities

In this section we address some of the many other opportunities for universities and industry to collaborate in ways that benefit students. Our list is not exhaustive, but we have tried to highlight some of the most common and beneficial activities that enhance the student experience.

Employment opportunities

Industry professionals are uniquely suited to provide employment opportunities for students. It is not uncommon for some firms to have a strong relationship with a university or department. Such relationships are mutually beneficial. Employers hope to get access (often early access) to the best students and may return to recruit year after year. Departments benefit by helping place their graduates with successful companies. Many departments develop reputations for producing students with specific strengths, such as strong quantitative skills, or solid financial training, which makes their students particularly attractive to certain employers.

Internships

Internships are highly sought after by students. They provide work experience and a chance to learn about potential careers. Moreover, students are frequently paid for their services. Students often find that the internship experience enhances their marketability and often gives them an inside track to employment opportunities with the company with which they interned. Another potential benefit is exposure to the agribusiness industry and increased knowledge of career opportunities.

Companies are motivated to offer internships for several reasons, including fulfilling short-term work needs, particularly when the work is seasonal, and for

project work. For both students and employers, internships are a means to determine the fit between prospective employer and employee, with little risk. It is not uncommon for an internship to end with an employment offer.

There are few drawbacks for students, largely because many students work internships into their summer or part-time work plans. However, when this is not the case, students may find that they may be forced to delay graduation. Depending on the specifics of the internship, students may be faced with relocation costs or a negative experience with a company or supervisor.

From the industry perspective, the internship gives the company the opportunity to evaluate a potential employee at a low cost. Furthermore, as a temporary employee, the company is able to train the potential employee in specific company procedures and company culture. The company may also benefit from increased exposure to potential employees who may not have known about the company prior to the internship. Moreover, as stated in the National Food and Agribusiness Management Education Commission (NFAMEC, 2006) review on the state of agribusiness education, a benefit that accrues to industry from internships is the potential retention of the best and brightest students in the agribusiness industry (not simply the company involved).

Many companies do not offer internships, or may do so only sporadically. Internships can be time consuming to manage and students may receive more benefit than does the company. This is particularly true for small or medium-sized companies that have not previously hosted interns. For these reasons it is particularly useful to develop a relationship with a company and to develop an internship program as a partnership. Doing so helps to institutionalize the program and makes it easier and less time consuming to manage.

There is also a cost to academic departments wishing to implement an internship program. Industry partners need a consistent contact within a department to gain access to the best students in a timely fashion. This requires a department to devote resources such as a faculty member or staff person to coordinate such a program. Recent experience with the departmental advisory committee of the Food and Resource Economics Department at the University of Florida made it clear that industry prefers a single faculty member who can be the sole contact for internships and job placement.

Mentoring

There are few formal industry-student mentor programs in the field of agribusiness. One such program is offered by Santa Clara University's Food and Agribusiness Institute (Baker, 1998). All students pursuing the Food and Agribusiness concentration within the MBA program are offered the opportunity to be assigned

an industry mentor. The major benefits for students include career counseling, the opportunity for practical experience through an internship, future employment opportunities, and networking.

Experience with the mentor program at Santa Clara University has been almost exclusively positive. Students are paired with mentors who are likely to be a good match and who already have a commitment to the institution. When a mentor pairing has not been successful it is usually because the mentor-student relationship simply did not develop. Managing a successful mentor program can be time consuming. Although some relationships take off immediately due to an aggressive response from either the student or mentor, this is often not the case. A successful mentor program should have a coordinator who will arrange for the students and mentors to meet, encourage students and mentors to pursue opportunities, such as company visits or internships, check in occasionally, and monitor the relationships to ensure that the objectives of the program are met.

Site Visits

Company visits are frequently requested by participants in programs offered by educational institutions, visitors, and students. While student motivation may be suspect (anything is better than sitting through another lecture), a visit to the field can enhance the classroom experience. Faculty members may schedule a site visit to illustrate the application of a particular method. It can break the monotony of lecture after lecture and help students better retain information. Additionally, in a field with an industry focus, it may provide students with their initial first-hand exposure to the industry.

While a few companies offer tours for individuals and groups, most companies do not. Because many firms are protective of their intellectual property, it is often difficult to arrange a company tour that does more than show a part of the process through a visitor window. It is extremely helpful to have a relationship with someone in the host company who will arrange a custom tour that is suited to your educational objectives.

In-Class Visits (Guest Speakers)

Perhaps the least costly and most common interaction between industry and students is in-class visits by industry members (or similarly, visits to student organizations such as an Agribusiness Club). The use of guest speakers is common practice in academics, particularly in the professional schools.

Typically, the individual industry member (or a team from a company) will travel to the university to meet with students in a classroom setting. Usually limited to approximately one-hour of contact time, the industry member often shares his or

her experiences, discusses the application of a particular tool or method, presents information about the industry or company, and, sometimes, offers information about job and internship opportunities with his or her company. The principal benefit for the company is the opportunity to spend time with students to promote his or her company and to encourage students to pursue activities that will make them better potential employees and therefore more marketable. Industry executives will frequently encourage students to pursue internships, become a member of an industry club, or take a leadership role in an organization. Depending on the location, the cost of in-class visits is limited to travel costs, the time the speaker must spend away from the office, and the time to prepare the presentation.

Students typically enjoy industry speakers, especially when the both the instructor and speaker have worked to ensure that students will benefit from the presentation. This involves some coordination on the part of the instructor and speaker to ensure that the speaker understands the instructor's expectations and is prepared to meet them.

As with other forms of industry-academic interactions, arranging for a guest speaker to visit the classroom is easier when a relationship exists between the prospective speaker and the faculty member or institution.

Industry Advisory Boards

Industry advisory boards provide a convenient mechanism for faculty members and departments to connect with industry. As the name implies, the board is made up of members working in, or sometimes retired from, industry. As such, industry advisory boards are best suited to benefit universities in those areas where industry has the most to contribute in either knowledge or resources. These include fundraising, jobs, internships, site visits, guest speakers, and curricular matters. Since some of these activities have been addressed in previous sections, in this section we will focus on the contribution advisory boards can make to fundraising, curriculum review, as well as providing some insights on effective use of advisory boards. Although we refer to industry advisory boards with reference to a department, the discussion applies equally well to advisory boards for a college, school, institute, or other academic unit.

Fundraising

Fundraising is one of the key uses of advisory boards. People working in industry, particularly company owners, are at the intersection of those people with the financial resources and the inclination to support academic departments. Benefactors often wish to support a particular disciplinary area by providing scholarships, professorships, or research funds in an academic area related to their business. Advisory boards may be used to cultivate relationships with potential

donors, allowing them to become familiar with an institution and its people, and eventually strengthen their ties to the institution, its faculty, and its administration. A position on an advisory board may also be a way to thank a donor for his or her contribution to the organization. For many people in business it is an honor to serve on an advisory board.

Curriculum review

If you ask industry professionals for advice on curriculum you'll get no shortage of answers. Of course, it's in their self-interest to suggest that students be trained with the skills that their organizations need. However, colleges and universities are more than training grounds for future employees. They are also charged with providing a broad-based education that will prepare students for a lifetime of learning. For departments whose students earn professional degrees, the challenge is to provide students with an education that fulfills the general education requirements of their institution as well as the required professional skills. This has become more complicated as the amount of knowledge continues to expand and what is expected of students continues to increase.

There are several ways to obtain industry input on the curriculum. Industry leaders are often invited to participate in program reviews, such as those conducted by accrediting agencies. Industry input may also be solicited directly from academic departments. Advisory boards are particularly helpful with the latter. Board members will typically be familiar with the department, its programs, and its students and graduates. It goes without saying that they will be well-informed as to what graduates need to be successful on the job. Advisory board members may be surveyed regarding the curriculum or they may be invited to serve on committees or study groups that are charged with reviewing the curriculum. Because faculty members are ultimately charged with overseeing the curriculum, it is helpful to be clear that the role of the advisory board is to provide input and recommendations, but that the responsibility for the curriculum rests with the faculty.

Insights for Managing Advisory Boards

As discussed in the above paragraphs, industry advisory boards serve a variety of purposes. The functions of the advisory board should determine the composition and organization of the advisory board. It is our experience that the most effective board members have a commitment to the institution. They are the most likely to agree to serve, attend meetings, and contribute time and resources to the institution. Departments with a long history, many alumni, and established relationships with industry will find it easier to attract highly qualified board members. When these criteria are not met, it will be more difficult to attract qualified board members and early efforts should focus on establishing relationships that will establish a foundation for a strong board.

The structure and organization of the advisory board will determine how much control the department has over the board. Because of the advisory nature of the board the department typically has a great deal of control over appointment of members, setting the agenda, establishment of committees, and other important matters. Often advisory board members will have little experience serving on such boards and will rely on faculty members or administrators for guidance. This puts responsibility for the success of the board squarely in the hands of the department. We have found that the following guidelines will result in effective use of the advisory board and ensure that both board members' and faculty members' time is well-utilized:

- set high expectations – successful people are used to meeting challenges;
- organize the board into working groups that match the major functions of the board, such as fundraising, curriculum review, industry relations, etc. – the difference between a working group and committee should be more than semantic and should imply an expectation for results, which will be appreciated by industry professionals;
- leverage board members' positions in industry to draw on the time and resources of other influential industry people;
- ensure that the board meetings are run efficiently and that they are more than an opportunity for the department to report to the board; board members should have an opportunity to make a contribution.

Concluding Remarks

In this article we present an in-depth discussion of opportunities for industry-academic partnerships. For a brief summary of the various types of collaboration and the key advantages and disadvantages of each the reader should refer to Table 1 *(see Appendix).*

The focus of this article is on describing the opportunities for collaboration between faculty members (or departments) and industry and the benefits and pitfalls associated with each type of collaboration. In most cases, we conclude that developing industry-academic partnerships can result in substantial dividends for both industry and faculty members when both the pros and cons are taken into consideration in planning the collaboration. We close this article with some insights we have gained for managing partnerships between academia and industry.

Collaboration with industry can be particularly fruitful for young researchers. This is especially true in an applied discipline such as agribusiness management. Industry managers have much to contribute to the discussion, including ideas for research problems, access to hard-to-get data, and funding or research studies. From the faculty member's perspective, it is important to structure such collaborations such that the results are broadly applicable, objective, and publishable.

Industry collaboration can also enhance a faculty member's teaching program. Interaction with industry managers will inevitably result in a lively discussion of what is important and relevant. Industry managers can help faculty members understand their most pressing problems and the tools students need to be successful in the workplace. Collaboration with industry can also be a rich source of ideas for classroom examples and data for problem sets that will make the teaching environment more relevant and interesting.

Finally, industry advisory boards are an effective mechanism to engage industry managers and executives and initiate many of the types of partnerships discussed in this article. A position on an advisory board involves a commitment on the part of all members. Advisory boards are effective at strengthening ties between faculty members and industry managers and can result in contributions from the industry member in many areas, including research projects, fundraising, curriculum review, student employment, internships, and in-class visits.

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Appendix:

Table 1: Key Dimensions of Industry-Academic Partnerships

	Joint and industry sponsored research projects	Long-term student-centered projects with industry	Short-term student-centered projects with industry	Sabbatical leaves with industry	Consulting	Outreach	Internships	Mentoring	Site visits	In-class visits	Industry advisory boards
Company ability to learn about potential employee	Depends on project	High	Medium	N/A	High	High	High	Medium	Low	None	Depends on interest
Company benefit in solving a problem	High	High	Low-Medium	High	High	Medium-High	Low	None	None	None	N/A
Student exposure to potential employer	Depends on project	High	Medium	N/A	N/A	N/A	High	Medium	Low	Low	Depends on interest
Insight gained for student	Depends on project	High	High	N/A	N/A	N/A	High	Medium	Low	Low	N/A
Investment cost to set up effective program	Medium	Medium	Medium	Medium	Medium-High	Depends on program	High	Medium	Low	Low	Low
Financial cost to company	High	High	Low	High	High	Low-Medium	Low-Medium	Low-None	Low	Low	Low
Company time commitment	High	High	Medium	High	High	Depends on program	Medium	Low	Low	Low	Low
Risk of variability in quality of information gained from company	Low	Medium	High	Low	Low	Low	High	N/A	Low	N/A	N/A
Cost to student	N/A	Low	Low	N/A	N/A	N/A	Medium	Low	Low	None	N/A
Cost to university of partnering	Low	Low	Low	Medium	N/A	Depends on program	Medium	Low	Low	Low	Low