

Three Essays on the Role of Ownership in the Food Economy

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## **Dedication**

This dissertation is dedicated to Marybeth, Emerson, and any other future children that grow our family. They are my motivation, support, perseverance, comic relief, and the loves of my life.

## **Abstract**

This dissertation helps to determine the role of ownership and the ways in which firms interact in the food economy. The three essays in this dissertation show how ownership structure affects the decisions of entry and exit, the pricing of retail food products, and where and how to locate international food economy firm operations. The first essay examines the entry and exit decisions of cooperative and non-cooperative firms into the U.S. corn-ethanol industry. This essay finds that cooperatives enter the industry sooner and exit later. This was partly due to policy driven incentives. The second essay analyzes the differential impact of a food retail acquisition on national brand and store brand prices. This essay finds that the acquiring retailer is likely able to exert market power in branded product categories such as Ready-to-Eat cereal, but not in homogeneous product categories such as fluid milk. The third and final essay explores the impact of changing governance institutional ownership and how the quality of institutions affect foreign investment decisions of food economy firms interested in locating operations in a foreign country. The essay finds that new economic policies, LEAP zones, can reduce risks for food economy firms by improving governance institutions. However, a case study of its implementation in Honduras shows that they can be hard to execute in practice and may lose many of the potential benefits accordingly.

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## **Chapter 1. Introduction: How do & how should firms compete in the food economy?**

The simple question in this chapter's title is one in which a pressing need exists for an answer as the food economy changes over time. There are three important changes that have an impact on food economy firms: policy changes, higher concentration, and more coordination. Three important policy changes are the Renewable Fuels Standard, the Food Safety Modernization Act, and discussions of changes in antitrust policy with regard to buyer power as evidenced in the 2008 presidential campaign. Policy changes may make different relationships between food economy firms more beneficial and others more costly. Moreover, it may make some industries more profitable changing existing inter-firm relationships and creating new ones.

Over the last twenty years or so, the food value chain has become more highly concentrated at each stage. For example, in the United States farmland has become more concentrated since the 1980s (MacDonald, Korb, & Hoppe, 2013), meat processing and fluid milk processing concentration ratios have increased (U.S. Department of Agriculture Economic Research Service, 2014a), and food retailers have become more concentrated with a nationwide reach since the early 1990s (U.S. Department of Agriculture Economic Research Service, 2014b). This creates a different setting in which firms interact. Today's food economy transactions rarely take place in a setting of many potential buyers and many potential sellers. At least one side of this buyer-seller relationship is typically constrained to just a few firms or individuals potentially exhibiting oligopsony or oligopoly power. This is particular true for farm inputs, food retailing, and food manufacturing. As this concentration has moved the food economy

from the many-to-many to a few-to-few transaction system, studying the interactions between firms has become increasingly important.

Finally, as the world population grows and the locations of major food demand shifts globally, more supply chain coordination across countries is required to produce and distribute food to those demand centers. The interactions between firms change and adapt as they work more closely together. As coordination increases in a new policy environment with higher concentration, the ways in which firms do and should interact requires analysis to ensure the food economy is meeting the dietary needs of the world.

### 1.1 Background

Although the question in the title is simple, the answer is immensely complex and nuanced. In this case, the economist's favorite answer is the simplest one – it depends. The answer depends on the industry, the relevant policies, the interaction under study, the timing and location of the interaction, and the firms involved. Due to its complexity and importance, this question has received a tremendous amount of study.

In a general setting, the theory of the firm literature is a core area of research. Nobel laureates Ronald Coase and Oliver Williamson among others<sup>1</sup> have made significant contributions to this field. In this literature, the focus is on how to organize production of a good or service: should it be made in-house or should it be bought from the market? This make-or-buy decision is critical in defining the vertical boundaries of the firm – the boundaries that define what a firm does. Moreover, it defines how firms interact vertically with others, including by interacting as a competitor (i.e., deciding to

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<sup>1</sup> These others include Armen Alchian, Michael Jensen, William Meckling, Nobel laureate Eugene Fama, Oliver Hart, John Moore, Sanford Grossman, Bengt Holmstrom, and John Roberts.

make). In the food economy, firms pursue several different strategies for this make-or-buy decision even within the same industry. This dissertation helps to explain some of this make-or-buy behavior.

The extensions of this make-or-buy decision permeate through many areas of inquiry. These extensions include entry-exit decisions, backward integration, and international location decisions. Each of these areas have several questions that can be analyzed. For example, under the backward integration topic, questions include the following. Should a firm integrate backwards, and if so, how should a firm integrate backwards? What are the effects on downstream buyers if a firm integrates backwards? What happens to the competitors of a newly integrated firm? This dissertation contributes to the literature on make-or-buy decisions in the U.S. corn-ethanol and food retailing industries (Chapters 2 and 3), and international location decisions for multinational food economy firms (Chapter 4).

## 1.2 Objective

The objective of this dissertation is to determine the importance of ownership and the ways in which firms interact in the food economy. The three essays in this dissertation show how ownership structure affects the decisions of entry and exit, the pricing of retail food products, and where and how to locate international food economy firm operations. The first essay examines the entry and exit decisions of cooperative and non-cooperative firms into a highly uncertain market. The second essay analyzes the differential impact of a food retail merger on national brand and store brand product prices. The third and final essay explores the impact of changing institutional ownership and how the quality of

institutions affect foreign investment decisions of food economy firms interested in locating operations in a foreign country.

### 1.3 Essay Summaries

#### *1.3.1 Ethanol Plant Investment: Impacts of Policy, Real Options, and Ownership Structure*

Beginning in 2002 and continuing through subsequent Farm Bills in the Rural Development title, policymakers authorized and developed funds to encourage the development of a corn-based ethanol industry with producer ownership. By 2014, 14% of the corn-ethanol capacity was owned by producers through cooperatives or limited liability companies. Hundreds of millions of dollars were authorized and appropriated to encourage this development. In addition, state governments, land grant universities, and others made public-private investments to support this industry. The objective of this essay is to review these policies and describe the pattern of investment behavior in this industry using a real options analysis. The results suggest that encouraging the development of an industry through business development policies may lead to unintended outcomes.

#### *1.3.2 Impacts from a Retail Grocery Acquisition: Do National and Store Brand Prices Respond Differently?*

This essay investigates the extent to which a grocery retailer merger has different effects on the prices of national and store brands. Mergers and acquisitions could increase the market share of the acquiring retailer's store brand relative to national brands in a food category. Studying the differential effects of the merger on national and store brand

prices is essential to understanding whether growth of store brands contribute to grocery retailer market power. Using retail scanner data, an ex-post analysis is performed of a food retail acquisition in a large United States city in 2012. This essay focuses on fluid milk and ready-to-eat (RTE) cereal categories, which represent a relatively homogenous and a relatively differentiated product category, respectively. Due to the unique nature of the acquisition, the effect of the acquisition on prices is identified for the acquiring retailer using a difference-in-difference estimation framework. The results indicate that on average the acquisition decreased fluid milk and RTE cereal prices by approximately 0.3% and 0.6%, respectively. Milk prices decreased similarly across national brand and store brand products. However, in the RTE cereal category the national brand prices decreased, while store brand prices increased. These results provide evidence that the growth of store brands contributes to grocery retailer market power in differentiated product markets.

### *1.3.3 Charter City Development: Benefits and Costs for Countries and Firm Decisions*

Special economic zones have boomed in popularity since the mid-1980s and the success of one of the most famous of such zones, Shenzhen, became apparent. However, not all special economic zones are successful, and they often fail due to underlying institutional problems rather than the changed economic policies. New LEAP zones or charter cities aim to solve this problem by allowing the zones to choose not just economic policies, but entire judicial, legal, administrative, and political systems. This essay finds that these new LEAP zones are unique and new geo-political zones. The LEAP zones have a governance institutional ownership structure unlike other areas like federalist states, colonies, or other

economic zones. The essay also finds that these LEAP zones and all economic zones create benefits and the costs. These benefits and costs imply that there are a hierarchy of economic zones with LEAP zones being prescribed when the country has poor economic policy and poor economic and governance institutions. Additionally, the essay describes the firm decision process in locating internationally, especially with regards to food economy firms. Location-specific risks play an important role in how and where multinational firms locate operations, and new LEAP zones may reduce these risks.

Finally, the essay applies the results from the general analysis to Honduras's LEAP zone-like economic areas called ZEDEs. Although ZEDEs are not true LEAP zones because the governance owners lack a direct feedback with the ZEDE's stakeholders, multinational food economy firms are likely to be very interested in the creation of these ZEDEs as they potentially reduce important risks surrounding contract enforcement, property rights protection, and production.<sup>2</sup>

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<sup>2</sup> Note that this dissertation was withheld from the public domain, and the work herein reflects the analysis as of December 2015. Subsequent publications may contain updated discussion and results.

## **Chapter 2. Ethanol Plant Investment: Impacts of Policy, Real Options, and Ownership Structure**

In 2001, United States (U.S.) policymakers began the creation of favorable state and federal policies designed to encourage the development of producer-owned corn-ethanol plants.<sup>3</sup> This was a response to states banning methyl tertiary-butyl ether (MTBE) as a fuel oxidizer. The 2005 Energy Policy Act created the Renewable Fuels Standard (RFS) which created a mandate for bio-based fuels such as ethanol. The corn-ethanol production industry increased capacity drastically with the prospects of high ethanol-corn margins (Urbanchuk, 2010).

Land grant universities developed programs to assist with the business development of “value-added” agriculture. Boland, Crespi, and Oswald (2009, p. 108) described the response of agricultural and applied economics programs in endowments, faculty positions, and similar activities. Agricultural science programs responded with research, development, and education investments. States began their own business development programs to help support producer-owned corn-ethanol plants and value-added activities.<sup>4</sup> State legislatures changed incorporation statutes to redefine producer-owned businesses to make them look more like a hybrid of traditional cooperatives and limited liability structures (Boland, Bosse & Brester, 2007). De Gorter and Just (2010) discussed the literature with regard to ethanol policy but none of their cited studies noted

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<sup>3</sup> In 2001, several of these programs were actually created and provided but they became institutionalized in the Rural Development title of the Farm Bill with hundreds of millions of appropriations since 2001.

<sup>4</sup> For example, state legislatures allowed non-producer equity in certain types of cooperatives, many land grant universities changed the names of historically departments of agricultural engineering to include words related to bio-based, and a number of states appropriated funds for rural business development initiatives.

the issue of producer-ownership or the topic of business development.

The objective of this essay is to describe the creation and development of the corn-ethanol industry taking into account its ownership structure. An asset investment decision model for this industry is developed using a discounted cash flow approach (net present value approach or NPV) and a real options (RO) approach. Both of these methods are commonly used by firms in making asset investment decisions. The research contributes to the real options literature by better modeling the stochastic process of gross margins using capital cost data broken out by ownership type.

Given the significant public-private investments, an orderly development of the U.S. corn-ethanol production industry might have been expected. However, this did not occur. By 2008 margins fell to pre-2005 levels due to corn price increases reflecting the increased demand for corn as investors began constructing new ethanol plants.<sup>5</sup> This margin squeeze resulted in many ethanol producers going out of business, changing ownership structure, or not building announced plants. The corn-ethanol industry began with most plants owned by producers through cooperatives. However, in 2014, only 14% of the capacity was owned by producers (Renewable Fuels Association, 2014).

Furthermore, this capacity was scattered in no clear economic pattern across the United States. This was in contrast to capacity owned by corporations (e.g., POET, Valero, ADM, etc.) which tended to be larger with regard to capacity and had economies of scope in production, transportation, and logistics (Boone & Özcan, 2014). It is important to understand why producer and non-producer investors entered and exited this

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<sup>5</sup> Although other factors impacted corn prices at this time, Wright (2014) notes that biofuel demand was, and continues to be, the most important driver in determining grain price changes since 2005.

industry. This understanding provides policymakers with insights into industry development and whether such policies achieve their purpose.

## 2.1 Overview of the Corn-Ethanol Industry

This is not the first time a food economy industry has seen large increases in processing plant capacity and increases in entry by new firms followed by a decrease in profitability and exit of firms. Schumpeter (1975) called this creative destruction. The beet sugar industry in 1967 to 1973 and corn sweetener industry in 1994 to 1998 are two examples of industries where this type of behavior has been observed. These two industries were impacted by changes in demand and government policy decisions. The beef slaughter industry and butter industry saw an increase in capacity and plants and exit of higher-cost plants in the 1978 to 1984 and 1919 to 1926 time periods, respectively, which was driven by introduction of boxed beef technology and butter-making technology. Similarly, milling of durum wheat into semolina flour for use in pasta manufacturing was driven by vertical integration of milling and manufacturing which led to the exit of non-vertically integrated plants in the mid-1990s. In all of these cases, there was rapid expansion in the number of plants and capacity followed by an exit of older plants and their capacity.

Before the late 1990s, the corn-ethanol industry remained small. It grew in response to oil supply shocks (e.g., World War II, 1970s energy crisis) or low periods of corn prices. Any significant growth was not permanent (Solomon, Barnes, & Halvorsen, 2007). The Rural Development title programs, MTBE bans, and RFS policy have created a sustained industry. Agricultural business development programs are administered through the U.S. Department of Agriculture's Rural Development office. These programs

include competitive grants, loans, and technical assistance to fund various aspects of business development for bioenergy plants and operations. For example, Oswald (2008, p. 9, Table 1.1) lists almost \$240 million in funds appropriated for bio-energy programs. Boland, Crespi, and Oswald (2009) note that 112 projects were funded through the Value Added Producer Grants program over the 2001 to 2006 time period with the vast majority going towards the development and construction of corn-ethanol plants. The U.S. Department of Energy assumed responsibility for additional grant, loan, and technical assistance programs for bioenergy in 2009.

It is clear that policymakers encouraged the development of a corn-ethanol industry with producer ownership. However, the effectiveness of these funds at creating producer-owned firms in the corn-ethanol industry is less clear. The goal of policymakers by encouraging the development of an industry owned by producers was vertical integration. Theoretically, this was to encourage forward integration from corn production into ethanol production so producers owned more of the marketing margin.<sup>6</sup>

By the end of 2008, gross margins returned to pre-2005 levels. As a result, some corn-ethanol plants were never built, mothballed, or sold to new owners at a significant discount. For example, CHS, Inc., the world's largest producer-owned cooperative based on sales volume, wrote off almost \$74 million in its investments in US BioEnergy which later became part of VeraSun and exited the ethanol industry in 2008. Because the industry was not economically sustainable above the RFS, some of this valuation decline

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<sup>6</sup> It should be noted that the rhetoric used by some policymakers often confused the words "farmer's share of the retail dollar" with the rationale for value-added activities or marketing margin. Atchley (1956) and Brester, Marsh, and Atwood (2009) show why this rhetoric is erroneous.

was likely due to economic obsolescence (Boland, Crespi, & Turner, 2014) or stranded capital (Wilén, 2009).

The structure of the industry changed dramatically during this period. The corn-ethanol industry shifted from 25% of capacity operated by producers in 2002 to a high of 36% in 2007, and a low of 14% in 2014. As a share of the number of companies, a similar, but less dramatic pattern arises. In 2002, over half (52%) of firms producing ethanol were producer-owned. By 2005, 57% of firms were producer-owned. In 2014, less than one-third (29%) were producer-owned (Renewable Fuels Association, 2014). The size of the ethanol plants coming online were not trivial in 2008. The average size of a plant increased from 145.66 million liters per year in January 2002 to 279.67 million liters per year in January 2009 (Renewable Fuels Association, 2015).

The over-expansion behavior seen in the corn-ethanol industry seems irrational. Sandmo (1971) shows that in an uncertain environment, risk averse producers will produce less in any industry. However, just the opposite occurred with regards to ethanol production. With the benefit of hindsight, it is easy to see that corn-ethanol production capacity grew too quickly. The method of real options takes the value of waiting to gain further information into account when evaluating investment decisions. It is well known that the NPV approach underestimates the value of waiting to expand production because future input and output prices are uncertain. With perfect information, a RO approach to estimate the return on investment would have valued this wait option properly.

## 2.2 Literature Review

In January 2015, the University of Minnesota's AgEcon Search shows 254 papers written

since 1996 using the search words “real options” in their title or abstract. These papers show the methodology being applied in the late 1990s and early 2000s with increasing use in environmental and resource economics since 2004. The vast majority of these papers are professional society selected papers, working papers, and other similar types of research. In general, these papers tend to use the RO approach in two types of analyses. The most common type of analysis is to evaluate potential investments using the RO approach. Examples of this research include milking systems (Engel & Hyde, 2003), pest populations (Saphores, 2000), German hog finishing systems (Odening, Musshoff, & Balmann, 2005), methane digesters (Stokes, Rajagopalan, & Stefanou, 2008), alternative cropping systems (Song, Zhao, & Swinton, 2011), California farmer and water investments (Carey & Zilberman, 2002), and forest systems in Alberta (Duku-Kaakyire & Nanang, 2004). The second type of research to use the RO approach is industry analyses using aggregated firm-level data. However, these studies do not do the aggregation themselves. For example, Stiegert and Hertel (1997), who were the first to introduce the Pindyck (1988) RO approach to the agricultural economics literature, use the RO approach to study anhydrous ammonia capacity.

These studies are useful because they show that a RO approach tends to suggest that investors wait to invest relative to what an NPV analysis suggests. Simulated data help show why the RO model yields different results and are useful to explain why certain investments require a high hurdle rate. Industry data is useful because it helps explain why an industry evolved in the way it did. A missing piece in this literature is a study that uses firm-level data within the same industry to analyze the impact of

individual firm behavior. This is especially important when using NPV and RO because the cost of capital is a critical input in these models.

The ideal method is to calculate an individual firm's weighted average cost of capital (WACC) rather than utilize a standard cost of capital for all firms. Such firm-level data can come from public databases such as Standard and Poor's Compustat data which has been used to analyze industry and firm effects (Schumacher & Boland, 2005), firm diversification (Dorsey & Boland, 2009), and corporate effects (Chaddad & Mondelli, 2013). However, this dataset lacks information on closely-held firms which include cooperatives, family-owned firms, and private firms.<sup>7</sup> The food economy has the second greatest number (as a percentage) of closely-held firms (Anderson & Reeb, 2003; Boland, Golden, & Tsoodle, 2008). Thus, studies using firm-level data should account for the food economy's ownership structure.

The corn-ethanol industry is widely studied with regard to capital investment decisions. Schmit, Luo, and Tauer (2009) calculated gross margins (ethanol price minus corn price) at which levels potential investors should build plants and when current plant owners should exit. These trigger margins are obtained by a RO analysis and compared to those obtained using a NPV analysis. They conclude that if margins continued to decrease in 2009, plants would exit and current construction plans would be delayed. Moreover, if margins become more variable, owners and investors would delay exiting or investing.

Pederson and Zou (2009) modeled the decision of a representative firm to expand

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<sup>7</sup> A European dataset Amadeus by Bureau van Dijk has such data on some EU firms since 2004, and Compustat has data since early 1980s.

or not expand production capacity. The authors use Monte Carlo simulations to obtain the value of the option and the value of the expanded capacity. They report that as price volatility increases the value to wait increases, which explains lower plant investment in late-2007 and early-2008. Cai and Stiegert (2014) calculated optimal capacity levels and conclude that the corn-ethanol industry expanded above an optimal level.

This essay contributes to this literature by incorporating firm heterogeneity into industry-level data and by better modeling gross margin changes over time. This paper expands on Pederson and Zou (2009) by finding trigger margins via dynamic programming techniques instead of using simulations. It extends Cai and Stiegert (2014) by incorporating ownership-linked WACC which accounts for differences across ownership structure. This research improves on Schmit, Luo, and Tauer (2009) by using an alternative stochastic process, Arithmetic Brownian motion, which appears to better explain the pattern of gross margins. This is conceptually different from the Geometric Brownian motion process used by most researchers.

### 2.3 Formal Model

The RO model is first described and advocated by Dixit and Pindyck (1994) in their seminal book, *Investment Under Uncertainty*. The basic premise of the RO approach is that when individuals or firms are presented with an investment opportunity, they have the option to invest in it, and this option has value. Once they decide to invest in the opportunity, the option is exercised. Therefore, when evaluating an investment opportunity, individuals and firms should take this option value into consideration. Using a RO framework takes this option value into account, but the more well-known NPV

approach does not value this option. As it pertains to ethanol plants, investors must account for the “real option” of investing at the current time in addition to the operating returns and potential scrap value of the plant.

The investment decision problem facing investors and plant owners is inherently dynamic because, at a given moment, the investor or firm must decide a course of action which depends on future ethanol-corn gross margins (ethanol price less corn price).<sup>8</sup> Because of this, the investment problem can be solved using dynamic programming. Moreover, because future gross margins are uncertain, stochastic-dynamic programming methods are needed.

Let  $f(\theta, k)$  represent the current net profit (gross margins less other fixed and variable costs) per liter to the firm where the gross margin is  $\theta$ . The firm is in a life cycle stage,  $k$ , where there are three investment or operational stages: waiting ( $w$ ), mothball ( $m$ ), and operation ( $o$ ). Net profits are gross margins plus co-product sales (if any) less costs other than corn (e.g., labor, energy, and upkeep costs).  $V_k(\theta)$  represents the value accruing to the investor or firm. The deterministic part of  $\theta$  is  $g(\theta, k)$ ,  $h(\theta, k)$  is the stochastic part of  $\theta$ , and  $dz$  is a basic Weiner process. Combining  $g(\cdot)$ ,  $h(\cdot)$ , and  $dz$  yields the following for  $\theta$ :

$$(1) \quad d\theta = g(\theta, k)dt + h(\theta, k)dz.$$

The following Bellman equation represents the value of being in stage  $k$  under the assumption of an infinite time horizon:

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<sup>8</sup> One can model corn and ethanol price uncertainty separately in this model instead of using the gross margin. This would account for changes in the relationship between these two price series. However, to keep with previous literature, this essay uses the gross margin.

$$(2) \quad \begin{aligned} V_k(\theta) &= f(\theta, k) + E[V_k(\theta + d\theta)e^{-\rho dt}] \\ \text{subject to: } d\theta &= g(\theta, k)dt + h(\theta, k)dz, \end{aligned}$$

where  $\rho$  be is the discount rate and  $E[\cdot]$  denotes the expected value operator. Because  $d\theta$  is an Ito process, the Bellman equation can be rewritten using Ito's Lemma as the following:

$$(3) \quad \begin{aligned} \rho V_k(\theta) &= f(\theta, k) + g(\theta, k)V_k'(\theta) + \frac{1}{2}h^2(\theta, k)V_k''(\theta) \\ \text{subject to: } d\theta &= g(\theta, k)dt + h(\theta, k)dz. \end{aligned}$$

Equations 2 and 3 show that the value of being in stage  $k$  is based on the current net profit and the expected discounted value of future net profits of being in stage  $k$ .

Moreover, Equations 2 and 3 show that the value of being in a particular stage depends on current gross margins and future gross margins, where future gross margins are determined by  $d\theta$ . While this is interesting, it does not directly prescribe what action investors and plant owners should take. These value functions are used to derive trigger margins as the value of being in a particular stage depends on gross margins. Formally, these trigger margins indicate when the investors or plant owners should switch stages. Trigger margins are levels of gross margins that indicate when to invest in, mothball, reactivate, or close an ethanol plant.

Two conditions must hold at each trigger margin: the value-matching and smooth-pasting conditions. The value-matching condition requires that the value of being in the two alternative stages, including switching costs, be the same at the trigger margin. That is, the value functions must be continuous at the trigger margin. This is intuitive. If the value of entering is larger than the value of waiting at the trigger margin, then the

investor loses by not entering sooner when the margin was lower. Although smooth-pasting is less intuitive, it is straightforward. The smooth-pasting condition requires that the derivative of the value functions of being in two alternative stages be equal at the trigger margin.

Suppose there is a trigger margin,  $\theta_k$ , between stages  $k_0$  and  $k_1$  and that it costs  $S$  to switch from stage  $k_0$  to  $k_1$ . Then, the trigger margin must satisfy the value-matching and smooth pasting conditions. These are

$$(4) \quad V_{k_0}(\theta_k) = V_{k_1}(\theta_k) - S$$

and

$$(5) \quad V'_{k_0}(\theta_k) = V'_{k_1}(\theta_k),$$

where the first equation is the value-matching condition and the second equation is the smooth-pasting condition.

### *2.3.1 Geometric Brownian Motion, Arithmetic Brownian Motion, and the Ornstein-Uhlenbeck Process*

An assumption is needed about the particular Ito process that gross margins follow. Three alternative processes considered in this essay are Geometric Brownian motion (GBM), Arithmetic Brownian Motion (ABM), and the Ornstein-Uhlenbeck mean-reversion process (OUMR).

Most RO analyses use the GBM process to model how the value of an investment opportunity changes over time. The GBM process is popular because many stock and commodity prices follow this process as Nobel laureate Eugene Fama (1965) notes. Moreover, this assumption provides an analytical solution to the value functions and the

associated trigger prices. An important property of the GBM process is that the value of an investment is never negative. This property is useful when studying the prices, but it is fundamentally problematic when analyzing margins. Clearly, margins can be, and often are, negative. This means that any analysis is flawed when using margins as the value of the investment under study and a GBM process. This fundamental shortcoming of the GBM process as it applies to margins implies that the derived trigger margins using it are incorrect. In the case of ethanol plant investment, the ethanol-corn margin is negative for several months between 1982 and 2014.

A natural alternative to the GBM process that does not have the non-negativity property is the ABM process. It is easiest to see the differences between the two properties by looking at equations. Assuming ethanol-corn margins follow GBM implies that the Ito process takes the following form:

$$(6) \quad d\theta = \alpha\theta dt + \sigma\theta dz,$$

where  $\alpha$  is a drift parameter and  $\sigma$  is a volatility parameter. Alternatively, assuming ethanol-corn margins follow ABM implies that the Ito process takes the following form:

$$(7) \quad d\theta = \alpha dt + \sigma dz,$$

This representation shows why the GBM process has the non-negativity property and the ABM process does not. The ABM process models the change in margins as changes in levels, while the GBM process models the change in margins as proportional changes. Proportional changes only make sense when the underlying values are always non-negative or always non-positive. In contrast, changes in levels do not have this requirement. Therefore, because margins can be positive and negative, the ABM process

better models ethanol-corn margins than the GBM process.

The OUMR process is the final process considered here. Assuming ethanol-corn margins follow an OUMR process implies that the Ito process takes the following form:

$$(8) \quad d\theta = \eta(\bar{\theta} - \theta)dt + \sigma dz,$$

where  $\bar{\theta}$  is the normal value of the gross margin to which it reverts and  $\eta$  is the degree of mean reversion. The OUMR process can be seen as a mean-reverting ABM process. It is important to consider this process because margins typically will not continue to increase or decrease indefinitely due to market entry or exit. If margins were exceedingly high, new firms would enter the market. As the new firms enter the market, they increase the demand of the main input (corn), while simultaneously increase the supply of the output (ethanol). These changes in supply and demand will increase the price of the input (corn) and decrease the price of the output (ethanol), thus lowering margins. The opposite occurs when margins are exceedingly low and current firms exit the market. Therefore, this process must be explored as a potential way in which ethanol-corn margins change overtime. Note that no analytical solution can be obtained under this assumption, and so numerical methods are required. Under all three Ito processes, the parameters  $\alpha$ ,  $\sigma$ ,  $\eta$ , and  $\bar{\theta}$  can be obtained from gross margin data.

## 2.4 Empirical Model

### 2.4.1 Plant Parameters

As investors or plant owners switch investment or operational stages, they incur fixed costs of switching. To switch from waiting to operating, investors incur construction costs,  $I$ . To switch from operating to mothballing, plant owners incur mothballing costs,

$M$ ; and, switching from mothballing to operating incur reactivation costs,  $A$ . To exit the market from mothballing, a switch from mothballing to waiting, plant owners incur exit costs of  $X$ . Note that exit costs should be non-positive because the plant can be sold for scrap. All other costs are non-negative.

For each stage, the net profits are different. Under the waiting stage, the net profits are zero. Under the operating stage, the net profits are gross margins less constant, per-unit operating costs,  $oc(I)$ . Under the mothballing stage, the net profits are constant, per-unit upkeep costs,  $uc(I)$ , or

$$\begin{aligned}
 f(\theta, w) &= 0 \\
 (9) \quad f(\theta, o) &= \theta - oc(I) \\
 f(\theta, m) &= -uc(I)
 \end{aligned}$$

#### 2.4.2 Trigger Margins, Revisited

Below is a discussion of the entry trigger margin; the same discussion for mothballing, exit, and re-entry follow in a parallel fashion. The gross margin that sets the value of waiting equal to the value of the operating ethanol plant less any sunk costs (i.e., construction costs) is the RO entry trigger margin,  $\theta_e$ . The value of the operating ethanol plant is

$$(10) \quad V_o(\theta; I) = \theta - oc(I) + E[V_o(\theta + d\theta)e^{-\rho dt}].$$

The value of waiting is the option value. This yields

$$(11) \quad V_w(\theta; I) = OV(\theta; I) = E[V_w(\theta + d\theta)e^{-\rho dt}]$$

Including the investment switching costs,  $I$ ,  $\theta_e$  is the gross margin such that

$$(12) \quad V_w(\theta_e; I) = V_o(\theta_e; I) - I$$

$$(13) \quad V'_w(\theta_e; I) = V'_o(\theta_e; I).$$

where  $V_w(\cdot)$  and  $V_o(\cdot)$  are the value of waiting and the value of operating, respectively.

The gross margin that sets the value of the mothballed plant equal to the value of exiting the industry less any sunk costs associated with exit is the RO exit trigger margin,  $\theta_x$ . The value of exiting the industry is the option value of re-entering or the value of waiting. Similar equations to those for the entry trigger margin can be obtained for the exit trigger margin. Re-entry and mothball trigger margins can be constructed in a similar way as the entry and exit trigger margins discussed above. The NPV entry trigger margin is the gross margin that sets the value of the operating ethanol plant equal to the discounted investment fixed costs. The gross margin that equates the value of the operating plant and its discounted scrap value is the NPV exit trigger margin. In general, the RO entry (exit) trigger margin is larger (smaller) than the respective NPV trigger margins.

## 2.5 Empirical Strategy

Prior to obtaining the numerical trigger margins, parameter estimates are needed for each of the parameters in the ABM and OUMR Ito process equations. Once these parameters are obtained, trigger margins are estimated for three representative ethanol plants: small, medium, and large.<sup>9</sup> That is, a RO analysis is performed for a small, medium, and large plant, respectively, under the assumption that gross margins follow ABM. This is then

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<sup>9</sup>Schmit, Luo, and Tauer (2009) defined a small plant as a plant with capacity of less than 95 million liters per year; a medium plant produces between 95 and 227 million liters per year; and, a large plant produces more than 227 million liters per year.

repeated under the assumption that gross margins follow OUMR. This is done using the rrsolve solver program COMPECON toolbox in Matlab (Miranda and Fackler, 2002).

This analysis is repeated using the WACC in place of the discount rate, obtaining trigger margins for small, medium, and large plants broken out by ownership type for the ABM and GBM processes.<sup>10</sup> Additional analyses are performed updating ABM parameters each year using the ten previous years of data. The baseline and WACC analyses are repeated using data for January 1998 – December 2007, January 1999 – December 2008, and so on. This procedure refines the trigger margins, providing better explanations for observed market entry.<sup>11</sup>

These trigger margins for the medium-sized plant are compared to observed margins to determine if the behavior of investors and plant operators was consistent with the real options framework or the NPV approach during the mid-2000s. Finally, the analysis is redone for medium-sized plants under the ABM processes to determine how sensitive the results are to parameter values.<sup>12</sup> The medium-sized plant for these analyses because it represents an “average” plant. It also allows for clarity of explanation.<sup>13</sup>

## 2.6 Data

The production, fixed costs, and operating cost parameters used in this study are identical to Schmit, Luo, and Tauer (2009, p. 1447, Table 2) and are shown in Table 2.1. These

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<sup>10</sup> This analysis is performed for the GBM process to compare it to the ABM process. This is not performed for the OUMR process because the OUMR process does not fit the ethanol-corn margin data well.

<sup>11</sup> A graph of the results from the repeated WACC analysis can be found in Figure 2.7. They follow the same pattern as the baseline.

<sup>12</sup> Sensitivity analyses for the medium-sized plant under the GBM assumption are available in Schmit, Luo, and Tauer (2009).

<sup>13</sup> These analyses can be extended for small- and large-sized, and farmer- and non-farmer-owned plants in a straightforward way.

**Table 2.1.** Assumptions for operating, upkeep, and fixed costs by plant size

Cost (cent/liter)	Small	Medium	Large
Operating, oc (I)	11	9	9
Upkeep, uc (I)	1.3	0.925	0.8
Investment, I	52	37	32
Mothball, M	2.6	1.85	1.6
Reactivation, A	5.2	3.7	3.2
Exit, X	-13	-9.25	-8
Discount Factor, $\rho^a$	0.08	0.08	0.08
Corn:Ethanol Conversion Factor <sup>b</sup>	10.6	10.6	10.6

Source: Table 2 of Schmit, Luo, and Tauer (2009).

a. The discount factor of 0.08 is used in the baseline results only.

b. Corn:Ethanol Conversion Factor is liters of ethanol per bushel of corn.

parameters are derived from various regional corn-ethanol industry reports and papers, USDA cost of production surveys, and engineering studies. The same parameters are used so that the effect of the ABM process change is not confounded by other changes in the model. The conversion rate of corn into ethanol is assumed to be 10.6 liters per bushel. For the baseline analysis, the discount factor is equal to 0.08. The discount rate is set to the WACC in analyses where ownership type is differentiated.

Data on capital costs are incorporated in the analysis. Specifically, WACC data is obtained at the industry level from Damodaran (2014, 2015). The WACC for the gas and oil distribution industry is used for 2007 to 2014, and adjusted for the oil (integrated) industry WACC for 1998 to 2006 time period by using the average difference between these two industries for 2007 to 2014 to obtain WACC data. To reflect the additional risk present in the ethanol industry due to its dependence upon government policy, the risk premium is increased by 25 percentage points. These data represent the WACC for non-producer companies. To obtain the WACC for producer companies, the same risk

**Table 2.2.** Weighted average cost of capital (WACC) by plant size and ownership type

Ownership Type	Statistic	All	Small	Medium	Large
Producer	Average	10.13%	9.66%	9.62%	13.27%
	N	58	15	35	8
Non-producer	Average	17.44%	15.99%	17.27%	18.26%
	N	156	27	67	62
All	Average	15.46%	13.73%	14.64%	17.69%
	N	214	42	102	70

*Source: Damodaran (2015) and authors' calculations*

premium is used, but the cost of equity is discounted by 20 percent.<sup>14</sup> This agrees with cooperative theory because equity in a marketing cooperative does not appreciate over time (Sexton, 1986).<sup>15</sup>

Companies that own ethanol plants are assigned a WACC in the following way. If they built the plant themselves, they are assigned a WACC of the third year prior to the first operating year. This delay reflects the three years needed to construct a plant. If they bought the plant, they are assigned the WACC of the year prior to them operating the plant. This data is summarized in Table 2.2. Medium (small) plants have the lowest WACCs, while large (large) plants have the highest WACCs for producer (non-producer) plants. The WACC is higher after 2005 when most large plants were built or purchased. As noted earlier there are significant economies of size and plant sizes were increasing during this period. It should be noted that most producer companies operated small or medium plants, while most non-producer companies operated medium or large plants. This again correlates with entry timing as most non-producer companies entered later with larger plants.

<sup>14</sup> A sensitivity analysis on these assumptions reveals no significant difference in the results.

<sup>15</sup> These WACCs are likely to be overestimates of the actual WACCs faced by cooperatives. This is because cooperative investment in a corn-ethanol plant is a vertical extension of the farm and farms have lower WACCs.

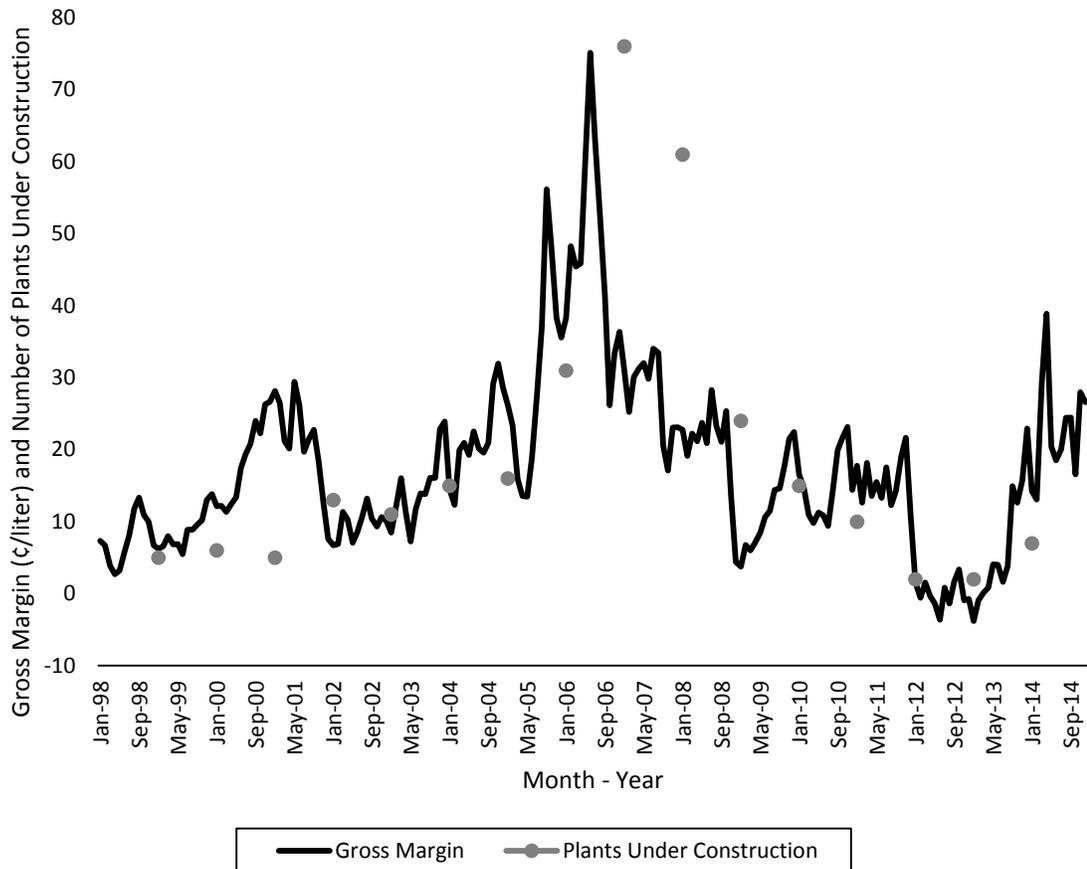
**Table 2.3.** Nebraska ethanol and corn price summary statistics, 1998 – 2014

Variable	Mean	Standard Deviation
Ethanol Price (\$/liter)	0.493	0.162
Corn Price (\$/bushel)	3.365	1.657
Corn Price (\$/liter)	0.318	0.156
Gross Margin (\$/liter)	0.175	0.125

*Source: Nebraska Ethanol Board and Nebraska Energy Office (2015) and Gould (2015)*

The price data is a time series of monthly ethanol rack prices and corn cash market prices in Nebraska from 1998 to 2014. The ethanol rack prices come from the Nebraska Energy Office and the Nebraska Ethanol Board (Nebraska Ethanol Board and Nebraska Energy Office, 2015). The Nebraska corn cash market prices are USDA NASS Prices Received data from the University of Wisconsin Dairy Marketing and Risk Management program website (Gould, 2015). Nebraska has the second largest number of corn-ethanol plants and a strong basis for corn. These ethanol and corn price data reflect a large number of transactions and likely reflect true market prices and market price changes. Table 2.3 contains summary statistics of the price data.

Figure 2.1 is a graph overlaying the number of plants under construction onto the ethanol corn gross margin between 1999 and 2014. The gross margin spike in 2006 is clearly evident as the impact of the MTBE ban, RFS implementation, and business development policies. After the spike, the margins returned to a lower level. Behaviorally, the number of ethanol plants under construction spikes during 2007 which is the year after the gross margin increase. This provides strong evidence that firms make investment decisions based on movements in the ethanol-corn gross margin, which in turn indicates that the suggested RO and NPV frameworks approximate reality.



**Figure 2.1.** Gross margins and plant construction  
*Source: Gould (2015) and Renewable Fuels Association (2015)*

## 2.7 Results

The results section is broken down into three subsections. The first subsection presents the firm Ito process parameter values under GBM, ABM, and OUMR processes for the period January 1998 – June 2008. The second subsection presents the baseline trigger margin results from the dynamic programming problem under each of the Ito processes. The third subsection presents the results from using the WACC data and differentiating between ownership types.

### 2.7.1 Ito Process Parameter Values

Table 2.4 presents the parameter values used for each of the Ito processes. This essay

**Table 2.4.** Baseline parameter values for Ito processes

Parameter	GBM <sup>a</sup>	ABM <sup>b</sup>	OUMR <sup>c</sup>
$\alpha$	0	1.267	-
$\sigma$	0.799	18.11	3.682
$\eta$	-	-	0.080
$\bar{\theta}(\text{¢})$	-	-	21.84

a. The GBM parameter values come from Schmit, Luo, and Tauer (2009).

b. The ABM parameter values are calculated using 1998-2014 data.

c. The OUMR parameter values are calculated using 1998-2008 data.

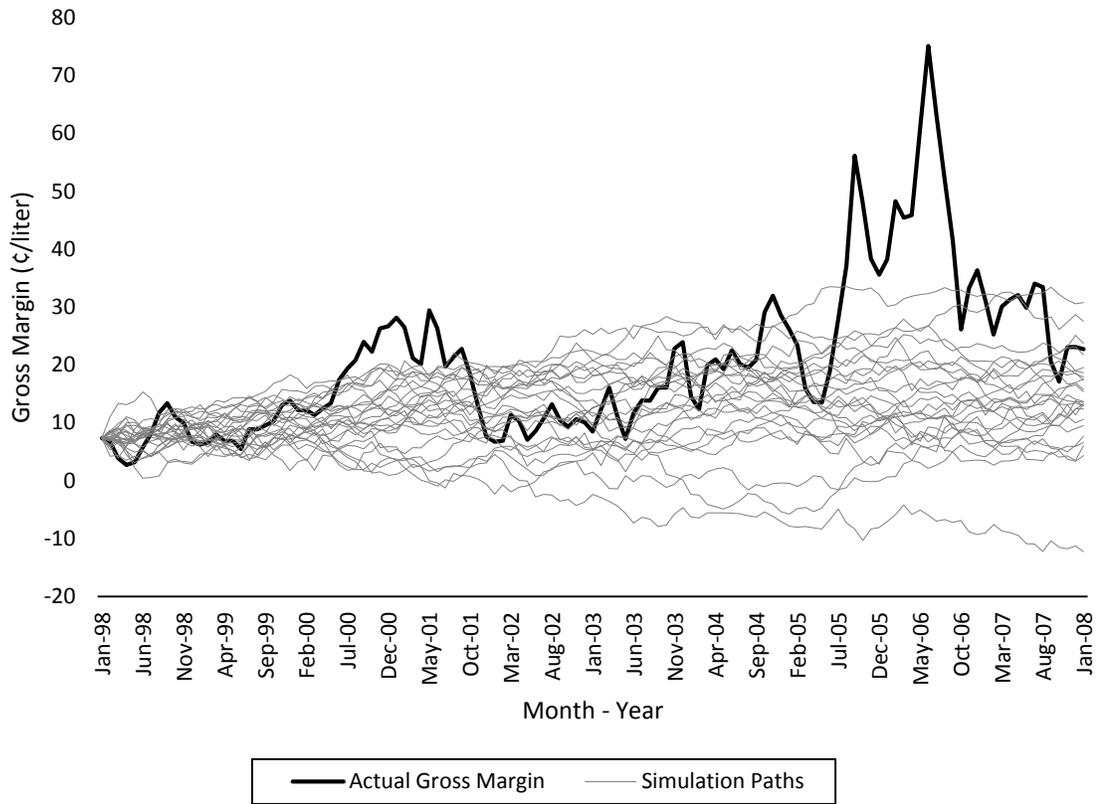
presents the parameters found by Schmit, Luo, and Tauer (2009) in the first column.

Separate parameters are not calculated. The second and third columns contain the parameter estimates for the ABM and OUMR processes, respectively. These are calculated with the corn and ethanol price data discussed above. Because these processes are so different conceptually, three figures (Figures 2.2, 2.3, and 2.4) of simulations comparing each of the Ito processes to the actual gross margins from 1998 – 2008 are presented.<sup>16</sup> Each graph has 25 simulations of monthly margins over 10 years.

Upon visual inspection of Figure 2.2, the OUMR process does not fit the data well. The small volatility parameter makes the simulated margin paths too stable. This lack of fit matches with the regression estimates where the  $R^2$  from the raw regression is only 0.04. This simulation shows that although mean-reversion may be present in economic theory, this type of mean-reversion does not fit the data empirically for this time period.

Figure 2.3 presents the simulations of the GBM process, and the non-negativity of the GBM process is evident. All GBM simulated paths are non-negative, and some paths match the actual margins well through the seventh year. However, nearly all of the

<sup>16</sup> For these simulations, margin data from 1998 to 2008 are used to calculate ABM parameters. The drift and volatility parameters are 1.215 and 17.629, respectively.



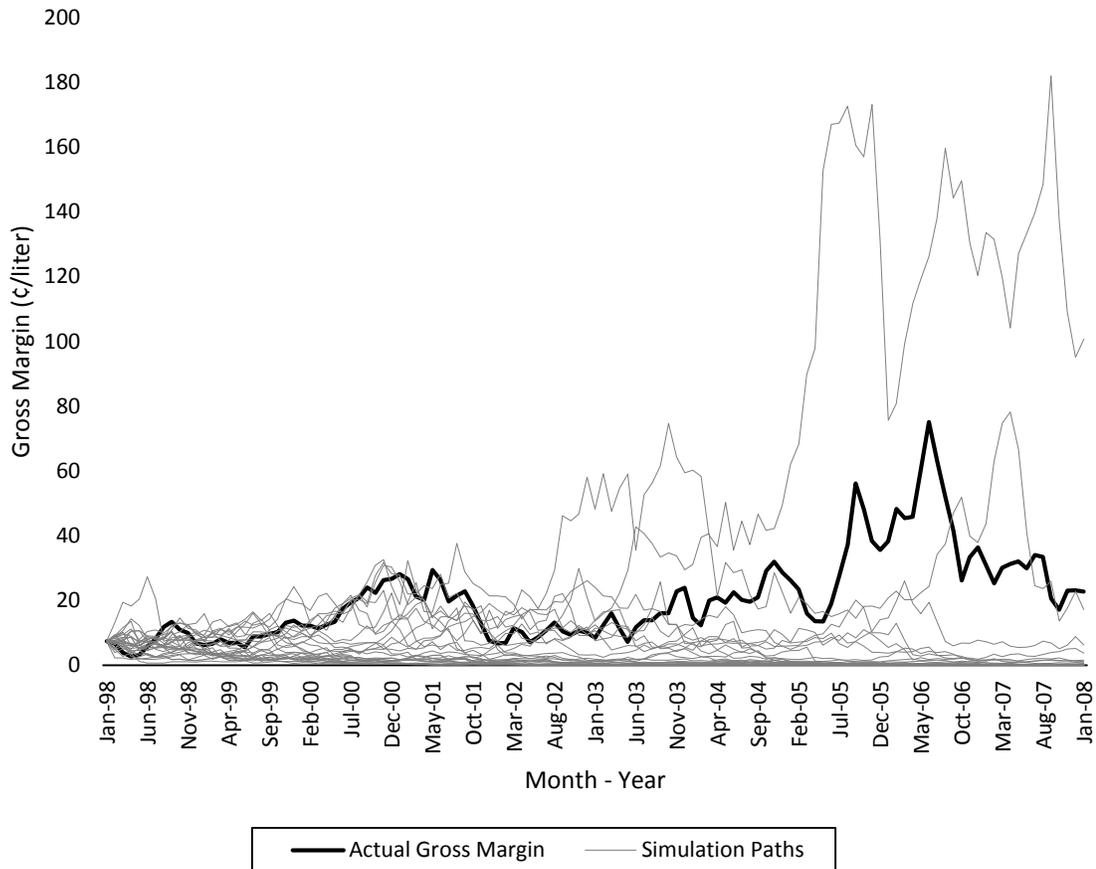
**Figure 2.2.** OUMR simulations

*Source: Gould (2015) and author calculations*

simulated paths become extremely close to zero and stay there. In contrast, the ABM process simulations in Figure 2.4 are much more widely spread, with actual margins being somewhere near the middle. These simulations indicate that the ABM process is not only conceptually more correct than the GBM process for modelling gross margin changes, but also seems to empirically fit the actual gross margins better than the GBM process during this time period.

### 2.7.2 Baseline Trigger Margin Results

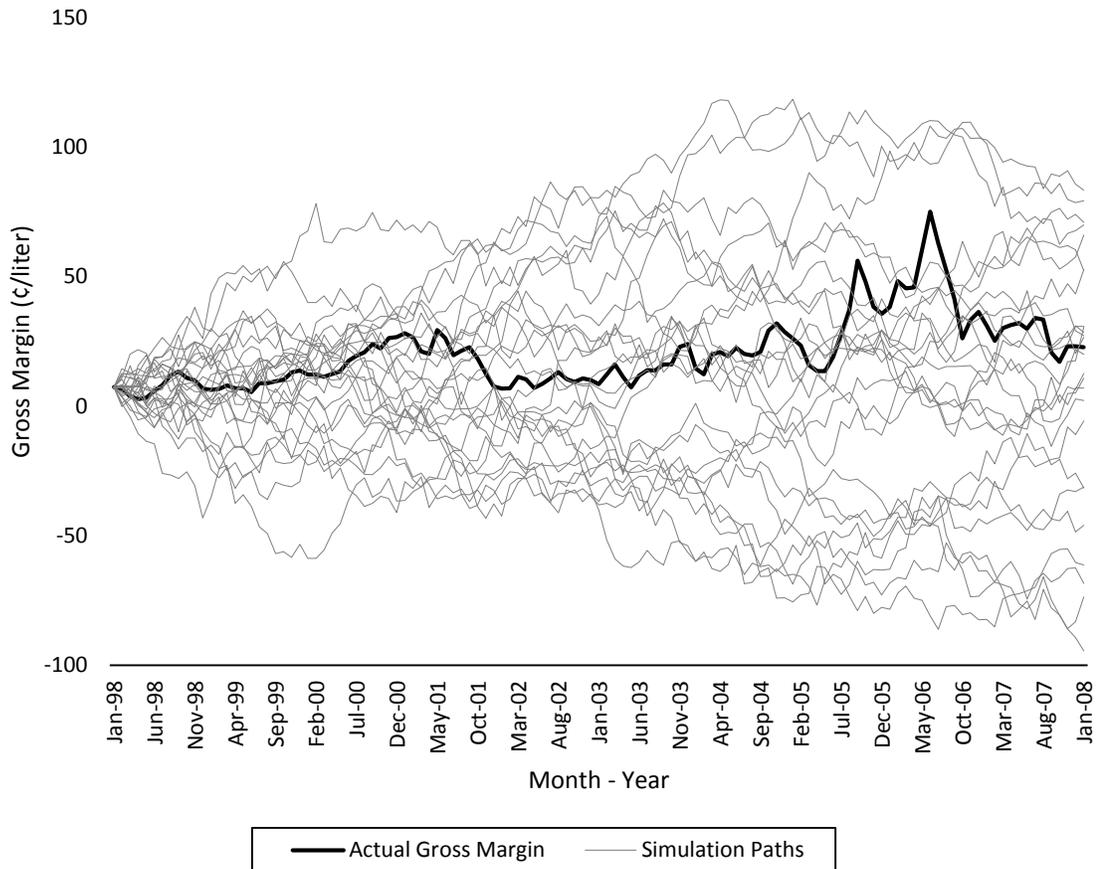
Table 2.5 presents the trigger margin results from the dynamic programming problem under the GBM, ABM, and OUMR assumptions in the first three columns. The final column presents the results of the NPV entry and exit trigger margins.



**Figure 2.3.** GBM simulations

*Source: Gould (2015) and author calculations*

Under each process, the trigger margins for medium and large plants are fairly similar, while the trigger margins for small plants are quite different. Consider the ABM process as an example and break down the behavior across plants. Because the large plants entry margins are lowest, the large plants will enter first, followed by medium and then small plants. The same pattern produces the opposite results with the exit trigger margins – small plants will exit first, followed by medium and then large plants. In fact, these same patterns emerge for the GBM and OUMR Ito processes, too. This seems to indicate that small plants fill demand at the margin while medium and large plants are more mainstay producers. This follows the intuition of market entry and exit.



**Figure 2.4.** ABM simulations

*Source: Gould (2015) and author calculations*

Now, consider the ABM and OUMR trigger margins in comparison to the GBM trigger margins. The ABM entry, mothball, and exit trigger margins are smaller than the respective GBM trigger margins. The ABM reactivation trigger margins are larger, but very similar to, the GBM reactivation trigger margins which is intuitive when considering Figures 2.3 and 2.4. The GBM process tended toward zero, while the ABM process moved much more freely. Therefore, investors will enter later and exit sooner if they think margins follow a GBM process because the margins will eventually go to zero.

The OUMR entry, reactivation, and exit trigger margins are all much smaller than the corresponding GBM trigger margins. The mothball trigger margins are all slightly

**Table 2.5.** Baseline trigger margins under GBM, ABM, and OUMR processes (¢/liter)

Plant Size	Trigger margin	Ito Process			
		GBM	ABM	OUMR	NPV
Small	Entry	48.4	33.6	15.2	15.2
	Reactivate	21.7	22.0	10.1	-
	Mothball	5.1	-3.1	5.6	-
	Exit	4.7	-40.4	2.0	12.0
Medium	Entry	36.7	28.3	12.0	12.0
	Reactivate	17.3	19.0	8.4	-
	Mothball	4.4	-3.3	4.4	-
	Exit	3.6	-44.5	-3.3	9.7
Large	Entry	34.1	27.1	11.6	11.6
	Reactivate	16.9	18.6	8.5	-
	Mothball	4.6	-2.7	4.8	-
	Exit	3.4	-45.4	-3.7	9.6

larger under the OUMR process, but approximately the same size. These results are intuitive in the context of the simulations. Under the OUMR process, the margins were climbing steadily to the normal level. Therefore, investors are willing to enter very early and exit very late because they know margins will return to the normal level.<sup>17</sup>

Interestingly, the ABM mothball and exit trigger margins are negative. This implies that these plants will continue to operate at a loss, even before operating costs are considered. This occurs because the expectation of where gross margins may go next is very uncertain in the ABM process. This occurs because the drift will “pull” the margins up slowly, but it is dominated by the very high volatility. However, ethanol-corn margins were never close to that.<sup>18</sup> Therefore, under the ABM process, no one should have exited the industry. However, many firms exited the industry. Because of this, the GBM process

<sup>17</sup> Because the OUMR process does not fit the data particularly well, the discussion of the results from the OUMR process are limited.

<sup>18</sup> Between 1982 and 2014 the smallest margin in the data was -6.9¢/liter in July 1996.

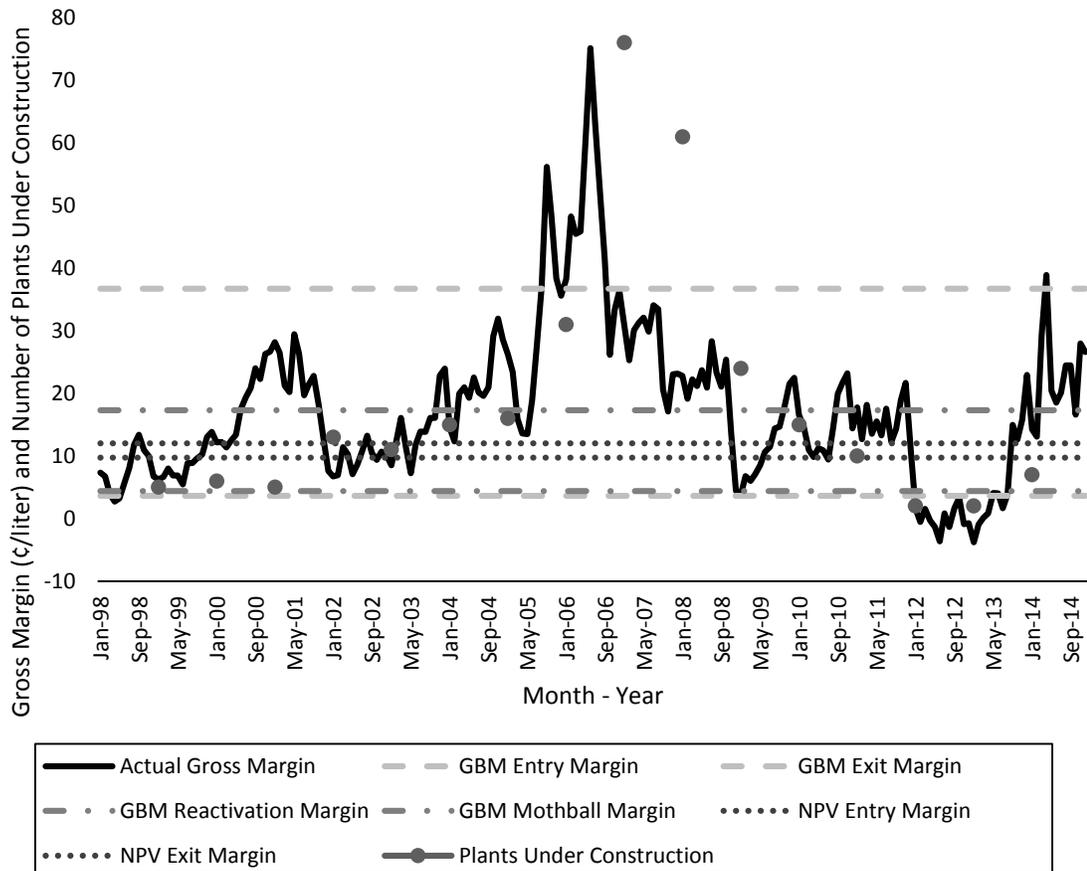
may better match the data because exits are observed. However, due to its conceptual and empirical flaws, this match is more correlation than causation.

At this stage, it is important to note that the RO and the NPV framework leave out important considerations. For example, these frameworks do not account for how the investment capital is raised, just how much it cost; they do not know exactly when loan payments are due, just how much they are; they do not account for shifts in government policy, just that margins may change because of it. These factors play an important part in entry and exit decisions, which may not be well-reflected in the trigger margins.

In the case of the corn-ethanol industry many of the investments in plants were highly leveraged. As the margin bubble burst, this leverage would not allow plant owners the opportunity to wait out the rough times. Approximately 13 of the exits in the corn-ethanol industry were due to bankruptcy. This shows that exits were due to factors unrelated to operating profit – things that are not taken into account by the RO and NPV frameworks. Due to this limitation, the structural nature of firm exits in the industry, and a lack of reliable data on mothballing, future discussion is on the entry decisions.

Figures 2.5 and 2.6 present actual gross margins (1998 – 2014) and GBM, ABM, and NPV trigger margins for a medium-sized plant. The higher (lower) dashed line is the real options entry (exit) trigger margin. The higher (lower) dot-dashed line is the real options reactivation (mothball) trigger margin. The higher (lower) dotted line is the NPV entry (exit) trigger margin.

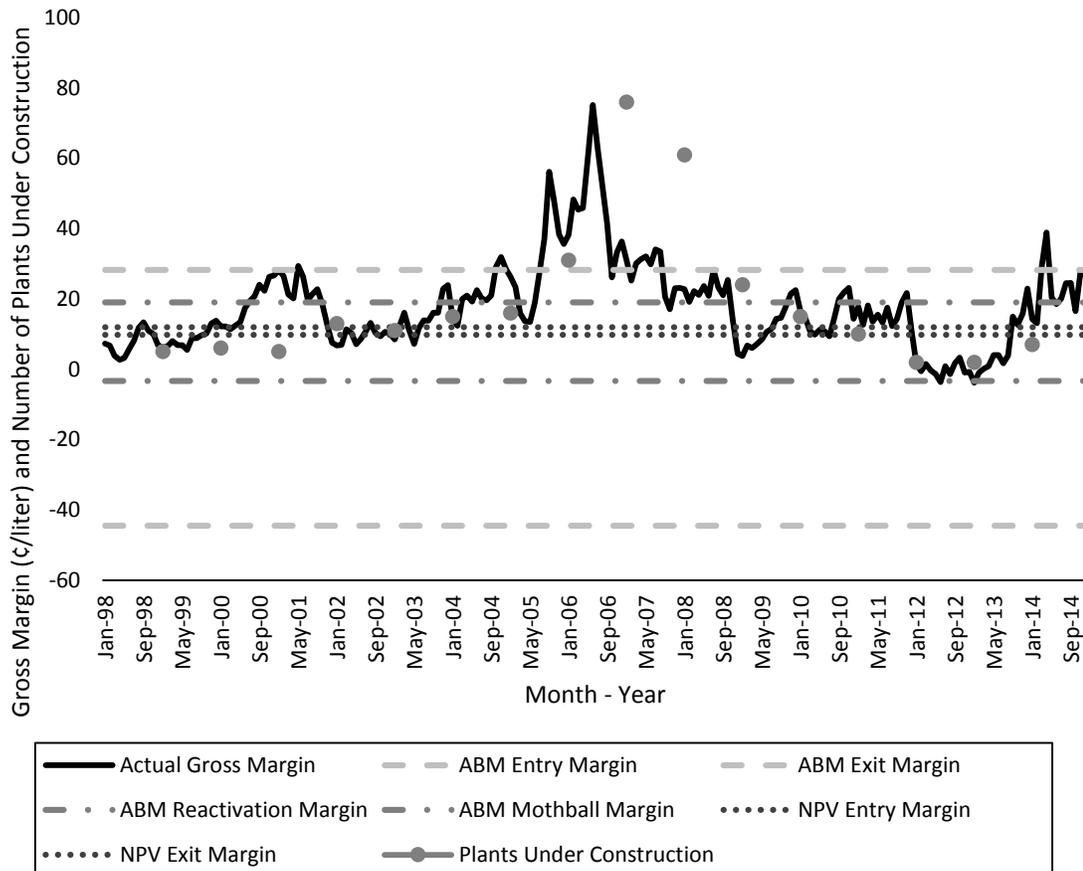
These figures show first that investors and plant owners seem to have valued the option to wait. This result follows because for nearly all of 2000 to 2011, the actual



**Figure 2.5.** GBM and NPV baseline trigger margin results, actual gross margins, and the number of plants under construction, 1998-2014

*Source: Gould (2015), Renewable Fuels Association (2015), and author calculations*

margin was above the NPV entry trigger margins, but there is an increase in plant construction in 2002 and 2006 to 2008 when there should also be construction increases in 2010 to 2012 if investors were following NPV margins. In contrast, the RO approach, which values the option to wait, predicts the construction increases in 2002, 2006 to 2008, while also predicting the lack of increases in 2010 to 2012. Although, they may not explicitly be using real options, this indicates that potential investors valued the option to wait. Moreover, it seems that ethanol investors may have followed an ABM model when entering the market.



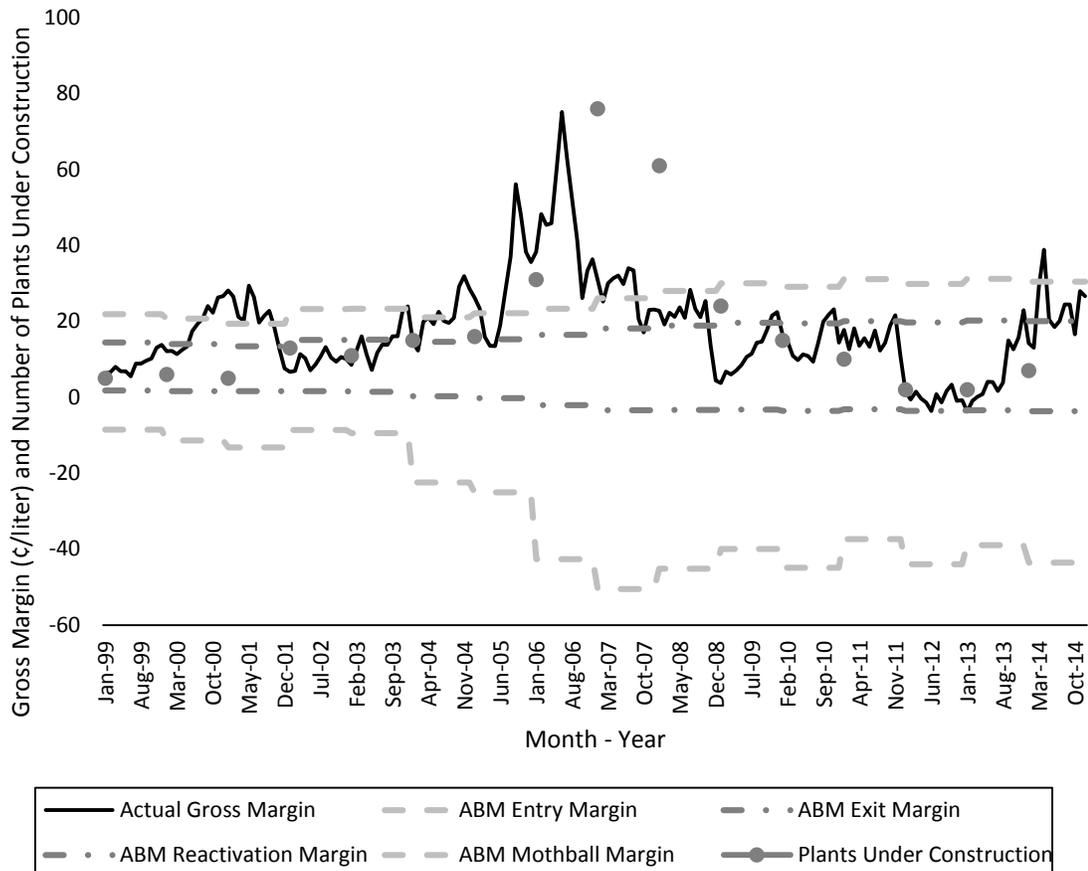
**Figure 2.6.** ABM and NPV baseline trigger margin results, actual gross margins, and the number of plants under construction, 1998-2014

Source: Gould (2015), Renewable Fuels Association (2015), and author calculations

These results also indicate that investors followed the ABM model for entering the ethanol market because the actual gross margins exceed the ABM entry trigger margin in late 2001, early 2005, 2006, and 2007. However, the GBM trigger margins are too high in 2001, thus missing the construction increase in 2002. This means that investors took into account that gross margins could be negative.<sup>19</sup>

### 2.7.3 Trigger Margin Results by Ownership Type

<sup>19</sup> These results are further supported when the ABM process parameters are updated yearly. The entry margins are clearly below the actual margins in 2001, parts of 2005, and most of 2006 – 2007. These correspond directly to construction increases. A graph of these results is found in Figure 2.7.



**Figure 2.7.** ABM baseline trigger margin results, actual gross margins, and the number of plants under construction – yearly updating, 1998-2014

Source: Gould (2015), Renewable Fuels Association (2015), and author calculations

Tables 2.6 and 2.7 present the results from changing the discount rate from 8% to the WACC for each plant size and changing the ownership type. When the WACC is used as the discount rate, nearly all of the trigger margins across both Ito processes increase. The mothballing trigger margin decreases, but only slightly. The same pattern emerges for differences between non-producer and producer trigger margins. This near universal increase in trigger margins occurs because all of the WACCs are larger than the baseline discount rate and all non-producer WACCs are larger than producer WACCs except for small plants. An increase in the discount rate means that investors require a higher return

**Table 2.6.** Trigger margins under GBM by ownership type (¢/liter)

Plant Size	Trigger Margin	Baseline	Ownership Type		Difference <sup>a</sup>		
			Producer	Non-producer	P - B	NP - B	NP - P
Small	Entry	47.0	49.5	53.8	2.5	6.8	4.3
	Reactivate	21.0	21.8	22.0	0.8	1.0	0.2
	Mothball	5.0	5.1	5.1	0.1	0.1	0.0
	Exit	4.0	5.1	6.5	1.1	2.5	1.4
	NPV – Entry	15.0	16.0	19.3	1.0	4.3	3.3
	NPV – Exit	11.0	12.3	13.1	1.3	2.1	0.8
Medium	Entry	17.0	37.5	41.2	20.5	24.2	3.6
	Reactivate	17.0	17.4	17.5	0.4	0.5	0.2
	Mothball	4.0	4.4	4.3	0.4	0.3	0.0
	Exit	3.0	3.9	5.2	0.9	2.2	1.3
	NPV – Entry	12.0	12.6	15.4	0.6	3.4	2.8
	NPV – Exit	10.0	9.9	10.6	-0.1	0.6	0.7
Large	Entry	35.0	36.3	38.3	1.3	3.3	2.0
	Reactivate	17.0	17.0	17.1	0.0	0.1	0.1
	Mothball	5.0	4.6	4.5	-0.4	-0.5	0.0
	Exit	3.0	4.3	5.1	1.3	2.1	0.8
	NPV – Entry	12.0	13.2	14.8	1.2	2.8	1.6
	NPV – Exit	10.0	10.1	10.5	0.1	0.5	0.4

a. P – B, NP – B and NP – P is the difference between the producer and the baseline, non-producer and the baseline, and non-producer and producer trigger margins.

(higher margins) for the investment and have a lower tolerance for low profitability (low margins). Therefore, producers invest sooner and exit later than non-farmers.

This difference in entry and exit timing across ownership type is supported by previous theoretical work and data on firm survivorship. Holland and King (2004) develop a conceptual model of firm entry and exit in the ethanol industry using a RO framework. They find that new generation or closed membership cooperatives enter the ethanol industry sooner than typical investors.<sup>20</sup> From the data, the average age of a producer-owned firm at the time of exit is approximately 5.5 years, while the age of a

<sup>20</sup> Holland and King (2004) also find that non-producers may buy producer-owned plants if the producers are risk-averse.

**Table 2.7.** Trigger margins under ABM by ownership type (¢/liter)

Plant Size	Trigger Margin	Baseline	Ownership Type		Difference <sup>a</sup>		
			Producer	Non-producer	P - B	NP - B	NP - P
Small	Entry	33.6	34.4	37.6	0.9	4.0	3.1
	Reactivate	22.0	22.0	22.2	0.0	0.2	0.2
	Mothball	-3.1	-3.1	-3.2	0.0	0.0	0.0
	Exit	-40.4	-36.2	-24.5	4.2	15.9	11.7
	NPV – Entry	15.2	16.0	19.3	0.9	4.2	3.3
	NPV – Exit	12.0	12.3	13.1	0.2	1.0	0.8
Medium	Entry	28.3	29.0	31.8	0.7	3.5	2.9
	Reactivate	19.0	19.1	19.2	0.0	0.2	0.2
	Mothball	-3.3	-3.4	-3.4	0.0	0.0	0.0
	Exit	-44.5	-40.5	-27.3	4.0	17.2	13.2
	NPV – Entry	12.0	12.6	15.4	0.6	3.4	2.8
	NPV – Exit	9.7	9.9	10.6	0.1	0.9	0.7
Large	Entry	27.1	28.9	30.5	1.9	3.5	1.6
	Reactivate	18.6	18.7	18.8	0.1	0.2	0.1
	Mothball	-2.7	-2.7	-2.7	0.0	0.0	0.0
	Exit	-45.4	-34.3	-27.1	11.1	18.3	7.2
	NPV – Entry	11.6	13.2	14.8	1.7	3.3	1.6
	NPV – Exit	9.6	10.1	10.5	0.4	0.8	0.4

a. P – B, NP – B and NP – P is the difference between the producer and the baseline, non-producer and the baseline, and non-producer and producer trigger margins.

non-producer-owned firm at the time of exit is 3 years. These ages are calculated following the entry and exit of ethanol companies from the list of ethanol plants from the Renewable Fuels Association (2014) annual industry outlook reports.<sup>21</sup>

Finally, the results across ownership types are very different. Even small differences in gross margins are economically significant due to the volume of production. A difference in gross margins of \$0.01 per liter for the entire year results in a

<sup>21</sup> The differences between non-producer and producer trigger margins are highest for entry trigger margins under the GBM process and for exit trigger margins under the ABM process. This difference is likely due to the non-negativity property of the GBM process. Because margins will not be negative under the GBM process there is only room for the entry margin to change. Under the ABM process, the margins are unbounded, so exit trigger margins increase much more as the discount rate increases compared to the GBM process. This conclusion is supported by the fact that the entry trigger margin differences are similar for both the GBM and ABM processes.

\$1.61 million difference in full-year plant gross margins for an average medium-sized plant (161 million liters/year capacity). This indicates that using industry-level data without accounting for firm ownership heterogeneity is advised when performing industry analyses.

The quick entry reaction and lower WACCs in 2006 by producer firms was made possible, in part, by the business development programs created by Congress in 2001 and 2002. Without the programs, producer firms would not have been able to react quickly due to the structure of collective action and a lag for cooperative creation. However, these programs were started well before the margin spike. In fact, between 2002 and 2005, nearly \$125 million were disbursed through these programs (Oswald, 2008, p. 9, Table 1.1). Certainly not all of these funds went to ethanol plant development, but a large share were towards producer-owned plants. These programs allowed producers to have feasibility studies finished, sites selected, and business plans available for lenders when margins spiked in 2006. This, in turn, allowed producer plants to enter at the same time as non-producer plants.

## 2.8 Conclusions

This essay has extended current research on ethanol plant investment in three ways. First, this essay finds that margins are better modeled conceptually using Arithmetic Brownian Motion (ABM) compared to Geometric Brownian Motion (GBM) because the latter requires margins to be strictly positive. Moreover, the ABM process is found to better model ethanol-corn gross margins empirically than the GBM process. The trigger margins inducing a change between waiting and investing, operating and mothballing,

and mothballing and exiting are smaller under the Arithmetic Brownian Motion process than under the Geometric Brownian Motion process.

Second, the results contradict the hypothesis that investors did not value the option to wait. The trigger margins under the ABM process fit the data on plant construction better than NPV trigger margins. Although it may be unlikely that investors explicitly used a real options analysis, they implicitly valued the option to wait properly when evaluating their investment decisions. Additionally, because the ABM process best fits the data, it is inferred that investors did not believe that gross margins would remain strictly positive or revert to some normal level.

Third, the capital cost differences across ownership type led to different entry and exit behavior. Specifically, using a unique dataset of weighted average cost of capital data, the results indicate that farmer-owned firms enter earlier and exit later than non-farmer-owned firms. This result is supported by previous theoretical work and is confirmed with company survivorship data which finds that farmer-owned firms are older than non-farmer-owned firms when they exit the industry. Additionally, this shows the importance of using firm-level data and accounting for heterogeneity in ethanol plant operations. The results indicate that even in industry-level analyses, firm-level data should be used and differences across plants should be accounted for properly.

Hundreds of millions of dollars were appropriated to encourage the development of corn-ethanol plants. These funds were used to pay for business development costs, underwrite producer loans to buy stock in cooperatives, underwrite operating loans for plants, and many other aspects of business development. Clearly, much public-private

investment helped the corn-ethanol industry develop as a substitute for MTBE and fulfillment of the RFS requirement. Many of these business development programs were designed to encourage the development of an industry where producer-owned plants were dominant. As of January 2014, however, producer-owned plants account for less than 15% of the total industry capacity. Could something have been done differently?

Few, if any, investment models could have prevented the boom and bust from occurring; even the RO framework indicated to enter during the boom time. Most investment evaluation models provide benefits and costs on average, and what occurred was far from average. These models do not account for the actions of other potential investors and do not reliably predict the effects from structural changes, both of which played significant roles in the corn-ethanol industry at this time.

It is also unlikely that any action from public agencies could have prevented the boom and bust given the policies that were in place. Land grant universities could have provided more information about where to build ethanol plants or how to hedge corn and ethanol prices. Perhaps they could have developed a web-based tool to evaluate the ethanol plant investment with an updating process using RO. However, extension economists at Iowa State and Kansas State universities and private firms were providing such information by providing corn basis maps, ethanol plant enterprise budgets, and education. Six of the ten Agricultural Innovation Centers with \$1 million each were based in departments of agricultural economics and many worked with corn-ethanol plants. Moreover, if a web-based evaluation tool was offered, it could have encouraged investment based on the trigger margin results described earlier.

It could be argued that the business development programs present in business development legislation designed to create a corn-ethanol industry dominated by producer-owned plants incentivized early entry by producers which normally would have enabled them to gain first-mover advantage. However, producer-owned ethanol plants that were constructed in reaction to the RFS fared the worst when gross margins later shrank. Many producer-owned plants built during this time were closed or sold to non-producer owners. However, after record corn prices, producers may have been the best placed potential investors after margins shrank and initial investors wanted out had they not already built ethanol plants. This provides the counter-intuitive result that the policy incentivizing producer participation in the corn-ethanol industry unintentionally kept them from maintaining their place as major capacity controllers as the industry evolved and matured.

One future area of research is to incorporate the ability of investors and owners to use futures markets to take away price uncertainty in major input and output markets in the short run. This would mitigate some of the problems of making assumptions about future price movements in the short run. However, this has shifted uncertainty about the future spot price to uncertainty about the future futures prices. This issue of shifting risk is especially important because one cannot hedge in the long run using futures and investments are evaluated by looking at their long run payoffs.

Further research should also be done linking price movements and investment evaluation methods with game theory. As gross margins increased, more ethanol plants were built and each increased the market quantity. However, this in turn, lowered the

gross margin, decreasing the number of new ethanol plants being constructed. This type of behavior will result in a mean-reverting gross margin process, but its empirical merits are limited. Linking the theory with a particular margin movement process will provide stronger conclusions for what was actually occurring in the market. Moreover, linking the theory on entry and exit to investment evaluation methods will help potential investors better evaluate their opportunities.

### **Chapter 3. Impacts from a Retail Grocery Acquisition: Do National and Store Brand Prices Respond Differently?**

The U.S. food-retailing industry is marked with increasing consolidation and concentration. The industry's national four firm market concentration ratio (CR4) was 36.4% in 2013, up from 16.8% in 1993. Additionally, the industry's national twenty firm market concentration ratio (CR20) was 63.8% in 2013, up from 39.9% in 1993 (U.S. Department of Agriculture Economic Research Service, 2014b).<sup>22</sup> Consolidation through mergers and acquisitions in the industry in recent years has been an important factor that contributes to increasing concentration in the food-retailing industry. Some of the recent merger and acquisitions include Kroger & Harris Teeter in 2013, Safeway & Albertsons in 2014, and Ahold & Delhaize in 2015. This increase in consolidation may allow food retailers to exert a degree of market power.

An additional feature of the industry is that store brands (also known as private labels) have become an increasingly important player in the food-retailing marketplace.<sup>23</sup> Recent trends reported by the Private Label Manufacturer Association show that sales of store brands have grown at an annual rate of more than 4% since 2012. Meanwhile, average growth for national brands was at 2%. As for total expenditures, in 2014, U.S. consumers spent about \$62.1 billion on store brands in supermarkets, comprising 19.5%

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<sup>22</sup> Much of this growth was organic in nature as firms like Wal-Mart, CostCo, Target, and other retailers built so-called 'greenfield' stores. There was some consolidation (ex., SuperValu bought Albertsons and other stores but later divested them, several large chains in the South divested themselves of retail stores which were bought by local retailers), but this, by itself, did not lead to the increase in concentration.

<sup>23</sup> Store brands are those products that are produced, distributed, and marketed entirely by the retailer. They may be produced directly or through contracts.

of the dollar share of total supermarket sales. Accordingly, research pertaining to store brands has garnered substantial interest from economists and food industry professionals.

The growth of store brands and the increased industry concentration are inherently related. For example, while an acquisition would contribute to industry concentration it could also allow the acquiring firm to increase market share of its store brand relative to market share of national brands. The latter effect would occur if small and medium size national brands cannot compete with store brands for shelf space and exit the market. However, the extant literature on the effects of store brand growth on prices and welfare does not account for the interplay between increasing grocery retailer concentration and the growth store brands. This essay addresses this issue by investigating whether increased grocery retailer concentration has differential effects on prices of national and store brand food products.

Specifically, this essay investigates the following question: do store brand prices change more or less than national brand prices after a merger or acquisition? The answer to this question helps improve the understanding of the implications of growth store brands for food prices and welfare. Furthermore, it sheds new light on concentrated retailers' store brand pricing strategy and its effect on different consumer types. For example, on the consumer side, store brand and national brand products serve different types of consumers. Low-income consumers often purchase store brand products to economize on their food budget (Leibtag & Kaufman, 2003). Therefore, a differential impact of acquisition on prices would imply differential impact on consumer types. On the retailer side, store brand and national brand products provide different margins for

retailers. Typically, retailer margins are larger for store brand products than for national brand products (Ailawadi & Harlam, 2004). Therefore, differential price changes differentially impact profits and could inform food retail managers how potential benefits of a merger may accrue to their business. Typically, benefits would stem from economies of scale or scope, better bargaining power with national brands, or exerting market power at the retail level.

This study fits into two literature streams. The first stream is that of store brands. Much of the literature studies why retailers introduce store brands and the effects of their introduction on price and welfare. Recent research has begun to analyze policy and other structural effects on the retail grocery industry while explicitly accounting for the existence of store brands (Bonnet & Requillart, 2013; Jaenicke & Carlson, 2015). An emerging area of research analyzes price changes in national brand and store brands after some structural change in the market (Volpe & Lavoie, 2008; Volpe, 2014). The current study builds on these areas of research by analyzing the effect of a merger on store brand and national brand prices.

The second stream is that of ex-post horizontal merger analyses. Several studies have analyzed the impact of horizontal mergers on consumer prices. Ashenfelter, Hosken, and Weinberg (2014) provide a brief summary of the most influential studies. However, only a few studies have accounted for the vertical relationships that exist between retailers and manufacturers. Additionally, although there is a substantial literature analyzing the pricing decisions made by retail food stores as discussed by Volpe, Risch, and Boland (2015), there has been little work done on pricing decision changes around a

merger event in the food retailing sector. Recent research indicates that the impact of mergers in this sector may be significant as noted by the studies by Hosken, Olson, and Smith (2012) and Allain, Chambolle, Turolloa, and Villas-Boas (2013). The current essay builds on this literature in two ways. First, it causally measures price changes for national brands and store brands after a food retailer acquisition thereby accounting for the vertical nature of each product. Second, due to the nature of the acquisition under study, price changes are identified for the acquiring retailer, not just competing retailers.

To estimate the differential price changes this essay performs an ex-post analysis of a food retail acquisition in a large United States city in 2012. Nielsen scanner data at the UPC level is used in a difference-in-differences (DID) estimation of the differential impact of the acquisition in two product categories – fluid milk and Ready-To-Eat (RTE) cereal. These product categories are selected because they represent typical high volume, fast-moving product categories with different competitive environments. The acquisition is unique because it is a nearly complete acquisition in which the acquired retailer sold most of its stores and exited the market but is limited to a small geographic area. Because of this feature, the acquisition effects are causally identified for the acquiring retailer.

The results show that, for the acquisition under study, prices decreased around 0.3% for fluid milk and 0.6% for RTE cereal per unit. The overall decrease in prices points to significant retailer cost savings or increased competition after the acquisition. Furthermore, the results provide important insights into the effects of the acquisition on national and store brand prices in different categories. The results show that in a highly differentiated product category (i.e., RTE cereal) national brand prices decreased, while

store brand prices increased after the acquisition. Whereas in a relatively homogeneous product category (i.e., fluid milk), the differential effect of the acquisition on national and store brand prices is found to be insignificant. These results indicate that store brands can be an important instrument for retailers to exert market power in a wide range of differentiated product categories. That is, grocery retailer merger analyses should more directly account for the growth of store brands and other close vertical relationships in the market.

The following section reviews the relevant literature. The third section first discusses pricing strategies in food retailing sector, and then provides an analytical framework for price changes after a food retail merger or acquisition. The fourth section describes the acquisition under study and the data used in the empirical analysis. The fifth section presents the methods used to obtain the estimates of price changes. The final two sections discuss the results and their implications, respectively.

### 3.1 Literature Review

#### *3.1.1 Private Label Literature*

Early research on private labels examined why they are sold and where and when they succeed. Hoch and Banerji (1993) analyze private label market share across grocery categories. They find that private labels gain more market share in categories that are large and have high margins, fewer manufacturers, less advertising, and higher quality private labels (Hoch & Banerji, 1993). Mills (1995) states that the fundamental reason why private labels are sold by retailers is to obtain some of the profit potential from the vertical chain that is unavailable due to double marginalization. Double marginalization

occurs when successive firms in a vertical supply chain exert market power.<sup>24</sup> This results in the lower quantity and higher prices for consumers in addition to lower channel profits. Mills (1995) further argues that as retailers introduce private labels their profits increase while the manufacturer's profit decreases. Total profit of the supply chain increases. Private labels also reduce double marginalization from the consumer's perspective resulting in a reduction in retail prices and an increase in quantity offered.

Next, quality and price relationships between store brands and national brands was explored. Bontems, Monier-Dilhan, and Requillart (1999) build on Mills' (1995) model by incorporating cost of quality. They find that there is an upper bound on quality at which the national brand manufacturer can deter the private labels entry. Additionally, the authors find that wholesale prices follow a U-shape curve across quality of the private label product implying that national brand manufacturers respond by differentiating or directly competing with the private label depending on its quality. Cotterill, Putsis, and Dhar (2000) use a demand system model to estimate how private label and national brands respond to each other's pricing strategies. They find that private labels cannot gain market share as easily as national brands by cutting prices. Moreover, they find that national brand prices are not very responsive to price changes of private labels, however the opposite is true for private label prices responding to national brand price changes. Similarly, Villas-Boas (2007) estimates a simultaneous demand and supply model of the

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<sup>24</sup> An implicit assumption in this idea of retailers capturing profits is that these economic profits are above the accounting profit norm or the retailer can increase the current economic profits made by the manufacturer. If either assumption is not correct, the value of the retailer will not change and may decrease due to increased risk under integration. In the theory of the firm literature, this discussion falls under the make-or-buy decision made by a firm. This decision is discussed in detail in the following chapter for multinational food economy firms.

yogurt market in Chicago to investigate manufacturer-retailer pricing interactions. The author tests between alternative pricing interactions and finds that the market is best characterized by non-linear pricing by the manufacturers or significant retailer bargaining power. This and the earlier research show that private labels and national brands use different quality and pricing strategies in the food retail sector.

As part of the research on the store brand-national brand relationship, many studies focused on the impact of store brand presence on prices, profits, and consumer welfare. Mills (1995) discussed these issues early on from a theoretical perspective. However, the body of literature below performed more rigorous empirical studies to determine price, profit, and consumer welfare impacts. An early study by Putsis (1997) finds that national brand prices decrease as private labels increase. This ex post analysis is later supported by a structural simulation analysis by Cohen and Cotterill (2011). Cohen and Cotterill find that prices decrease when private labels are introduced. Additionally, the authors find that retailer profits increase and consumer welfare increases. In contrast to these studies, Ward, Shimshack, Perloff, and Harris (2002) find that national brand prices actually increase in an ex post study of retail prices. The findings of Ward, Shimshack, Perloff, and Harris (2002) is also supported by Cotterill and Putsis (2000). More recent work has looked at breaking these effects out by category or type of product. In a study on determinants of organic premiums Jaenicke and Carlson (2015) find that private label products have a smaller organic premium than branded products. Additionally, the private label market share size does not decrease this organic

premium because there is no significant national brand pricing response to private label penetration in organic products.

Recently, research has begun to analyze policy, macroeconomic, and other structural impacts on the retail grocery industry while explicitly accounting for the store brands' competition. Bonnet and Requillart (2013) study the impact of sugar tax reform and an excise tax on soda prices and cost pass-through. The authors find that pass-through of cost changes by private labels are lower in percentage terms, but the price changes are greater in percentage terms compared to national brands (Bonnet & Requillart, 2013). Turning to the impacts of macroeconomic changes, Volpe (2014) finds that inflationary pressure on food prices affects private label products more than national brands. This leads to a smaller difference between national brand and private label prices. Importantly, Volpe states that price increases affect low-income households more because they purchase private label products more. These are the households that are hurt most by increasing food prices because they spend more of their income on food, so the finding that private labels increase more than the average adds to their issues (Volpe, 2014).

Finally, in a closely related study, Volpe and Lavoie (2008) find that private label and national brand prices respond differently to a change in local food retail market structure. Specifically, they find that national brand prices decrease more than private label prices when a Wal-Mart Supercenter enters the local market. The current study builds on this research by looking at price changes of national brands and store brands after a food retail acquisition.

### *3.1.2 Horizontal Merger Literature*

There is a large empirical literature on the effects of horizontal mergers on market prices. In theory, the effect of a merger on prices is ambiguous due to two opposing factors. For concreteness, consider a merger between two close competitors in a differentiated product market. After the merger, the new firm would be able to set prices by taking into account the substitution effect between products of the merged firms.<sup>25</sup> This would result in reduced competition between the products and put an upward pressure on product prices. Mitigating or even overriding this upward price pressure is the second factor of lower costs through efficiencies of scale and scope that may materialize in the larger, merged firm. These lower costs are passed through to the consumer to some degree. If costs decrease sufficiently, retail prices may actually decrease.

Merger studies can be broken into two categories: ex-ante and ex-post studies. Ex-ante horizontal merger studies use simulation or structural models to predict the impact of mergers. For example, in a seminal article in this area, Nevo (2000) estimates demand for RTE cereal and then uses the estimated price elasticities of demand in a supply-side model of differentiated product competition. Nevo simulates two mergers using the supply-side model to determine the effect on prices and finds that in both cases prices increase but to different degrees. Smith (2004) uses this method to simulate the effect of various mergers in the British retail grocery industry. The author estimates demand for groceries at each grocery store. These stores vary by store characteristics, the distance from a customer to a store, and the average price for a basket of goods at each

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<sup>25</sup> In a homogeneous good market, a pure market share increase allows the merged firm to increase prices.

store. Smith finds that mergers increase retail prices in all cases and that the degree of price increase varies by location. Smith's study points to the very regional and local nature of retail food competition (2004).

Ex-ante analysis of mergers has a number of limitations. First, ex-ante analyses rely on structural assumptions of the model. Second, to measure the change in prices for several products across several stores creates an incredible dimensionality problem because the product is defined as the combination of store and brand. Finally, only hypothetical mergers may be studied. Ex-post analyses overcome these limitations.

Several studies have analyzed the impact of horizontal mergers on consumer prices using an ex-post framework. Ashenfelter, Hosken, and Weinberg (2014) provide a brief summary of many of the most important studies to try to draw conclusions about the efficacy of anti-trust regulation of mergers. Few of these studies account for the vertical relationship between retailer and manufacturer. For example, research on mergers in gasoline sector shows the importance vertical relationships play in affecting retail prices. Hastings (2004) finds that increasing the presence of vertically integrated, branded gas stations increases gas prices, and Houde (2012) finds that prices increase after a merger in the Quebec City gasoline market increased the number of vertically integrated stations. Current ex-post food retail merger research has not taken these important vertical interactions into account.

In the food retailing sector, Hosken, Olson, and Smith (2012) use an ex-post reduced-form analysis to estimate the effects of several mergers in major U.S. metropolitan areas using market level price indices. The study finds that mergers in

already concentrated markets increase prices, while mergers in less concentrated markets decrease prices or have no effect. Similarly, Davis (2010) measures price changes around several mergers using firm-level scanner data from 1997-1999 and finds that national and store brand prices increase by approximately 4% and 6% on average, respectively. Allain, Chambolle, Turolloa, and Villas-Boas (2013) use a DID method with household purchase data to measure price changes after a nationwide merger between two French food retailers. They find that prices increase significantly for those stores in the same market as merging stores. The authors are unable to find causal evidence of price increases at merging stores, but find price increases at merging stores are correlated with the merger.

This essay contributes to the literature first by causally measuring price changes for national brands and store brands after an acquisition using a dataset of grocery store scanner prices. In particular, using retail scanner data a difference-in-differences analysis is performed to measure the price effects of an acquisition ex-post. In the analysis, the treatment and control groups are carefully specified for the acquisition under study. The analysis controls for many factors that could simultaneously affect prices and include fixed effects for products and store locations to control for other potentially confounding factors that are unobserved. Furthermore, because of the unique nature of the acquisition, the results causally identify the effects of the acquisition on the acquiring retailer prices. Whereas, previous studies analyzing a nationwide merger or acquisition were able to causally identify the effects only on the competing retailer prices or overall food retail prices in affected markets.

### 3.2 Food Retail Pricing Background and Merger Framework

### *3.2.1 Food Retail Pricing*

Volpe, Risch, and Boland (2015) provide an extensive review of why food retailers adjust prices. They categorize the reasons into four groups: input price changes, competitor pricing, consumer demand, and promotional pricing. Food retailers pass through input price changes to consumers to some degree. The rate at which input price changes pass through to consumers could be different depending on whether it is a price increase or decrease. Also, in imperfectly competitive markets each store accounts for competitor prices in determining its own prices. The strength of the competitor price effect depends on the underlying market structure and market power of competing stores. Additionally, retailers adjust prices in response to changing consumer demand over time. Aggregate changes in consumer demand across types of product categories are often slow. However, in the case of seasonal products, demand shifts can be sharp and regular. Finally, retailers heavily use promotions as a tool for adjusting prices. Promotional pricing is often short-term in nature and is likely used in response to external changes that will likely have a short-term impact. Because of this, promotional price changes are qualitatively different than shelf price changes. In this study, shelf prices are used in the analysis because an acquisition reflects a long-term, structural shift in the market. As such, promotional pricing would be an ineffective measure to respond to such a change.

### *3.2.2 Theoretical Framework*

Ashenfelter, Hosken, and Weinberg (2014) describe how antitrust enforcement policy has changed since the 1960s. Historically, antitrust regulators were interested solely in market concentration. If a proposed merger or acquisition would result in a significant

increase in market concentration, measured by the Herfindahl-Hirschman Index (HHI), then antitrust regulators would not allow it to proceed. This perspective accounted for the mutual dependence effects of mergers and acquisitions. Mutual dependence effects stem from inter-firm strategic behavior. Today, antitrust regulators use HHI changes as a useful indicator rather than the main measure of a proposed merger's anticompetitive effects. Regulators focus more on unilateral effects of mergers and acquisitions. Unilateral effects are the effects that result from intra-firm strategic behavior. These latter effects are the focus of the following Bertrand price competition model.

Suppose there are  $N$  firms, each producing a subset,  $\gamma_n$ , of  $J$  differentiated goods.

The subset,  $\gamma_n$  contains  $g_n$  goods. The short-run profit of firm  $n$  is the following:

$$(14) \quad \Pi_n = \sum_{j \in \gamma_n} (p_j - mc_j) M s_j(p) - C_n$$

where  $p_j$  is the price for the  $j^{th}$  product,  $mc_j$  is the marginal cost of product  $j$ ,  $M$  is the size of the market,  $p$  is the vector of prices for all  $J$  goods,  $s_j(p)$  is the market share of good  $j$ , and  $C_n$  is firm  $n$ 's fixed cost of production. The first order conditions that solve the short-run profit maximization problem for firm  $n$  are a set of  $g_n$  equations with the following form:

$$(15) \quad s_j(p) + \sum_{k \in \gamma_n} (p_k - mc_k) \frac{\partial s_k(p)}{\partial p_j} = 0 \quad \forall j \in \gamma_n, \quad \text{or}$$

$$(16) \quad p_j = - \left[ s_j(p) + \sum_{r \in \gamma_n, r \neq j} (p_r - mc_r) \frac{\partial s_r(p)}{\partial p_j} \right] \frac{\partial p_j}{\partial s_j(p)} + mc_j \quad \forall j \in \gamma_n.$$

Each of the  $N$  firms have the same first-order conditions over their respective subset of goods. Taken together, the first-order conditions for the  $N$  firms provide  $J$  pricing equations, one for each of the  $J$  differentiated goods.

Equation 15 shows that a short-run profit maximizing firm accounts for all cross-price effects across all of its products in setting its prices. That is, the firm takes into account the substitution effects that occur as consumers shift between its products. The internalization of substitution effects in optimal pricing decision often called the portfolio effect.

Equation 16, a rearrangement of Equation 15, illustrates how prices change when a merger occurs. When two firms merge, more products are under one firm's control. This increases the number of products that are being summed over. If the products are substitutes ( $\frac{\partial s_r(p)}{\partial p_j} < 0$ ), the summation term becomes more negative in Equation 16. This, in turn, increases the right-hand side of Equation 16. Therefore, prices for products offered by the merged firm increase when the products are substitutes, *ceteris paribus*.

The basic model of firm competition in prices predicts that a merger increases prices when holding marginal costs constant. However, it is possible that marginal costs can be reduced through efficiency gains from economies of scale or scope.<sup>26</sup> The marginal costs ( $mc_j$ ) may decrease sufficiently to override any price ( $p_j$ ) increases that would result from capturing more of the market and internalizing substitution effects. The

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<sup>26</sup> Economies of scope gains from the merger in this context means that the per-unit cost of producing the  $j^{th}$  good decreases as the firm has additional goods in its portfolio that it produces.

following subsection develops a framework that applies these general principles of price changes after a merger in the food retailing sector.

### *3.2.3 Food Retail Merger Framework*

After a retail merger, retail prices change due to changes in costs and changes in market structure. In a food retail merger (ignoring private labels for the moment), two factors put pressure on prices to change in the merged firm: cost reduction and substitution effect internalization, respectively.<sup>27</sup> For the merged firm, costs may decrease for two reasons. First, costs may decrease through typical efficiency gains through economies of scale or scope. Second, costs may decrease through a better bargaining position with suppliers. This distinction becomes important when relative price changes are discussed as each likely affects national brand and private label products differently. These lower costs could be passed through to consumers to some degree. However, as the merged firm now controls more stores, it will take into account more substitution effects that price changes have on the products it sells. This puts upward pressure on prices at the merged firm's stores because they are substitutes.

For competing firms, the story changes. Costs may increase because of a negative externality effect from the merging firm's better bargaining position. This effect incorporates the idea that suppliers receive worse terms from large retailers, and to make up for this, provide worse terms to smaller retailers. The higher costs in competing firms may be passed onto consumers in the form of higher retail prices. Also, the competing

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<sup>27</sup> Costs may increase due to higher monitoring and coordination problems. However, mergers are often rationalized with expected cost efficiencies. Therefore, this theoretical discussion focuses on potential cost savings.

**Table 3.1.** Price pressures from a merger on merged and competing firms

	Merged firm	Competing firms
Cost changes – Efficiency	Decrease	No effect
Cost changes – Bargaining power	Decrease	Increase
Substitution effect internalization	Increase	Follow net price change of merged firm

firms respond to the price changes that the merged firm makes. For example, if products are substitutes, competing firms would raise their prices if the merged firm raises its prices, potentially due to the portfolio effect. Similarly, if the merged firm decreases its prices, potentially from efficiency gains through merger, the competing firms would respond by decreasing their prices. Table 3.1 summarizes the merger effects on the merged and competing firms' prices. The table shows that the net price effect from the merger is unclear *a priori* for the merged and competing firms. Thus, price effects from a merger are suitable for empirical study.

To extend the framework to relative price changes, the following discussion analyzes the portfolio effect and cost changes with respect to private labels and national brands. The portfolio effect impacts both private labels and national brands, but the magnitude of the effect is unknown and may be different for each type of product.

Cost changes for store brand and national brand products may continue to accrue due to efficiency and bargaining power changes. Cost changes due to efficiency may accrue to the retailer across private labels and national brands differently. Some efficiency gains that accrue to the retailer likely accrue evenly across brands such as those efficiencies in headquarter functions like accounting, human resources, and retailer advertising. Efficiency gains from bulk discounts and better bargaining power may accrue to private labels and national brands to different degrees. Since there are more

stores, there may be significant discounts or scale economies in purchasing that the retailer can capture. These may be in production, distribution, storage, or other parts of the value chain. Bulk discounts for private labels are more likely going to be different from bulk discounts for national brands because the retailer is producing or contracting for private labels. Additionally, the proportional increase in sales of private labels for the private label manufacturer is likely to be more than the proportional increase in sales of national brands for the national brand manufacturer. Therefore, to the extent that they exist, cost changes due to bargaining power would likely have differential effects on national and store brands.

There are six price change scenarios of interest to this study. These are summarized in Table 3.2. Each scenario implies something different about the relative magnitude of the economic forces (cost savings or the portfolio effect) at play for each product.

When store brand and national brand prices both decrease, cost savings dominate the portfolio effect. For the reasons that are mentioned above, it is possible that store and national brand prices may not decrease at the same proportion. Suppose that national brand prices decrease more than store brand prices; this is scenario A in Table 3.2. In this scenario, there are two cases that may cause this. One case is that the store brand portfolio effect may be larger than that of national brand. This would be possible if the market share of store brands increases relative to share of national brands. The second case is that the cost savings on the national brand products may be larger than the savings on the store brand products. Now suppose that store brand prices decrease more than

**Table 3.2.** Relative price change scenarios and dominant economic forces

Scenario Labels	Price Change Scenario	Ranking of economic forces
A	$\Delta P_{NB} < \Delta P_{PL} < 0$	$(PE_{NB} + CC_{NB}) < (PE_{PL} + CC_{PL}) < 0$
B	$\Delta P_{PL} < \Delta P_{NB} < 0$	$(PE_{PL} + CC_{PL}) < (PE_{NB} + CC_{NB}) < 0$
C	$0 < \Delta P_{NB} < \Delta P_{PL}$	$0 < (PE_{NB} + CC_{NB}) < (PE_{PL} + CC_{PL})$
D	$0 < \Delta P_{PL} < \Delta P_{NB}$	$0 < (PE_{PL} + CC_{PL}) < (PE_{NB} + CC_{NB})$
E	$\Delta P_{PL} < 0 < \Delta P_{NB}$	$(PE_{PL} + CC_{PL}) < 0 < (PE_{NB} + CC_{NB})$
F	$\Delta P_{NB} < 0 < \Delta P_{PL}$	$(PE_{NB} + CC_{NB}) < 0 < (PE_{PL} + CC_{PL})$

national brand prices; this is scenario B in Table 3.2. Again there are two cases in which this occurs. First, the national brand portfolio effect may be larger than the store brand portfolio effect; or, second, the store brand products experience more cost savings than national brand products. The larger efficiency gains may be obtained through store brand production, distribution, or marketing.

When store brand and national brand prices both increase, the portfolio effect dominates any efficiency gains. Again, there are two possible scenarios. In each, the arguments parallel the situation when both prices decrease. First, store brand prices increase more than national brand prices, scenario C. In this scenario the arguments are the same as when the national brand prices decrease more than store brand prices. Second, national brand prices increase more than store brand prices, scenario D. In this scenario the stories are the same as when store brand prices decrease more than national brand prices.

Another scenario is that national brand prices increase and private label prices decrease after the merger, scenario E. In this case, the dominant force is likely to be the economies of scale in production, distribution, or marketing of private labels. The increase in national brand prices would indicate that portfolio effect is important.

However, the decrease in private label prices would indicate that gains from scale economies outweighs the portfolio effect for private label products.

Lastly, it is possible that private label prices increase and national brand prices decrease due to the merger. In this scenario, scenario F in Table 3.2, the dominant force is the increased retailer market power exerted on private label products. Suppose there were no efficiency gains. Then, the retailer might have shrunk its margins on national brands to increase foot traffic (i.e., demand) and more sales in the category. Simultaneously, it could increase the margin on the private label generating more profit on the higher margin product. For example, the acquiring firm can exert more market power on the private label product if the number of competing store brands decreases due to the acquisition and/or acquiring firm's store brand market share increases relative to national brand market share due to extended shelf space. The argument for the exertion of retailer market power in this case would be reinforced if efficiency gains exist.

### 3.3 Acquisition Background and Data

#### *3.3.1 Large U.S. Metropolitan Food Retail Market*

In 2012, the large U.S. metropolitan area (LUSMA) where the acquisition took place was one of the ten largest metropolitan areas in the U.S. (U.S. Census Bureau, 2015).<sup>28</sup>

Notably the market is very fragmented with several national and regional chains. Before the acquisition in 2011, the market leader had less than 20% market share, followed by the runner-up with less than 15% market share and the other three top five market share leaders each with less than 10% market share. In addition to these large chains, smaller

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<sup>28</sup> In order to maintain the confidentiality of the retailer, the name of the market where the acquisition took place is withheld.

grocery stores serving only the LUSMA market had a significant share of the market in 2011 (Metro Market Studies, 2012). By 2013, after the acquisition, the market share leader runner-up in 2011 became the market leader with still under 20% of the market share, followed by the 2011 leader less than a percentage point behind. Each of the three other top five retailers had less than a 10% market share with two of them not in the top five in 2011 (Metro Market Studies, 2014). Most regional and national retailers that serve the LUSMA market vary prices by location which reflects spatial differences in demand and costs.

### *3.3.2 The Acquisition*

In 2012, a large, regional supermarket chain, RA, announced it was acquiring approximately 60% of the stores from a small supermarket chain, RB, which served only the LUSMA market. In 2011, RA had nearly a quarter of its stores that were located in the state in the LUSMA market. Later in 2012, RA completed the purchase of all but one of the stores and reopened them that same month. These stores were rebranded under the RA brand. Of the remaining RB stores, most were sold to minor chains and the rest were closed.

Before the acquisition, RA and RB pursued different pricing strategies with RB prices typically higher. However, both retailers followed similar macro-shifts and trends, such as higher milk and food prices during the 2008-2009 recession, across the time period of study. The acquisition did not greatly change the concentration of the top 4 firms during the period of study. The CR4 dropped in 2013 by approximately 2 percentage points from 2011. This decrease in CR4 looks to be attributable to the market

leader losing market share and the third place retailer in 2011 dropping out of the top 5. However, the acquisition represents a large number of stores for a single retailer in a single market. RA increased the number of its stores in the LUSMA market by more than a 25% with the acquisition. This increased its market share in the LUSMA market.

### *3.3.3 Data Sources*

The current study uses Nielsen scanner data available through the Kilts Marketing Center at the University of Chicago to analyze product-level price changes. The scanner data consists of a panel of stores across the United States that has provided data to Nielsen and has agreed to release it to the Kilts Marketing Center. Each store has a store code that remains constant across time and a parent code tracking which retailer owns the store. These parent codes do not directly identify the retailers by name. At the store level, the dataset provides information on a store's location at the county level.

The key information in the dataset are weekly price and sales observations for each store from 2009-2013 at the Universal Product Code (UPC) level. For a given week, weighted average weekly price and total sales are recorded for all UPC. That is, a single unit of observation provides price and sales information for a particular week and product. These are referred to as a product-week observation.

The data allows for the identification of the identical products in two different stores by matching UPCs. National brand products can also be identified through a brand description variable. To maintain anonymity of the retailer, all private label products are coded under a single brand, CTL BR. Because private labels are associated with the stores and retailers that sell them, private label products can be linked to a store's parent

code. By making this link, the analysis can measure price differences across stores for the same retailer. That is, despite entire store brands in a product category being bundled together, the data differentiates between them by associating the product with the retailer for the product-week observations.

The analysis focuses on two product categories – fluid milk and RTE cereal. These products are selected because they are typical examples of high volume, fast-moving product categories. The product markets also exhibit different competitive structures. For example, milk is a relatively homogeneous product with private labels having a majority of sales. In contrast, RTE cereal is dominated by national brands and is a highly differentiated product. Additionally, these are well-studied products in the literature. A Google Scholar search of “fluid milk economics” and “Ready-to-Eat cereal economics” returns over 14,000 and over 4,000 results since 2011, respectively. Notable studies related to this essay include Cohen and Cotterill (2011) for fluid milk and Nevo (2000) for RTE cereal.

The Nielsen scanner data is supplemented with U.S. Bureau of Economic Analysis (BEA) data by county to describe the market conditions for each store. These include variables such as per capita income, total population, and total county income. Table 3.3 contains the Nielsen scanner data variables and BEA market variables and their definitions.

### 3.4 Methods

A naïve approach to measure price changes for national brand and store brand products due to RA acquiring RB is to measure the average difference in the prices for RA stores

**Table 3.3.** Nielsen Retail Scanner dataset and market characteristics variables

Variable	Definition	Source
store_id	Unique store identifier number	Nielsen
parent_code	Unique code for the retailer who owns a store	Nielsen
fips_county	Code identifying the county a store is located in	Nielsen
DMA	Code identifying the Nielsen market the store is located in	Nielsen
UPC	UPC code for the product	Nielsen
week	Identifies the week during which transaction data was collected	Nielsen
price	Weighted average price of the product for the week	Nielsen
units	Number of units sold during the week	Nielsen
stores	Number of food stores present in the county in Nielsen dataset	Nielsen
county_pop	Population of a county	BEA
county_PCinc	County per capita income	BEA

in the LUSMA before and after the acquisition. However, this assumes that the counterfactual price change is zero, which is unlikely to be accurate as prices may also change due to other factors that affect demand or supply conditions in the market. A more plausible counterfactual is constructed by using price changes in RA stores not in the LUSMA market. Specifically, the counterfactual in this essay uses price changes in a similar market that is unaffected from the acquisition to account for changes in the economic environment. This approach is commonly referred to as the difference-in-difference (DID) identification strategy.

There are a number of advantages in using the DID identification strategy to study the acquisition in the LUSMA market. First, the only major change occurring in the LUSMA grocery market during the study is the acquisition, which suggests, to the extent that they exist, the confounding effects of other changes in the LUSMA market are potentially small. For example, no other major shocks to the competitive environment such as entry by a new store or an exit are observed. Additionally, the geographic price

variation allows for the use of price changes in other locations as counterfactual to price changes in the LUSMA. By using the DID identification strategy and controlling for other market factors that may be changing between the LUSMA and non-LUSMA markets in the same state and before and after the acquisition, the analysis obtains a causal estimate of national brand and private label price changes due to the acquisition.

In general, the DID identification strategy begins with a treatment, observations before and after treatment, and groups that received and did not receive the treatment. In the case of this study, the treatment is the acquisition ( $T$ ), the observations before the treatment are prices for product  $j$  at store  $i$  before the acquisition ( $p_{ij0}$ ), and the observations after the treatment are prices for product  $j$  at store  $i$  after the acquisition ( $p_{ij1}$ ). For the basic DID estimate, the treatment group consists of stores in a market that was affected by the acquisition ( $T = 1$ ), and the control group consists of stores in nearby markets that were not affected by the acquisition ( $T = 0$ ). The pure DID estimate of the effect of the acquisition is the following:

$$(17) \quad E[p_{ij1} - p_{ij0} | T = 1] - E[p_{ij1} - p_{ij0} | T = 0].$$

In the pure DID identification strategy, an important assumption is that the assignment to treatment, being a store in the LUSMA, is uncorrelated with price changes. This assumption is tenuous for the case of retail acquisitions if store locations are determined based on current and expected local demand and other market factors. For example, stores located in rural areas may provide a different product-price mix over time than stores in urban areas. In other words, the acquisition decision can be based on the location characteristics. To account for this endogenous acquisition decision the analysis

uses a regression DID model which includes store, product, and market characteristics in the analysis to control for the differences between locations. The following subsections detail the implementation of the DID identification strategy to the current study.

#### *3.4.1 Treatment and Control Group Selection Framework*

The practical delineation of stores into treatment and control groups is important for ensuring that the control group is a good representation of the treatment group's counterfactual. The treatment group should include all stores that were affected, directly or indirectly, from the acquisition. The control group should include only those stores that are not affected by the acquisition.

A conceptual division of the net price effects from a food retailer acquisition by market and store type can be useful in determining appropriate treatment and control groups for empirical work. The first division is by market. There are within market effects and across market spillovers. The within market effects are composed of cost changes and substitution effect internalization.<sup>29</sup> These affect stores in the markets where the acquisition occurred. There are direct, within market effects that affect the acquiring firm's stores, and there are indirect, within market effects that affect competing firms' stores in the markets where the acquisition occurred. The across market spillovers are benefits and costs accruing to retailers' stores in other markets because they compete with the acquiring retailer. Assuming efficiency gains or losses in these stores because of the acquisition complicates the problem while the argument or evidence is weak. To avoid confusion, only direct effects of the acquisition are analyzed.

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<sup>29</sup> See the *Food Retail Merger Framework* sub-section for more detail about these channels.

In the LUSMA acquisition case, direct acquisition effects are felt by RA stores in the LUSMA. Stores in the LUSMA competing with RA experience indirect acquisition effects. RA stores and other retailers' stores not in the LUSMA may experience across market spillovers.

The following is an example to provide concreteness to the above discussion. Suppose there are four retailers, retailers A, B, C, and D, and two markets, market 1 and 2. Suppose, as is the case in this study, retailer A acquires retailer B. Furthermore, suppose retailer B has stores only in market 1 and retailer A has stores in markets 1 and 2. Additionally, suppose retailer C has stores in market 1 and 2, and retailer D has stores only in market 2. Then, retailer A is the only retailer to experience direct within market effects. Retailer C is the only retailer to experience indirect within market effects. Retailer A and retailer C also experience across market spillovers because they are the acquiring store and compete with the acquiring store in market 1, respectively. Finally, retailer D experiences across market spillovers also because it competes with retailers A and C only in market 2.

These conceptual effects delineate treatment from control groups by illustrating which stores may be affected (treated) by the acquisition. In general, all of these effects and spillovers may be non-zero. However, different acquisitions and mergers have different magnitudes on each of the effects. In the LUSMA acquisition under study, the baseline analysis assumes that the across market spillovers are zero. Therefore, the treatment effects obtained from the DID method are composed of within-market effects only.

Previous research has not been able to maintain the assumption that across market spillovers are zero within the merging or acquiring firms (Allain, Chambolle, Turolloa, & Villas-Boas, 2013). This acquisition is unique in that the acquiring firm makes a near complete acquisition of the acquired firm, but the acquisition is isolated geographically and is relatively small compared to the overall size of the retailer and the national market. These characteristics of the acquisition imply that across market spillovers will be very small if present.

### *3.4.2 Market Definition*

Market definitions are a combination of the county and the Nielsen market delineation. Specifically, the LUSMA market (the treated market) is defined as the Nielsen LUSMA market. Other food retail merger studies have used similar, traditional market level definitions (Hosken, Olson, & Smith, 2012). To define the non-LUSMA market, a one county buffer around each county in the Nielsen LUSMA market is used and define all other counties in the same state as the non-LUSMA market. The reasoning for using buffer counties is as follows. Because the store location is given at the county level in the Nielsen dataset, the store's location within the county is unknown. Therefore, the data does not reveal how geographically close two stores are to one another even if they are in different, but adjacent counties. Therefore, the analysis conservatively uses a buffer county between the LUSMA and non-LUSMA counties.<sup>30</sup> Control stores must be in a non-buffer county outside of the LUSMA. Those stores in buffer counties are not used in the analysis.

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<sup>30</sup> Robustness checks include dropping this buffer.

### *3.4.3 Empirical Model and Treatment Effects*

The analysis provides average treatment effects of the acquisition (acquisition effects) for national brand and store brand milk and RTE cereal products in RA stores.<sup>3132</sup> The treatment group are RA stores in the LUSMA, and the control group are RA stores not in the LUSMA.<sup>33</sup> These control groups are valid under the assumption that there are no across market spillovers. The average treatment effect of the acquisition on all products is the weighted average of the separate private label and national brand acquisition effects.

Specifically, the control variables are product-store-quarter fixed effects and time-varying, county-level market characteristics. Product-quarter-store fixed effects control for a number of unobserved confounding factors. First, consider just product-store fixed effects; these control for time-invariant product and store characteristics like product loyalty and store location. Including quarter fixed effects into the product-store fixed effects now controls for time-variant product and store characteristics in addition to time-invariant characteristics. Time-variant product characteristics include recipe or quality changes and time-variant store characteristics include store expansions, renovations, or changes in services (e.g., deli counters, wine advisor, etc.). Time-variant county characteristics such as per-capita income and population are included to control for changes in market demand and the number of food stores to control for changes in competition.<sup>34</sup> The following equation provides the DID treatment effects:

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<sup>31</sup> The following empirical models are run separately for milk and RTE cereal.

<sup>32</sup> The effect on store prices for retailers with stores only in (outside of) the LUSMA cannot be identified because a counterfactual cannot be created with stores outside of (in) the LUSMA market.

<sup>33</sup> No acquired stores are used in the baseline analysis because of a structural change between retailer management would confound the effects of pure market power changes.

<sup>34</sup> The analysis can additionally control for potential significant differences across the LUSMA and non-LUSMA stores by estimating pre-acquisition price trends for the control and treatment groups. This allows

$$(18) \quad \ln(P_{ijt}) = \alpha + \beta A_t + \gamma(A_t \times SB_j) + \delta_1(A_t \times T_i) + \delta_2(A_t \times T_i \times SB_j) + \theta' X_{it} + \sum_{k=1}^{K=i \times j \times t} \lambda_k Z_{ijt} + \varepsilon_{ijt}.$$

where  $\ln(P_{ijt})$  is the natural log price for product  $j$  at store  $i$  in time period  $t$ ,  $SB_j$  equals 1 if product  $j$  is a store brand and 0 if not,  $T_i$  equals 1 if store  $i$  is in the LUSMA and 0 if not, and  $A_t$  equals 1 if the observation is after the acquisition period and 0 otherwise.  $X_{it}$  is a vector of market characteristics for store  $i$ .  $Z_{ijt}$  are product-quarter-store fixed effects.  $\varepsilon_{ijt}$  is the error term that is assumed to be normally distributed. The terms,  $X_{it}$  and  $Z_{ijt}$  are used to control for market characteristics, and product and store characteristics that may change overtime.

The parameter  $\beta$  measures the average change in national brand prices after the acquisition in RA stores outside the LUSMA. Similarly,  $\gamma$  measures the difference in the average change in prices after the acquisition between national brands and store brands in RA stores outside the LUSMA.

The estimates of acquisition effects are obtained from  $\delta_k$  ( $k = 1,2$ ). The acquisition effect on national brand prices ( $\Delta P_{NB}$ ) is measured by parameter  $\delta_1$  because national brands are the reference group for the  $SB_j$  dummy variable. The difference in store brand and national brand acquisition effects is measured by parameter  $\delta_2$ .

Therefore, the acquisition effect on store brand prices ( $\Delta P_{PL}$ ) is obtained by summing parameters  $\delta_1$  and  $\delta_2$ . The overall acquisition effect is the weighted average of  $\delta_1$  and

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for time-varying price trends that are not controlled for by product-quarter-store fixed effects and market characteristics. However, this imposes an additional assumption that these are long-run, structural trends which is unlikely to hold. Therefore, the analysis does not include these additional controls in the analysis. Results from alternative model specifications are available upon request.

$\delta_1 + \delta_2$  with the weights being the share of national brand price-week observations and store brand price-week observations, respectively. This estimate is obtained by running the following regression:

$$(19) \quad \ln(P_{ijt}) = \alpha + \beta A_t + \delta(A_t \times T_i) + \theta' X_{it} + \sum_{k=1}^{K=i \times j \times t} \lambda_k Z_{ijt} + \varepsilon_{ijt}.$$

The estimate of the overall acquisition effect is  $\delta$ .

#### 3.4.4 Data Implementation

To maintain a consistent and representative sample across time, products with infrequent observations are removed. Specifically, the analysis only includes UPCs that have sales in every month. This is important because the DID method requires price observations for the same UPC-store combination before and after the acquisition. Moreover, this ensures that the results are not driven by outliers and unpopular products. Also, in order to have a balanced dataset, the final dataset includes the same number of months before and after the acquired stores reopen. Finally, to maintain a consistent sample across the treatment and control groups, products that are not sold in both the treatment and control areas are removed. This ensures that only those products that are directly comparable across groups are included.

Leading up to the stores changing ownership, RA and RB store prices may change in ways that would bias the true acquisition effect. These are anticipation effects. These include RB reducing prices on products to clear inventory before the stores are officially sold. Alternatively, RA stores may reduce prices after negotiations to indicate to anti-trust regulators that the acquisition will not negatively affect consumers. These distortions

would distort the price difference before the acquisition and bias the acquisition effect estimates from the DID analysis. In order to keep the data clean from anticipation effects, the final dataset removes observations leading up to the acquisition. Also, to ensure transition effects after the acquisition are not included, the data cleaning procedure drops observations immediately after the RB stores re-open.

Four buffer windows are considered. In this discussion, “the acquisition” refers to the month in which the stores close and reopen. The first buffer removes two months of data prior to the acquisition and two months after the acquisition. The second buffer removes four months prior to and after the acquisition. The third buffer removes six months of data on each side of the acquisition. Finally, the fourth buffer removes eight months on before and eight months after the acquisition. These buffer windows leave approximately a year of data after the merger, so these acquisition effects are short-term effects. This means that other long-run structural changes that occur in the market will not confound the estimates.

#### *3.4.5 Testing the Significance and Equivalence of Relative Price Changes*

Tests on  $\delta$ ,  $\delta_1$ , and  $\delta_1 + \delta_2$  are performed to determine if the overall, national brand, and store brand acquisition effects are significant, respectively. These tests determine if the acquisition had a significant effect on prices. Table 3.1 of the analytical framework provides no clear predictions of the treatment effects’ qualitative signs. To determine if national brand and private label prices change differently the analysis tests if  $\delta_2$  is significantly different from zero. Here again, the theory does not provide any predictions a priori about the results from this test.

**Table 3.4.** Empirical tests and their descriptions

Empirical test	Description
$\delta_1 = 0$	Tests if the acquisition had an effect on any of the prices individually
$\delta_1 + \delta_2 = 0$	
$\delta = 0$	Tests if the acquisition affected prices at RA stores on average
$\delta_2 = 0$	Tests if store brand price changes are the same as national brand price changes

Table 3.4 presents description of empirical tests performed on interaction parameters and the corresponding insights they reveal. In Table 3.4, the first two sets of tests determine if the acquisition had a significant impact on prices in RA stores in the LUSMA. The first set determines if it had any effect on store brands or national brands individually, while the second test determines if it had an overall impact on prices. The third test determines if store brand and national brand prices changed differently.

For concreteness, consider the following example. Let  $\delta_1 < 0$ ,  $\delta_2 > 0$ , and  $\delta_1 + \delta_2 > 0$ . This means that  $\Delta P_{PL} > 0 > \Delta P_{NB}$  in RA stores in the LUSMA, which corresponds to sixth row of Table 3.2. The story is then retailer market power as described in detail in the food retailing framework section.

#### 3.4.6 Robustness Checks

To analyze how results of the baseline model change by altering some of the maintained hypotheses, five robustness checks are performed. First, the robustness check analysis determines if removing one-county buffer around the LUSMA from baseline analysis makes any difference on the results. Second, the analysis checks if the results significantly change when acquired stores are included in the treatment group. Adding the data from acquired stores might affect the results significantly because the stores changed format. Third, the robustness check analysis determines if using weighted prices

changes the acquisition effects where the weights are each UPC's share of sales. Weighting will reduce the impact of less popular products. Finally, three robustness checks investigate how sensitive the results are to the buffer around the time of acquisition. These check the effects from excluding data two, four, and six months before and after the acquired stores reopen. The baseline case excludes data for the 8 months before and after the acquired stores reopen.<sup>35</sup>

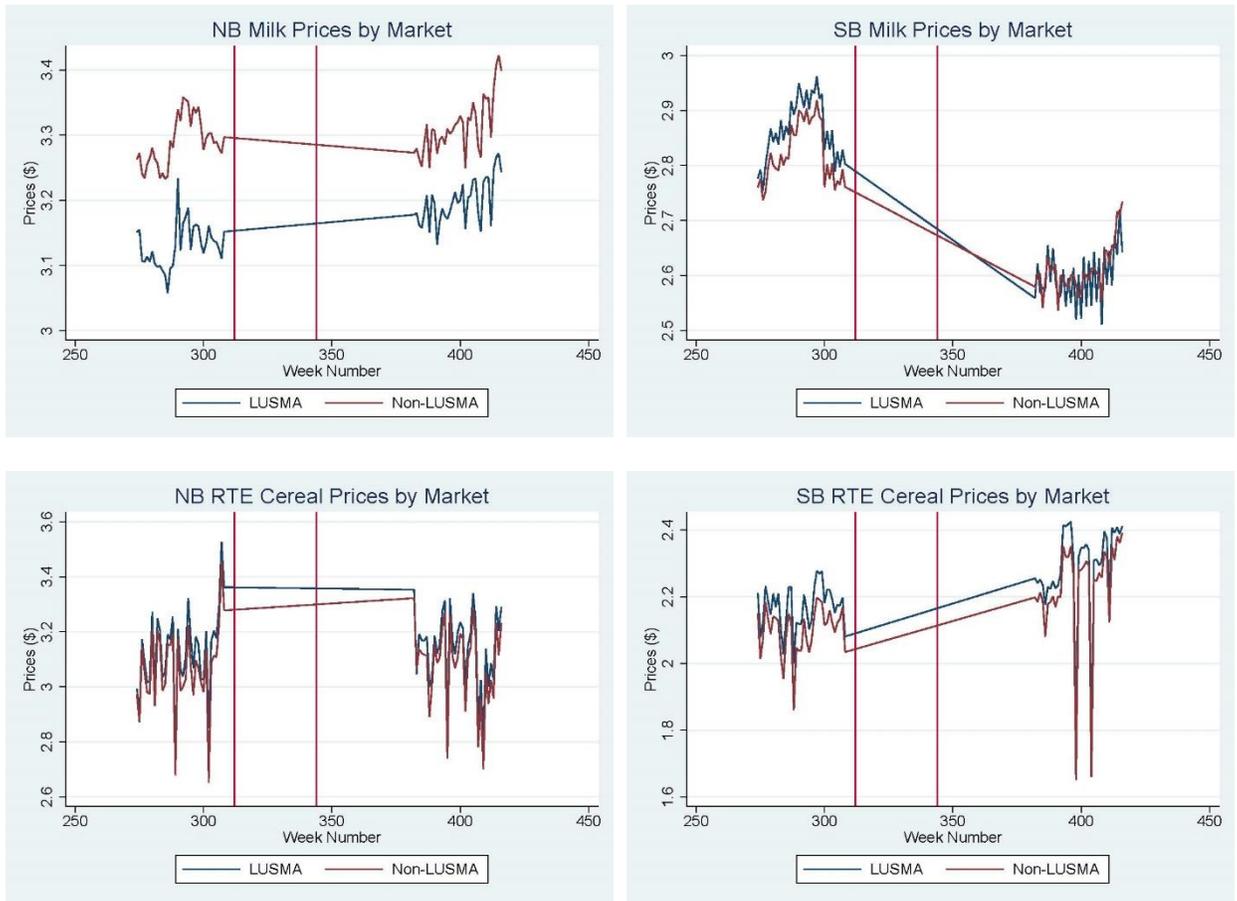
### *3.4.7 Summary Statistics*

The key identifying assumption of the DID approach is that the price trends for the treatment and control groups would have been the same in the absence of the acquisition. This assumption implies that a common price trend exists in the pre-acquisition period for the treatment and control groups. Figure 3.1 contains graphs for average milk and RTE cereal prices weighted by sales for the balanced dataset by market (the LUSMA or non-LUSMA) and brand type (national brand and store brand).<sup>36</sup> The top two panels contain milk prices, and the bottom two panels contain RTE cereal prices. The two left panels contain national brand prices, and the right two panels contain store brand prices. This figure shows that national brand and store brand milk prices track each other closely between the LUSMA and non-LUSMA stores. Also, there is much more volatility after the acquisition in store brand milk prices in the LUSMA. For RTE cereal, both national brand and store brand prices seem to follow each other well across markets. However, RTE cereal prices are more volatile than milk prices. This may be due to more

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<sup>35</sup> See the Data section for more details on the acquisition buffers.

<sup>36</sup> Data from the acquisition buffer period has been excluded. The straight line links the last pre-acquisition price before the buffer to the first post-acquisition price after the buffer.



**Figure 3.1.** Average milk and RTE cereal prices by market and brand type, Balanced dataset

promotions being run on these products or because milk is more of a commodity. Overall, store brands and national brands follow each other closely across the LUSMA and non-LUSMA for both products in the pre-acquisition time period. These trends provide strong evidence that the common trend assumption holds.

Tables 3.5 and 3.6 contain summary statistics of data for milk and RTE cereal, respectively. In the top panel, summary statistics for all stores, just the treated stores, and just the control stores are presented in the first three columns, respectively.<sup>37</sup>

<sup>37</sup> The bottom panel contains raw difference-in-difference estimates of the acquisition effect. These

**Table 3.5. Summary statistics by treatment type – Milk**

<i>County</i>	Overall			Treatment			Control		
<i>Characteristics</i>									
Population	279,739 (34,760)			639,458 (78,174)			135,852 (14,089)		
Per Capita Income	41,642 (993)			51,257 (2,192)			37,796 (562)		
Food Stores	9.7 (1.36)			25.1 (2.73)			3.6 (.50)		
<i>Store</i>									
<i>Characteristics</i>									
RA Stores	121			66			55		
<i>Product</i>									
<i>Characteristics</i>									
<i>Product Type</i>									
	Total	NB <sup>a</sup>	SB <sup>b</sup>	Total	NB	SB	Total	NB	SB
Products	85	68	17	85	68	17	85	68	17
Observations (1,000s)	407.7	269.9	137.8	240.0	164.2	75.8	167.8	105.8	62.0
Units Sold (Mill)	29.7	9.6	20.1	18.0	6.5	11.5	11.8	3.2	8.6
Sales (Mill \$)	85.9	30.8	55.1	51.9	20.4	31.6	34.0	10.4	23.5
Units Sold 2013 (Mill)	13.4	4.3	9.1	8.0	2.9	5.2	5.4	1.4	4.0
Share of units sold	100%	32.3%	67.7%	60.3%	35.9%	64.1%	39.7%	26.8%	73.2%
Share of sales	100%	35.9%	64.1%	60.5%	39.3%	60.7%	39.5%	30.7%	69.3%
<i>Price Statistics</i>									
<i>Product Type</i>									
	Total	NB	SB	Total	NB	SB	Total	NB	SB
Pre-merger Price per unit (\$)	3.28 (.003)	3.64 (.003)	2.57 (.004)	3.29 (.004)	3.62 (.004)	2.58 (.005)	3.26 (.004)	3.67 (.005)	2.57 (.006)
Post-merger Price per unit (\$)	3.39 (.003)	3.72 (.003)	2.75 (.005)	3.40 (.004)	3.69 (.004)	2.76 (.007)	3.38 (.004)	3.75 (.005)	2.74 (.008)
Price Change per unit (\$)	.11*** (.004)	.08*** (.005)	.18*** (.007)	.11*** (.005)	.08*** (.006)	.18*** (.009)	.12*** (.006)	.09*** (.007)	.17*** (.010)
<i>Difference-in-Difference</i>									
	Total			NB			SB		
DID (\$)	-.008 (.008)			-.010 (.008)			.011 (.015)		
DID (Log Price)	-.005*** (.002)			-.005** (.002)			-.005 (.004)		

Notes: Numbers in parentheses are standard errors. Numbers not in parentheses are averages if there is a corresponding standard error underneath it, while those without standard errors are totals or shares as indicated by the row name. Asterisks indicate statistical significance only in the price change row. \*\*\*, \*\*, and \* means there was a significant price change at the 1%, 5%, and 10% levels, respectively. The data used for these statistics are observations in the balanced dataset with an 8-month acquisition buffer, buffer counties excluded from the treatment and control, and acquired stores are excluded from the treatment and control.

a. NB stands for national brands.

b. SB stands for store brands.

estimates will be discussed in the results section.

**Table 3.6. Summary statistics by treatment type – RTE Cereal**

<i>County</i>	Overall			Treatment			Control		
<i>Characteristics</i>									
Population	279,739 (34,760)			639,458 (78,174)			135,852 (14,089)		
Per Capita Income	41,642 (993)			51,257 (2,192)			37,796 (562)		
Retail Stores	9.7 (1.36)			25.1 (2.73)			3.6 (.50)		
<i>Store</i>									
<i>Characteristics</i>									
RA Stores	119			66			53		
<i>Product</i>									
<i>Characteristics</i>									
<i>Product Type</i>									
	Total	NB	SB	Total	NB	SB	Total	NB	SB
Products	154	121	33	154	121	33	154	121	33
Observations (1,000s)	1,005.7	754.2	251.5	563.5	425.2	138.3	442.2	329.0	113.2
Units Sold (Mill)	14.1	11.9	2.2	7.9	6.8	1.2	6.1	5.1	1.0
Sales (Mill \$)	41.5	36.8	4.7	23.7	21.1	2.6	17.9	15.7	2.2
Units Sold 2013 (Mill)	6.4	5.4	1.0	3.6	3.1	0.5	2.8	2.3	0.4
Share of units sold	100%	84.5%	15.5%	56.3%	85.4%	14.6%	43.7%	83.5%	16.5%
Share of sales	100%	88.6%	11.4%	57.0%	89.2%	10.8%	43.0%	87.8%	12.2%
<i>Price Statistics</i>									
<i>Product Type</i>									
	Total	NB	SB	Total	NB	SB	Total	NB	SB
Pre-merger Price per unit (\$)	3.08 (.001)	3.38 (.001)	2.19 (.002)	3.12 (.002)	3.42 (.001)	2.20 (.003)	3.03 (.002)	3.32 (.001)	2.18 (.003)
Post-merger Price per unit (\$)	3.11 (.001)	3.39 (.001)	2.26 (.002)	3.14 (.002)	3.42 (.001)	2.27 (.003)	3.07 (.002)	3.35 (.001)	2.24 (.003)
Price Change per unit (\$)	.03*** (.002)	.01*** (.001)	.07*** (.003)	.03*** (.002)	.00* (.002)	.08*** (.004)	.04*** (.002)	.03*** (.002)	.06*** (.004)
<i>Difference-in-Difference</i>									
	Total			NB			SB		
DID (\$)	-.012*** (.003)			-.024*** (.003)			.017*** (.006)		
DID (Log Price)	-.003*** (.001)			-.008*** (.001)			.009*** (.003)		

Notes: Numbers in parentheses are standard errors. Numbers not in parentheses are averages if there is a corresponding standard error underneath it, while those without standard errors are totals or shares as indicated by the row name. Asterisks indicate statistical significance only in the price change row. \*\*\*, \*\*, and \* means there was a significant price change at the 1%, 5%, and 10% levels, respectively. The data used for these statistics are observations in the balanced dataset with an 8-month acquisition buffer, buffer counties excluded from the treatment and control, and acquired stores are excluded from the treatment and control.

a. NB stands for national brands.

b. SB stands for store brands.

The county characteristics, summarized in the first three statistics, are the same across both tables. The statistics show that the average treated county has a much larger population, higher per capita income, and more food stores. This is expected because the treated counties are around the LUSMA metropolitan area. It also clearly shows that the county characteristics should be included in the econometric model because they display variation across time and treatment status. Note that there are similar shares of observations across treatment and control with slightly more data coming from treated areas.

A close inspection of Table 3.5 reveals a number of important aspects of the milk category. First, the table shows that milk is a large and important segment. There are 85 products that had sales every month in the balanced dataset excluding the buffer time period with just under 30 million units being sold totaling nearly \$86 million in sales. Next, note that a majority of the units sold and sales come from private labels. Additionally, these shares are fairly similar across the treatment and control stores. Finally, the table shows that milk prices increased after the acquisition and more so for store brands than for national brands. Store brand milk prices increased more in treatment stores, while national brand milk prices increased more in the control stores.

Similarly, Table 3.6 reveals important aspects of the RTE cereal category. First, RTE cereal is a large and important segment. There are nearly 120 products that had sales every month in the balanced dataset excluding the buffer time period. Approximately 14 million units were sold bringing in sales of \$41.5 million. Second, the RTE cereal category is dominated by national brands. Approximately 85% of the units sold are

national brands, and nearly 90% of sales are from national brands. These shares are similar across both treatment and control stores. Finally, prices have increased after the acquisition with store brands increasing more than national brands. Like milk prices, RTE cereal national brand prices increased more in control stores than treatment stores, and store brand prices increased more in treatment stores than in control stores.

### 3.5 Results

The differences in price changes discussed in the summary statistics section above are precisely the pure DID estimates. These are contained in the bottom panels of Table 3.5 and Table 3.6. The pure DID estimates indicate that the acquisition decreased prices overall for both milk and RTE cereal. However, this decrease was only significant for RTE cereal prices. Moreover, the prices changed differently for national brands and private labels in the RTE cereal category, while price changes were the same for national brand and private label milk.

Specifically, the results show that the acquisition lowered the average price per unit of milk and RTE cereal products by just under and just over one cent, respectively. The second row of the bottom panel provides DID estimates of the logged prices which can be interpreted as percentage changes. These indicate that the prices decreased by 0.5% for milk and 0.3% for RTE cereal. For milk, both the national brand and private label prices decrease by 0.5%. These are very similar price drops, so the acquisition seems to affect national brand and private label milk products similarly. RTE cereal provides a stark contrast to the milk. For RTE cereal products, the national brand and private label products change in different directions. The national brand prices decrease

by 0.8% and the private label products increase by 0.9 %. While these differences imply that the acquisition affected national brand and private label prices differently in the RTE cereal category, it should be noted that the pure DID estimates are not controlling for any confounding factors that could be happening at the same time as the acquisition. That is, these pure DID estimates are likely to be biased because they do not account for any market characteristics, time buffers, fixed effects, or other controls. The regression DID analysis incorporates these controls.

Table 3.7 contains the estimated acquisition effects for milk and RTE cereal from the empirical DID regression model specifications. The top panel contains results for milk and the bottom panel contains results for RTE cereal. Odd numbered models obtain overall acquisition effects and even numbered models provide acquisition effects by brand type. Moving from left to right more fixed effects are added to the model. Once fixed effects are included, the  $R^2$  drops dramatically because it is now a within- $R^2$ . This measures the amount of price variation explained within each of the fixed effects rather than the overall fit. The overall  $R^2$  is likely to be very high because of the number of observations. The final two specifications have all controls and fixed effects added to the model. These last two specifications are the preferred models.

For milk, the overall acquisition effect is somewhere around a 0.3% price decrease. There is no significant difference between store brand and national brand acquisition effects as seen by the SB-NB difference parameter being insignificant. This puts the milk changes in scenarios A or B from Table 3.2. These price changes are not extremely important in magnitude economically. For 2013, approximately 8.0 million

**Table 3.7.** Results from the DID specification

<i>Model<sup>a</sup></i>	1	2	3	4	5	6
<i>Acquisition Effects – Milk</i>						
Overall	-.001 (.0035)		-.003 (.0025)		-.003 (.0023)	
NB		.004 (.0034)		-.002 (.0027)		-.002 (.0027)
SB		.004 (.0045)		-.002 (.0039)		-.002 (.0039)
SB-NB difference		-.000 (.0042)		-.000 (.0042)		-.000 (.0042)
<i>Model Statistics</i>						
R <sup>2b</sup>	.002	.144	.029	.031	.038	.040
Obs	407,743	407,743	407,743	407,743	407,743	407,743
<i>Acquisition Effects – RTE Cereal</i>						
Overall	-.004*** (.0016)		-.006*** (.0013)		-.006*** (.0013)	
NB		-.000 (.0013)		-.010*** (.0013)		-.010*** (.0013)
SB		.017*** (.0027)		.004 (.0025)		.004 (.0025)
SB-NB difference		.017*** (.0028)		.013*** (.0025)		.013*** (.0025)
<i>Model Statistics</i>						
R <sup>2b</sup>	.0045	0.402	.0017	.0037	.0049	.0068
Obs	1,005,683	1,005,683	1,005,683	1,005,683	1,005,683	1,005,683
<i>Controls &amp; Fixed Effects</i>						
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Unit FE	-	-	Yes	Yes	Yes	Yes
Time FE	-	-	-	-	Yes	Yes

Notes: \*, \*\*, and \*\*\* indicate significance levels of 10%, 5%, and 1%, respectively. Standard errors are clustered at the store-product level. All analyses use an eight month buffer around the acquisition.

a. Odd numbered models provide overall effects of the acquisition. Even numbered models provide effects of the acquisition by product type.

b. The R<sup>2</sup> for regressions including fixed-effects are within R<sup>2</sup>. They do not account for overall fit of the model. Therefore, these within R<sup>2</sup> can only be compared with other within R<sup>2</sup>. They cannot be compared with the R<sup>2</sup> from the regressions without fixed-effects.

units of milk were sold in RA LUSMA stores. From the pre-merger average price of \$3.29, this price decrease amounts to around a \$78,960 reduction in sales just for milk products ignoring changes in unit sales.

For RTE cereal, the overall acquisition effect is around a 0.6% price decrease. In contrast to milk, the acquisition effects are significantly different for national brands and store brands. National brand prices decrease by approximately 1%, but store brand prices increase by approximately 0.4% and is insignificant. The difference between these acquisition effects of 1.3% is economically and statistically significant. These results put the RTE cereal price changes in scenario F from Table 3.2. In 2013, treated stores sold 3.6 million units of RTE cereal with 3.1 million being national brand products and 0.5 million being store brand products. From the overall pre-merger price of \$3.12, the overall acquisition effect price decrease amounts to around a \$67,392 reduction in sales just for RTE cereal. For national brands, the reduction in sales is even larger; from the pre-merger price of \$3.42, this price decrease amounts to around a \$106,020 reduction in sales. However, this reduction in sales is partially offset by the increase in price for store brand products. From the pre-merger price of \$2.20, the price increase results in around a \$4,400 sales increase.

Table 3.8 contains the results from robustness checks to determine how the results change with different assumptions. Under all model specifications the analysis includes product-quarter-store and estimates acquisition effects by product type. The first column of results contains the final specification from the main results in Table 3.7. Subsequent columns check the one county buffer around the LUSMA, the exclusion of acquired store observations, weighting prices by their sales share, and altering the buffer around the acquisition time period, respectively. These results indicate that the final baseline specification is fairly robust to these changes. For milk, the most notable result is that the

**Table 3.8.** Acquisition effects under various robustness checks

<i>Model</i>	1	2	3	4	5	6	7
<i>Acquisition Effects – Milk</i>							
NB	-.002 (.0027)	-.002 (.0025)	-.003 (.0028)	-.002 (.0027)	.000 (.0021)	-.001 (.0023)	-.001 (.0026)
SB	-.002 (.0039)	-.005 (.0037)	-.011** (.0044)	-.002 (.0039)	-.004 (.0033)	-.003 (.0038)	-.002 (.0041)
SB-NB difference	-.000 (.0042)	-.002 (.0040)	-.007 (.0048)	-.000 (.0044)	-.004 (.0038)	-.003 (.0043)	-.000 (.0046)
<i>Model Statistics</i>							
R <sup>2</sup>	.040	.042	.027	.040	.036	.032	.034
Observations	407,743	450,988	433,961	407,743	559,975	483,107	400,640
<i>Acquisition Effects – RTE Cereal</i>							
NB	-.010*** (.0013)	-.009*** (.0012)	-.011*** (.0013)	-.010*** (.0013)	-.009*** (.0010)	-.010*** (.0011)	-.012*** (.0012)
SB	.004 (.0025)	.002 (.0023)	.011*** (.0026)	.004 (.0025)	.005*** (.0018)	.006*** (.0021)	.004* (.0025)
SB-NB difference	.013*** (.0025)	.010*** (.0023)	.022*** (.0026)	.013*** (.0025)	.014*** (.0020)	.016*** (.0023)	.017*** (.0026)
<i>Model Statistics</i>							
R <sup>2</sup>	.0068	.0071	.0070	.0068	.0043	.0043	.0069
Observations	1,005,683	1,124,025	1,086,073	1,005,683	1,326,662	1,163,571	975,034
<i>Robustness Checks</i>							
County Buffer	Yes	No	Yes	Yes	Yes	Yes	Yes
Exclude Acquired Stores	Yes	Yes	No	Yes	Yes	Yes	Yes
Dependent Variable <sup>a</sup>	$l(price)$	$l(price)$	$l(price)$	$l(wprice)$	$l(price)$	$l(price)$	$l(price)$
Acquisition Buffer <sup>b</sup>	8 Mo.	8 Mo.	8 Mo.	8 Mo.	2 Mo.	4 Mo.	6 Mo.

Notes: \*, \*\*, and \*\*\* indicate significance levels of 10%, 5%, and 1%, respectively. Standard errors are clustered at the store-product level.

a. The dependent variable,  $l(price)$ , is the natural log of a price for a UPC, store, and week. The dependent variable,  $l(wprice)$ , is the natural log of the weighted price for a UPC, store, and week. The weighted price is the price for a UPC, store, and week multiplied by its average share of weekly sales in that product module for the pre-merger period.

b. Acquisition buffer refers to the number of months removed from analysis before and after the acquired stores were converted to RA store formats. 2 Mo. indicates that the two months before and the two months after this conversion were removed, and so on.

difference in acquisition effects changes slightly, but remains statistically and economically insignificant. Additionally, when acquired stores enter, the store brand price effect is negative and significant. Due to the change in format, the results using this do not make sense logically. For RTE cereal, the most notable result is that the increase in store brand prices becomes significant when changing the buffer around the

acquisition. However, the difference between the national brand and store brand acquisition effects remains very robust.

These results provide insights into the relative importance of the economic forces during and just after the acquisition under study. First, the results indicate that cost savings potentially outweigh market power price increases on average in this acquisition given the theoretical models because overall acquisition effects are negative. Second, the results show that it is important to break down price changes into national brand and store brand categories. This is apparent especially from the RTE cereal results where the national brand and store brand acquisition effects are significantly different.

Finally, the results suggest that the competitive environment of the product affects the size and direction of the acquisition effect when broken down by national brands and store brands. A plausible explanation to why the difference in estimated acquisition effects on store and national brand milk prices is not different is that milk is a relatively homogeneous product. There is very little market power and brand competition involved in the fluid milk category. In contrast, the estimated acquisition effects on national and store brand RTE cereal prices are significantly different, possibly because RTE cereal category is marked with product differentiation and branding.

This final result provides important insights on market power. The data reveal that the market share of RA store brand products increased in the acquired stores after the acquisition relative to the RB store brands, thus increasing its market share in the RTE cereal category. However, the data also show that store brands of fluid milk decrease their market share after the acquisition relative to the RB store brands, thus decreasing its

market share in the milk category. As such, the evidence shows that RA has improved its markup more on their store brand products while actually increasing the market share of its store brands in the RTE cereal category. This demonstrates that RA has some market power in the RTE cereal category. This is consistent with the discussion of scenario F in Table 3.2 in the *Food Retail Merger Framework* section. However, because RA lost market share in the milk category while also decreasing prices, the results indicate that RA does not have market power in the milk category. This matches the discussion of scenarios A and B in the *Food Retail Merger Framework* section about the cost savings cases.

### 3.6 Conclusions

The U.S. food-retailing sector has been marked by two recent trends over the past two decades. First is an increase in concentration. Mergers and acquisitions have been a driver of some of this increase, particularly in the past several years. The second trend is the private label growth and staying power. Private labels have continued to grow since the recession of 2008-2009. This essay explores the relationship between these two trends because they are intrinsically linked. Private labels, controlled by the retailer, may be used as an instrument to exert retailer market power. To explore the connection between retailer concentration and private labels, this essay analyzes the following question: do store brand prices change more or less than national brand prices after a merger or acquisition? The answer to this question will improve the understanding of the implications of growth store brands for food prices and welfare. Furthermore, it would

shed new light on concentrated retailers store brand pricing strategy and its effect on different consumer types.

To answer this question, this essay performs an ex-post analysis of a food retail acquisition in a large United States city in 2012. Nielsen scanner data at the UPC level is used in a difference-in-differences (DID) estimation of the differential impact of the acquisition in two product categories – fluid milk and ready-to-eat (RTE) cereal. These product categories are selected because they represent typical high volume, fast-moving product categories with different competitive environments. The acquisition is unique because the acquired retailer only had stores in the large U.S. city and sold most of its stores to one retailer, the acquiring retailer. Because of this feature, the price effects of the acquisition are causally identified for the acquiring retailer.

The results show that, for the acquisition under study, prices decreased around 0.3% for fluid milk and 0.6% for RTE cereal per unit. The overall decrease in prices points to significant retailer cost savings or increased competition after the acquisition. Furthermore, the results provide important insights into the effects of the acquisition on national and store brand prices in different categories.

The overall price decrease due to the acquisition speaks to firm behavior. Two alternative interpretations exist. In a direct interpretation, this price decrease suggests that the acquisition might have provided the retailer important cost savings for milk products and national brand RTE cereals. From the framework presented earlier, the price reductions likely did not occur without at least as large cost savings from either economies of scale or scope gains or from a better bargaining position. More

interestingly, because the estimated parameters break out the acquisition effects by national brand and store brand for two different products, they provide important insights into the RA's use of market power.

The results show that RA reduced prices across the board for the more homogeneous product category which would indicate that the acquisition may have created cost efficiencies for RA stores in the LUSMA. However, in the more differentiated product category the results indicate that RA decreased prices only for highly brand competitive, national brand RTE cereal products, whereas RA did not change prices or even increased them for store brand RTE cereal products indicating it gained significant store brand market power. If aggregate price changes were used, the overall cost savings would have masked this market power effect. That is, the results provide evidence that the growth of store brands contributes to retailer market power, which should be accounted for more directly in merger analyses.

The alternative interpretation of the price decrease is that competition intensified requiring RA to reduce prices. This would occur if competitors reduced prices in response to the acquisition. A competitor that is similar to RA, and dissimilar to RB, may respond to the acquisition by lowering prices because RA now has a larger market share and represents a larger threat to their own market share. In turn RA would need to reduce its prices. Moreover, RA would respond more in product categories and with products that are more substitutable across retailers, that is milk products and national brand RTE cereal, not store brand RTE cereal. This interpretation may hold as it explains both the differential price changes, the decrease in the CR4 after the acquisition, and the change in

RA's market shares across milk and RTE cereal. More research should be done to determine which and when each mechanism is at play when prices change after an acquisition.

The overall results also indicate that the consumer benefitted from the acquisition under study. On the whole, RA consumers in the LUSMA saved just under \$200,000 on milk and RTE cereal in 2013 alone. These savings are not insignificant. Moreover, these results affected consumers differentially. For milk drinkers, savings were similar across the brand types in percentage terms. For RTE cereal consumers, however, store brand consumers were hurt, while national brand consumers were helped. As national brand consumers typically have higher incomes, the acquisition under study disproportionately helped those with higher incomes. This study provides a first glimpse into how mergers and acquisitions may impact different types of consumers in different ways. More research should be done to analyze more product categories and more mergers and acquisitions.

The conclusions of this essay are limited by the empirical assumptions and by the empirical analysis's scope. If the common trend assumption does not hold the empirical results cannot be interpreted as the causal effect of the acquisition. If the assumption of no across market spillovers is incorrect, the results will be biased. If the prices in the control group decreased (increased) due to the acquisition, then the results are an underestimate (overestimate) of the true acquisition effect. This would mean that the true acquisition effects in the LUSMA would be more negative (less negative).

The limited scope of the analysis affects its external validity. This essay analyzes only one acquisition, and as a result, the results may change when analyzing another acquisition. Additionally, this essay analyzes two product categories, while there are hundreds of product categories in a grocery store. Therefore, these results may change when looking at additional product categories. Future research on other acquisitions and products should be done to explore the robustness of the results.

## **Chapter 4. Charter City Development: Benefits and Costs for Countries and Firm Decisions**

Special Economic Zones (SEZs) have increased in popularity, and they continue to be popular despite uncertain economic benefits. SEZs are "... demarcated geographic areas contained within a country's national boundaries where the rules of business are different from those that prevail in the national territory" (Farole, 2011, p. 23). A new type of zone tries to fix underlying institutional problems present in SEZs that prevent them, and the country at large, from growing. These LEAP zones allow for the zone itself to make and implement fiscal, judicial, and social policies. However, implementing any SEZ is not costless, and the new LEAP zones present additional tradeoffs. Policymakers want to know if the costs associated with creating a new zone are outweighed by its benefits.

Honduras is creating the world's first economic zone using the LEAP zone concept. Honduras's weak political and legal systems and its central location in Central America make it a prime location to implement this new structure. A current proposal put forward by the Korean International Cooperation Agency and approved by the government of Honduras is creating a LEAP zone-like area (called a ZEDE in Honduras) on Honduras's Pacific coast. This implementation points to an immediate need to investigate the difference between LEAP zones and SEZs and the potential benefits and costs of implementing a LEAP zone.

The objective of this essay is to describe the LEAP zone concept in the context of other economic zones, provide policymakers with information on the benefits and costs of each economic zone, show how these benefits may accrue by describing multinational

firm location behavior especially as it relates to food economy firms, and apply these findings to the Honduran ZEDEs.

Agriculture, and the food economy more generally, is a potentially integral player in the success of these LEAP zones. Honduras is no exception as their plan creates an agricultural research and development area near a new proposed port on the Pacific coast and a dry canal linking this new port with the major Atlantic port near San Pedro Sula. More specifics of the logistics corridor will come out in summer 2016, but food economy firms' reception and use of a LEAP zone in a country like Honduras is important. This is also critical for U.S. food economy firms as the full terms of the Food Safety Modernization Act (FSMA) are implemented.

FSMA affects the food economy in five ways. First, it requires firms to put in place prevention- and risk-based procedures to reduce food-borne illness. Second, the U.S. Federal Drug Administration inspection and compliance ability is enhanced. Third, the FDA is allowed to institute mandatory food recalls. Fourth, it promotes collaboration between different food safety agencies within the U.S. and internationally. Finally, international partners of U.S. firms have to meet the same environmental, labor, safety, and other food safety standards that U.S. farmers, processors, and other firms meet (U.S. Food and Drug Administration, 2015). This is important to U.S. food economy firms because their supply chains are immense and global. This changes the risks that these U.S. firms face and thus changes their operational decisions around who to partner with and how.

Farole and Akinici (2011) provide a description of other SEZs.<sup>38</sup> They also present several case studies that provide lessons that can be learned from the implementation of SEZs. However, there has been little work analyzing LEAP zones. One exception is Romer (2010) which discusses the potential benefits of a charter city which is a type of LEAP zone. Romer alludes to the work that has found that institutions and their quality greatly affect economic growth, trade, and foreign investment from a macro-economic perspective as potential benefits (Acemoglu, Johnson, & Robinson, 2001; Globerman & Shapiro, 2002). Other literature on clusters, agglomeration, and trade also points to how benefits from these charter cities and other SEZs might accrue (Krugman, 1991; Porter, 1998; Romer, 1994). However, the literature on how and why LEAP zones and SEZs are created has only recently been explored from a political economy perspective (Moberg, 2014). The Moberg (2014) study and the literature reviews by Oates (1999) and Faguet (2014) on federalism and decentralization provide a jumping off point to discuss when a country should create a LEAP zone or SEZ.

This essay's contribution is fivefold. First, it lays out the differences between this new economic entity, the LEAP zone, its establishing country, and other SEZs, providing a structure around SEZs and LEAP zones. Second, using literature on how these differences may provide differential benefits between different zones, this essay describes when LEAP zones should be implemented relative to other SEZs. Third, this essay analyzes how the governance differences affect business level decisions through the

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<sup>38</sup> One alternative to a typical SEZ is an Export Processing Zone (EPZ) which focuses on facilitating trade through small changes in economic policies such as lower taxes or subsidized credit. Another important alternative is an Early Reform Zone (ERZ) which is a far reaching zone similar to a LEAP zone without the degree of autonomy that a LEAP has. These are discussed more fully in this essay.

different level of risks present for each location using a theory of the firm perspective. Fourth, this research looks specifically at the LEAP zone's impact on multinational food economy firms as much of the other literature focuses on the manufacturing sector and many of the benefits may accrue through this sector as firms in the food economy develop global supply chains. Fifth, this essay applies these general analyses to the Honduran ZEDEs.

The next section describes SEZs and LEAP zones in more detail, including the background of the LEAP zone concept. Following that, economic geography and theory of the firm literatures are reviewed in order to determine the potential benefits from implementing SEZs and LEAP zones. In the fourth section, the federalism and decentralization literature is reviewed in order to determine if and how the benefits may accrue from implementing SEZs and LEAP zones. After that, the LEAP zone is placed in context with other geo-political structures by analyzing its governance institutional structure. The fifth section builds on this by discussing the benefits and costs of each economic zone and provides a prescription for when each should be used. Following that, a conceptual framework of a multinational firm location decision-making process centering on risks is provided and applied to multinational food economy firms. After this, these insights are applied to analyze the Honduran ZEDE case study. This discussion describes the political economy of the proposed ZEDE and the potential interest of multinational food economy firms in locating there. The eighth section concludes the essay.

#### 4.1 SEZ and LEAP Descriptions

The number of SEZs has increased dramatically since the 1980s. In 1986, 6 years after Shenzhen was named the first SEZ in China, there were 176 SEZs worldwide. By 2002, there were 3,000 (Boyenge, 2007). Many of these have been created in developing countries as they seek to boost economic growth and trade. Asian countries, such as China, India, Bangladesh, South Korea, and Vietnam, have been major implementers because of their high trade potentials. All SEZs have the goal of promoting foreign investment, while some have additional objectives like reducing unemployment and experimenting with economic reforms (Farole & Akinci, 2011). Over time, policymakers have shifted from classic SEZs with financial incentives to more far-reaching reforms in more modern SEZs and even now to the nearly all-encompassing LEAP zones. This shift has been in response to lackluster performance of many more-traditional zones formed prior to modern SEZs.

Not all SEZs are successful. As noted by Farole and Akinci (2011), many SEZs have failed from a lack of good governance institutions and supporting industries and infrastructure, not because of poor economic policy. Farole (2011) states that the quality of institutions inside and outside of an SEZ is significantly correlated with the performance of the zone, while low wages and economic incentives are not. Anecdotal evidence from a 2015 article in *The Economist* states that a majority of companies located in Indian SEZs made “irregular” payments to Indian officials in charge of the zones (The Economist, 2015). This literature on poor governance points to the obstacles faced by traditional SEZs.

Because of the failure of more traditional SEZs and the importance of supporting institutions in promoting economic growth, a new type of zone aims to alter not just economic policy, but legal and political institutions. In the late 2000s, Paul Romer put forward the idea of creating charter cities in developing countries to overcome the obstacles that poor institutions pose to economic growth (Romer, 2010). Charter cities have three elements: 1) a charter that lays out the new rules of the game, 2) people and land providing individuals and firms with choices, and 3) partnerships with other nations helping to provide credibility and expertise to the country's leaders. Romer's idea is that charter cities become reform zones that test out new policies that spread to the rest of the country if successful. Cities such as Hong Kong and Singapore (colonized by the United Kingdom) are frequently used examples of successful charter type cities while Goa and Macau (Portugal) and Ceuta and the Spanish enclaves in North Africa are used as examples of less successful charter cities. Another similar, more recent charter city type area was the Panama Canal Zone when it was run by the United States. Romer argues that countries such as Honduras, Mozambique, and Tanzania have governments and port cities located fortuitously for logistics and transportation purposes that would lend themselves to a 21<sup>st</sup> century charter city. Agriculture is often cited as a prime example of an industry that would benefit from such institutional arrangements as firms in the food economy develop global supply chains.

Using the body of literature from economic geography and governance institutions, Romer argues that these charter cities are needed in order to circumvent current institutional stumbling blocks and create new institutions that provide the

necessary environment for development to take place. This can be seen as Romer's supply side argument for charter cities. Romer's demand side argument uses a Tiebout (1956) argument concerning local public good provisions. The reforms that Romer envisions do not just attract businesses, but citizens, as well. Two important charter city characteristics, the opportunity to opt-in and its creation by the establishing country, are critical in distinguishing a charter city from a colony. Moreover, the demand side reforms are important so that labor will flow into the charter city. These demand side reforms create a competitive environment for all localities (Romer, 2010).

The charter city idea is best captured by the LEAP zone concept. These zones have the opportunity to change the legal, economic, administrative, and political systems and policies from those of the establishing country. A direct measure of success for LEAP zones is increasing foreign direct investment in the short-run. However, in the long-run, additional goals may include spurring domestic industry, spreading reforms throughout the country, and improving economic opportunities throughout the country through linkages with the LEAP zone. SEZs change the economic environment and sometimes the administrative system, but leave the legal and political systems unchanged. Farole and Akinici (2011) provide a useful breakdown of different SEZ types. In that study an important distinction is drawn between SEZs like that of Shenzhen in China and EPZs like those in Bangladesh and Vietnam. These EPZs typically focus on manufacturing sectors for export that may reduce the bureaucracy and provide financial incentives for locating there.

SEZs are broader without a focus on a particular sector and broad reaching economic reforms (Farole & Akinci, 2011). Auty (2011) discusses early reform zones (ERZs) as potential far-reaching SEZs that are similar to charter cities and LEAP zones. He discusses the important characteristics, and why and where they might succeed. Each zone differs in who controls the governance institutions in the zone. This control arrangement is called the governance institutional ownership structure. The differences between each of these zones creates choices for a country's policymakers on which zone (if any) they should implement.

## 4.2 Economic Reasons for SEZs and LEAP Zones

### *4.2.1 Economic Geography and International Institutional Economics Literature*

The theoretical literature lagged the initial practical implementation of SEZs. It was not until the late-1980s and early-1990s that the economic geography and development literature fully developed reasons for differential economic development and solutions for economic growth and development. This literature provided some initial support for creating SEZs because it showed the importance of history and agglomeration. Prior to this literature, the link between geography and economic development was largely ignored (Krugman, 1995). McCombie (1988) provides an excellent overview of the neoclassical view of differences in economic growth between regions. The growth rate, wage, capital rents, and unemployment differences across regions merely reallocate resources and labor. Essentially, the economy is in a disequilibrium, and it is adjusting to reach a common growth rate. This body of literature gave rise to the idea of convergence. Sala-i-Martin (1996) and other empirical studies test the convergence hypotheses and

provided initial support for convergence, but subsequent research has questioned its validity (Jones, 1995; Quah, 1996).

The incongruence between basic neoclassical growth theory and the empirical evidence on convergence led to the development of new growth theories. In contrast to the neoclassical view, these new growth theories are fundamentally based on reinforcing mechanisms. Krugman's groundbreaking work used increasing returns to scale and imperfect markets to show that economic activity, growth, and trade become concentrated and depend on the history and economic path taken (Krugman, 1979, 1991). Other, more macroeconomic, growth theories rely on endogenous growth which comes about through spillovers and leads to concentrations of economic activity (Romer, 1994). Important to the economic zone concept is that trade is very beneficial to each location. Therefore, economic zones nearly always have some sort of trade facilitation component. Additionally, these new growth theories point to policies that would begin the reinforcing cycle of economic growth.

Porter (1998) provides several broad recommendations for the development of economic clusters based on the idea of spillovers and economic history. Drawing on the endogenous growth, economic geography, and other literatures, Porter lays out the importance of clusters, their function, their value creation for the area, and the role of policy. In a specific section on developing economies, Porter recommends starting with improvements in areas like education, infrastructure, capital markets, and institutions (1998, p. 86). These recommendations for developing industry clusters are intimately linked to the development of new SEZs. Traditional SEZs are intended to foster growth

in its area through the improvement of economic policies and capital markets that often attract specific industries. New LEAP zones are intended to improve not just economic policy, but infrastructure, education systems, and governance institutions.

The importance of good governance institutions in promoting economic growth, international trade, and foreign investment is not a new idea as noted by the early contribution of Wolf Jr. (1955). It has not been until recently that institutions have come under scrutiny again. One of the early contributors is Nobel laureate Douglass North (1989). North takes an economic history perspective to analyze the role of British and Spanish institutions on the different economic growth between North and South American countries over the past 200 years. The body of empirical studies linking institutions and economic growth is now large. Seminal studies in this area are Acemoglu, Johnson, and Robinson (2001) and Rodrik, Subramanian, and Trebbi (2004). These and subsequent studies show that institutions like the rule of law, political stability, and control of corruption are a significant driver of economic growth.

More tightly related to the microeconomic contributions of this study is the literature studying the impacts of institutional quality on foreign direct investment (FDI). Globerman and Shapiro (2002) provide an early study measuring the impact of governance institutions on FDI, and find that these institutions' quality plays a significant role in attracting FDI. This study is important in that it is one of the first to use quantitative governance institutional quality indicators. A study by Bénassy-Quéré, Coupet, and Mayer (2007) find that improving governance institutional quality can provide an improvement in FDI aside from its effects on GDP. Moreover, the impacts are

as large as being a source country neighbor. This study uses this literature as a jumping off point for the potential benefits and ways in which a LEAP zone may provide an establishing country with benefits.

#### *4.2.2 Theory of the Firm and the Make-or-Buy Decision*

The theory of the firm literature is integral in this case because it lays the microeconomic foundations linking governance institutional quality with a firm's make-or-buy and location decisions (i.e., how much and where to make FDI). This literature begins with Nobel laureate Ronald Coase (1937) and involves the simple question of whether a firm should make or buy a product. Coase finds that firms exist because there are lower transaction costs of making a product within the firm structure than buying it on the open market.

Nobel laureate Oliver Williamson shed new light on this theory in the 1970s and 1980s through his work on transaction cost economics (Williamson, 1971, 1979, 2002). In his work, Williamson points out that a transaction goes under a “fundamental transformation” when the transaction moves from trading between many potential buyers and sellers to just one buyer and one seller. This fundamental transformation creates relationship-specific assets that create quasi-rents that each party wants to obtain. This, in turn, creates the holdup problem in which haggling ensues after the contract has been made and production has taken place. This theory of the firm implies that transactions with highly relationship-specific assets will be performed within the firm to avoid the holdup problem.

Transaction cost theories of the firm were quickly rivaled by other theories of the firm. Two predominant alternatives have arisen. The first alternative is the property rights theory of the firm. This theory's seminal works include Grossman and Hart (1986) and Hart and Moore (1990). This theory begins with the idea that a firm owns something when it controls the residual rights of an asset. The firm decides what happens when something occurs that was not contracted for or was inherently uncontractable. The theory's most basic setup is that two parties may gain from joint production and must each make ex-ante investments in assets for production. After production, efficient bargaining over the gains from the production is performed with the split being based on the party's ex-ante investments. Because of this efficient bargaining, the party whose assets more affect the outcome has the higher incentive to invest, ex-ante.

This relates to the theory of the firm because it implies when one firm should buy another and when they should remain separate firms. As a loose example, suppose firm 1 is the firm whose assets affect production more than firm 2's. Then, firm 1 should buy out the other firm when the increase in production that results from the buyout outweighs the loss of firm 2's control over its assets. If the loss that results from integration is greater, the two firms should not integrate.

The second alternative to the transaction cost theory of the firm is the incentive system or agency theory of the firm. This theory applies principal-agent models to analyze the inner-workings of the firm and the broader incentives related to ownership. The seminal paper in this area is Jensen and Meckling (1976). This body of modelling shows that the incentive system theory of the firm focuses on aligning incentives to

achieve better payoffs. Nobel laureate Eugene Fama (1980) contributed significantly to this field by describing that ownership and management can be performed by different entities by compensating managers with stock options. This aligns their incentives with those of the firm's owners.

Holmstrom and Roberts (1998) provide a review of the essential ideas of each theory of the firm perspective presented above. In this paper, the authors describe each theory as focusing on different aspects with the incentive system theory as an extension of sorts to both the transaction cost and property rights theories of the firm. Along these lines, Gibbons (2005) shows that there are two elemental theories of the firm after discussing four typical theories of the firm.<sup>39</sup> First, ex-post governance structure theory describes a setting in which ex-post decisions are non-contractible, and so the ex-post structure of how to determine these decisions will be made must be constructed properly ex-ante. The transaction cost or rent-seeking theory of the firm is a special case of this theory. Second, an ex-ante incentive alignment theory suggests that ex-ante actions and ex-post decisions can be contracted, which affect payoffs, so that incentives can be aligned, affecting the ex-ante and ex-post actions taken, to maximize these payoffs.

Empirical work in the theory of the firm area shows that transaction costs, property rights, and principal-agent relationships matter. In the transaction cost area, much of the research began with several case studies finding that relationship-specific assets increased integration (Alchian & Demsetz, 1972). More recently empirical studies have found that relationship specific assets increase the length of contracts and the degree

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<sup>39</sup> The fourth theory of the firm is the adaptation theory. This is a minor theory with little relevance for this essay, so it is not discussed.

of integration (Joskow, 1987; Leffler & Rucker, 1991). Property rights theory is difficult to test directly because of its fairly unrealistic setup. However, Grossman and Hart (1986) apply this perspective to explain client list ownership patterns in insurance sales. They find that individual agents, rather than insurance companies, own the customer lists when insurance plans are renegotiated more frequently and the costs of shirking by the agents are high. The incentive system theory has been applied empirically to several different settings in the food economy including poultry production (Knoeber, 1989) and processing tomatoes (Goodhue, Mohapatra, & Rausser, 2010).

John Dunning's body of work provides a business literature perspective of multinational firm behavior including what they are, their location decisions, and the pros and cons of having one from a country's perspective. His seminal work is *International Production and the Multinational Enterprise* (Dunning, 1981). In the economics literature, the transaction cost theory is the most prominent perspective present in the literature on the multinational firm, their location decisions, and how they expand internationally. Teece (1986) laid out the transaction cost framework of the make-or-buy decision of a multinational enterprise (MNE), but does not look specifically into the impacts that institutions play in determining this decision. Gatignon and Anderson (1988) find that as the foreign country becomes more risky, the firms looking to invest in that country should maintain less control over their investment. In contrast, more recent research by Li and Filer (2007) who find that as a country develops more structured institutions, foreign investment shifts from direct investment to portfolio investment. This shows that as the country becomes less risky, investors will buy (invest in foreign

companies) instead of make (direct investment). This discrepancy in conclusions is likely due to the specific risks and transaction involved. In the first, Recently, Orellano, Azevedo, Sylvia, and Nascimento (2015) provide an empirical study of uncertain property rights to the food economy. In their study, the authors find that increased land invasions in Brazil are related to less perennial crop production and more annual crop production. This indicates that as property rights become less secure, the less fixed investments a farmer (or firm) will make in his or her enterprise. These studies point to the microeconomic foundations of where and how a firm expands internationally. Therefore, it describes how SEZs and LEAP zones may be successful in attracting firms' investment by trying to improve property rights protection.

The ex-ante incentive alignment perspective is less common in this literature because it does not have direct implications for the environment in which the transaction takes place except in how the payoffs may change across location. The incentives are inherent to the parties and the nature of the transaction. There is an area for future research to fully lay out how the environment interacts with the transaction in this setting.

#### 4.3 Political Economy of SEZs and LEAP zones

In thinking of how LEAP zones and other SEZs create these improvements in governance and attract citizens, this essay draws a natural parallel with the ideas of federalism and decentralization. Much of the work on SEZs has ignored this connection. This paper defines federalism using the Oates (1999) definition for fiscal federalism which states that it is the study of the vertical relationships in the public sector in normative and positive terms (Oates, 1999, p. 1120). Faguet (2014, p. 4) defines decentralization as “...

the devolution by central (i.e., national) government of specific functions, with all of the administrative, political, and economic attributes that these entail, to regional and local (i.e., state/provincial and municipal) governments that are independent of the center within given geographic and functional domains.” This definition of decentralization is important to the study of SEZs because SEZs gain some independence from a central government, typically administratively. The LEAP zone concepts’ link to the idea of decentralization is clear because LEAP zones gain so much control over so many aspects of governance.

#### *4.3.1 Federalism*

Much of the literature on federalism describes why a central government may want to decentralize. The economics literature on federalism began from the normative perspective. Oates (1972) is a seminal book in this area. Others, including Musgrave (1959), discussed federalism in the context of public finance, but Oates brings these together, developing a cohesive study of it. This normative view of federalism purports the idea that each level of government should control the production of public goods that cover their geographic area (Oates, 1999).<sup>40</sup> For example, national governments should control the military, interstate highways, and macroeconomic policy, while local governments should control local roads, fire departments, and potentially education.

This prescription leaned on the Tiebout (1956) model of local public good demand. Consumer welfare is maximized by allowing local governments set the provision of local goods due to heterogeneous demand by a country’s citizens. The

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<sup>40</sup> In addition to national public goods, the central government should control income redistribution (Oates, 1999).

federalism literature uses this result because local governments likely know local demand better than central governments. This informational advantage in providing local public goods is critical to a LEAP zones success.<sup>41</sup> If LEAP zone administrators do not know the local demand for public goods, few if any citizens will decide to move to the new LEAP zone. Nobel laureate Elinor Ostrom's research on common property resource management supported much of this literature with regards to control of public goods like fisheries, air pollution, and water quality (Dietz, Ostrom, & Stern, 2003; Ostrom, 1990).

There are two other main potential benefits for federalism which are particularly relevant for the LEAP zone concept. First, sub-national units may serve as policy laboratories (Oates, 1999). These laboratories allow policymakers to test out new policies in a kind of pilot setting. Successful policies may spread vertically to the national level or horizontally to other sub-national units. This "policy lab" conception of sub-national units has a direct link to LEAP zones, especially in Romer's idea that charter cities may be reform zones.

Romer's contribution is that the policies the charter cities implement will spread to other areas of the country and may be introduced by the national government. So, these LEAP zones try out new policies that, if successful, hopefully spread. This horizontal spread of ideas alludes to the second potential benefit – sub-national units will compete with each other to attract businesses and residents (Oates, 1999). In order to retain and attract new residents and businesses many sub-national governments will implement

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<sup>41</sup> Much of the federalism literature is also concerned with distributional concerns. LEAP zones do not address these concerns as they are designed to have governance institutions that are insulated from the rest of the country. However, the mechanisms for successful local public goods provision and the ultimate goal of spreading successful reforms to the rest of the country from the LEAP zone unites these two literatures.

policies that were successful in other areas. However, competition between governments does not always create this “race-to-the-top”, and instead it may create a “race-to-the-bottom”. The classic example of a race-to-the-bottom is in state-level environmental policies. In order to maintain and aid business development, a state would reduce environmental regulations. In order to compete with that state in business development, another state would reduce their own environmental regulations further. This continues until there are little or no environmental regulations. There is a large body of theoretical literature that deals with this, but the empirical work here is still limited (Oates, 1999).

Much of this normative literature assumes that the national and sub-national governments are trying to maximize their constituents’ well-being. Recent literature departs from this seeking a more positive perspective of how a federalist system works. Weingast (2009) provides an overview of the literature in this area. Much of this research models each government seeking its own ends in a principal-agent model with the national government being a principal and the sub-national government being an agent. Chubb (1985) and Tirole (1994) are seminal studies in this area. Finally, research by Inman and Rubinfeld (1997) takes a transaction cost approach to describe why a national government would setup sub-national units.

#### *4.3.2 Decentralization*

The literature on decentralization leans on several of the arguments of the benefits of federalism. This literature is distinct from the federalism literature because decentralization is an active choice and transition from a current state of centralization rather than a theoretical construct from a point of no government. This literature has two

streams in outcome changes and two streams in contribution to the literature. The two streams in outcome changes are changes in local public goods and welfare and changes in governance quality. The two streams of the types of contributions are theoretical and empirical.

The local public goods and welfare outcomes literature begins with Tiebout (1956). Local governments know local demand and so can provide residents with the higher welfare as they move to the areas that best fit their demand. More recent theoretical literature builds on this by accounting for spillovers and differences in tastes (Besley & Coate, 2003). From an empirical side, Faguet (2014) lists several empirical studies measuring these changes. For another example, Uchimura and Jutting (2009) measure the health outcomes from decentralization in China and find that decentralization improves health outcomes. Shifting to governance quality changes from decentralization, Faguet (2014) provides an excellent literature review of this literature. Other important articles include Bardhan (2002) which provides an overview in developing countries and Weingast (2014) from the perspective of market preservation and reputation.

Faguet (2014) describes four ways in which decentralization may improve governance. First, it changes how politicians must compete. Researchers find that politicians have new ways of entering the political system allowing for more competition. It also provides incentives for politicians to do well at the local level to move up to the national level. Second, decentralization increases accountability and reduces corruption. Faguet reviews the literature and finds that recent empirical studies have shown that

decentralization increases government responsiveness, satisfaction with local services, and program delivery. However, information and incentives are key. In reviews of case studies in Argentina and China, Faguet finds that poor information transfer and misaligned incentives reduce these benefits. Third, it promotes political stability because sub-national units can better address the needs of the population sub-groups that are concentrated in particular regions. By meeting these needs, those that promote instability and radical changes do not receive as much attention. Another way in which this outcome occurs is by having political parties that must work together at all levels. Finally, decentralization limits the power of a national government that unimpeded by other institutions. This is also linked to political stability.

This literature provides context for the Moberg (2014) study which performs a political economy analysis of SEZs. In her study, Moberg describes the political economy of creating an SEZ successfully as a two-fold problem. First is the informational problem – how will a central government best know how to setup an SEZ? Her solutions are to decentralize its creation through privatization or through local government intervention. Second is the incentive problem – how does one setup an SEZ so that it is beneficial to the economy knowing that those setting it up have their own set of motives? Moberg frames this as a rent-seeking minimization problem. She finds that democratic institutions or privatization controls corruption (rent-seeking).

#### 4.4 LEAP Zones in Context

A LEAP zone creates a tradeoff between a country's direct control over an area and potential economic growth that is unlike other SEZs and EPZs. A LEAP zone creates a

dynamic and largely independent process of policymaking that is not present in other SEZs and EPZs. These differences between economic zones represent the critical line along which geo-political constructs (e.g., countries, colonies, territories, SEZs, etc.) differ. Geo-political constructs differ by who controls the governance institutions. The governance institutional ownership structure describes this ownership pattern for several governance institutions. This institutional ownership structure describes what a LEAP zone is in the context of other types of economic zones and other geo-political constructs. This section analyzes the ownership structure of governance institutions for the new zone comparing it to EPZs, SEZs, “Banana Republics”, a colony, a federalist state, and the country. EPZs represent present-day industry areas like maquilas in Honduras, single enterprise zones like Foxconn in China, or free trade zones in Bangladesh. Maquilas and single enterprise zones are often structured more like a university campus with its own rules for residence eligibility and, often, its own security or police forces. Although the EPZ is its own category, they may operate within SEZs or LEAP zones. For example, Foxconn’s largest campus is in Shenzhen, one of China’s first SEZ. SEZs are unique in their focus on economic reform.

Shenzhen is a classic SEZ in comparison to EPZs. SEZs are often large, multi-industry areas with far reaching economic reforms. The Banana Republic ownership structure represents historical company-controlled areas like large plantations or company-towns. A classic example of a banana republic is the United Fruit Company’s operations in Central America during the late 1800s and the first half of the 20<sup>th</sup> century. The federalist state represents a country with multiple levels of government. At a local

level, one can think of counties or cities, while at the national level, one can think of a central government. Each level may control different policies and governance institutions. Finally, LEAP zones are like ZEDEs in Honduras with extreme amounts of autonomy.

The World Bank Governance Indicators (WGI) are a starting point to choose the most important governance institutions, and this essay includes additional institutions to provide additional insights. The WGI database was developed by Kaufman, Kraay, and Mastruzzi (2010) to create quantitative indicators to analyze the impacts of governance on development. The authors glean dozens of surveys of citizens, businesses, and experts to obtain hundreds of subjective measures of governance quality. These are then combined into six broad categories of governance quality. First, voice and accountability measures the ability of citizens to participate in the political process. Second, political stability and absence of violence measures the risk of political instability and violence. Third, government effectiveness measures the quality of government policies and their implementation. Fourth, regulatory quality measures the business environment for private sector growth. Fifth, rule of law encapsulates opinions about the effectiveness of a country's judicial system. Sixth, control of corruption measures the prevalence and degree of corruption within a country (Kaufmann, Kraay, & Mastruzzi, 2010). These broad indicators provide the jumping off point while the sub-measures provide more detailed context and nuance to the ownership structure.

Some additional assumptions and simplifications are needed. One assumption is that there is no federalist structure within the country category. This keeps the analysis

simple by assigning a single entity control in the base case. Within the federalist state category there is just a single division between the central, country government and several sub-national units. This is again for simplicity as certainly there can be more than just two levels. As the structures outside of the country are examined, these discrete categories are more of a spectrum. For example, some EPZs may look more like an SEZ, while an SEZ may look more like a traditional EPZ in who owns which governance institutions. However, these categories provide a useful framework for looking at differences between typical governance ownership structures. The categories also display the hallmarks of the different ownership structures even if they are slightly different in practice.

Table 4.1 below summarizes the institutional ownership structures under comparison. The analysis begins with the country as the baseline zone. A country maintains control over all governance institutions. The power over each governance institution may be wielded by different entities, but it still remains under the control of the country. Additionally, these governance institutions may be under the control of the country using a constitution or by force of power. The critical assumption is that the government retains control over all of the governance institutions and is responsible for their quality.

In the federalist state, the country controls voice and accountability, but shares responsibility for other institutions with the sub-national units. This responsibility sharing is represented by “&” in Table 4.1. The “&” symbolizes that both entities control the governance structure or that either entity may control the governance structure. In a

**Table 4.1. Institutional ownership structure in principle**

Institution	Country	Federalist State	Colony	Banana Republic	EPZ	SEZ	LEAP
<i>Voice and Accountability</i>							
- Type of political system	C <sup>a</sup>	C	CPC <sup>a</sup>	C & Co. <sup>a</sup>	C	C	LEAP <sup>a</sup>
- “Bill of Rights” freedoms	C	C	CPC	C & Co.	C	C	C
- Citizenship decisions	C	C	CPC	C	C	C	C
<i>Political Stability and Absence of Violence</i>							
- Military	C	C	CPC	C & Co.	C	C	C
- Police	C	C & S <sup>a</sup>	CPC & C	C & Co.	C & Co.	C	LEAP
<i>Government Effectiveness</i>							
- Infrastructure	C	C & S	CPC & C	C & Co.	C & Co.	C & SEZ <sup>a</sup>	LEAP
- Education	C	C & S	CPC & C	C & Co.	N/A	C	LEAP
- Bureaucratic implementation	C	C & S	CPC & C	C & Co.	C	C & SEZ	LEAP
<i>Regulatory Quality</i>							
- Anti-competition regulation	C	C & S	CPC	C & Co.	C	C & SEZ	LEAP
- Trade policies	C	C	CPC	C & Co.	C	C & SEZ	LEAP
- Tax policies	C	C & S	CPC & C	C & Co.	C	C & SEZ	LEAP
<i>Rule of Law</i>							
- Contract enforcement	C	C & S	CPC & C	C & Co.	C	C	LEAP
- Judicial administration	C	C & S	CPC & C	C & Co.	C	C	LEAP
- Equal treatment of foreigners	C	C	CPC & C	C & Co.	C	C	LEAP
- Expropriation with compensation	C	C & S	CPC & C	C & Co.	C	C	LEAP
- Private property protection	C	C & S	CPC & C	C & Co.	C	C	LEAP
<i>Control of Corruption</i>	C	C	CPC & C	C & Co.	C	C	LEAP

a. C – Country, S – Country’s subunit, CPC – Colony’s Parent Country, Co. – Company, SEZ – Special economic zone, LEAP – LEAP zone

sense, the country sets the rules of the game, and the sub-national units help enforce and make minor modifications to those rules. From the literature on decentralization and federalism, this setup may allow for better provision of services and may make the government more responsive to their citizens.

There is a dramatic shift in control moving from the country and federalist state to the colony ownership structure. Here, the ultimate rule comes from the colony's parent country (CPC). There may be some sharing of control between the CPC and the colony. A federalist structure may be set up in some respects. In some cases a governance institution is administered or controlled by the CPC, the colony, or shared by both. Banana Republic areas resemble something more like a colony with the company maintaining a large degree of control. Companies involved in Banana Republic structures often intervened in domestic policies and politics (Kentor & Boswell, 2003). Therefore, despite the countries de jure control of the area and even the entire country, the companies may have had much more de facto control.

Shifting from more historical ownership structures back to present day structures, EPZs represent the basic economic zone. Under this ownership structure, the country is in control of everything. The business or businesses within an EPZ receive a financial incentive for being there, but they have little control over the governance of the area. As an exception, some EPZs offer housing and private security like an apartment complex with special rules like a three strikes policy. In this regard, the companies may control some governance institutions within the area they own, but that is because they own the

property not because of some inherent control over policy. They are subordinate to country laws in performing these functions.

The SEZ is a step up from an EPZ in the complexity of the economic policies and reform. The size and purpose may vary significantly across SEZs, but the control over governance institutions is similar. The country retains ownership over voice and accountability, political stability and violence prevalence, and control of corruption. The SEZ or country may control economic regulations, infrastructure and bureaucracy decisions, property rights protection, and equal treatment of foreigners.

The last zone to consider is the LEAP zone. A LEAP zone is in control of all governance institutions except for the military, citizenship rules, and “Bill of Rights” freedoms. The LEAP zone will share tax revenue with the country for these larger services.<sup>42</sup> The LEAP zone has the freedom to change the political system; the legal environment; and economic, fiscal, and, to a large degree, social policies in the area. This freedom is given to the LEAP zone to experiment with far reaching reforms that could not be successfully implemented in the rest of the country. These reforms, economic and otherwise, are designed to bring in foreign investment and provide beneficial services local residents. These, in turn, spur development that spreads to surrounding areas and the rest of the country.

LEAP zones have been compared to colonies because of the extraordinary autonomy that they have and their ability to obtain government services, like the use of courts, from other countries. However, Table 4.1 shows the critical difference. The

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<sup>42</sup> The exact revenue sharing will be dictated by the specific LEAP zone law put in place. Likely, income tax revenue will be shared, but usage fees will not be shared.

country in which the LEAP zone is located retains control over the governance institutions that make a country a truly sovereign state. The country still controls the military; it still decides who can and cannot be citizens of its country; and, it ensures all people in the LEAP zone have the same or better “Bill of Rights” freedoms as the rest of the country.

Each of the economic zones differs from the other because of the scope of the autonomy given to the zone’s administrators. The focus on economic reform makes the SEZ distinct from the EPZ. The EPZ focuses on providing economic incentives, while the SEZ experiments with economic reforms that may prove beneficial. Moreover, if the economic reforms in the SEZ spread through the rest of the country, the whole country may be better off because all might enjoy the same reforms. The extreme degree of autonomy is what separates LEAP zones from EPZs and SEZs. This difference is clear from the table. Most EPZs and SEZs have their policies set by the rest of the country. These policies set for EPZs and SEZs are unique to the area, but often they may be changed by the country, not the EPZ or SEZ itself. In contrast the LEAP zone is in control of nearly all of its policies. Additionally, because the LEAP zone can set its own policies, the LEAP zone is dynamic. It can adjust its policies and administration to adapt to new economic conditions and residential demands. The EPZ and SEZ model is static from within the zone. They must wait for the country to change the policies affecting these zones. The SEZ and LEAP zone structures may allow for benefits to accrue through mechanisms discussed in the federalism and decentralization literature above.

#### *4.4.1 Benefits and Costs of LEAP Zones and other SEZs*

EPZs, SEZs, and LEAP zones have their place in attracting foreign investment. However, the costs and difficulty in implementing each zone and the benefits from each are different. This subsection discusses these benefits and costs drawing on the discussion of the previously reviewed literature. These benefits and costs point to a rudimentary prescription for when each should be used.

EPZs provide benefits by facilitating international trade. These benefits accrue in Krugman-like fashion by taking advantages of economies of scale and gains from trade. Additionally, these areas may facilitate agglomeration creation. These benefits include increased employment, wages, and economic output. These benefits ideally spillover to surrounding areas and ripple through the rest of the economy. The costs associated with these zones are physical costs associated with creating the zone (e.g., port construction, administration, infrastructure, etc.), costs from economic policy changes (e.g., subsidy payments, foregone taxes, etc.), and costs of creating geographic, and potentially sector specific, winners and losers. Also, necessary to their success is an underlying structure of infrastructure, markets, and governance institutions.

SEZs provide benefits by improving economic policies and economic governance institutions. These proposed improvements are intended to increase domestic and foreign investment and facilitate trade. These benefits accrue through the same channels as EPZs while also opening up channels along the lines of Acemoglu, Johnson, and Robinson (2001) and Gliberman and Shapiro (2002) by improving the underlying institutional framework. The same costs are present as those with the EPZs, but may be larger in magnitude because an SEZ often covers more area and more sectors. Additionally, a

“political” cost is incurred. This political cost represents the cost that a government experiences when it implements the SEZ reforms that may not be in its interest or particularly popular, but is put in place to make the SEZ successful.

LEAP zones may provide benefits by improving legal, economic, administrative, and political governance institutions and policies. These improvements are intended to increase foreign and domestic investment, promote trade, and improve the lives of its residents. In addition to the channels discussed in the EPZ and SEZ paragraphs above, benefits accrue through federalist (Oates, 1999) and decentralization channels (Faguet, 2014). The same costs of implementation for EPZs and SEZs are also present for LEAP zones. Additional costs occur due to the new federalist structure and decentralization. From the federalism literature, these costs may include the loss of economies of scale in providing public goods and services and creating a race to the bottom. From the decentralization literature, these costs include another type of political cost due to the central government giving up some of its powers.

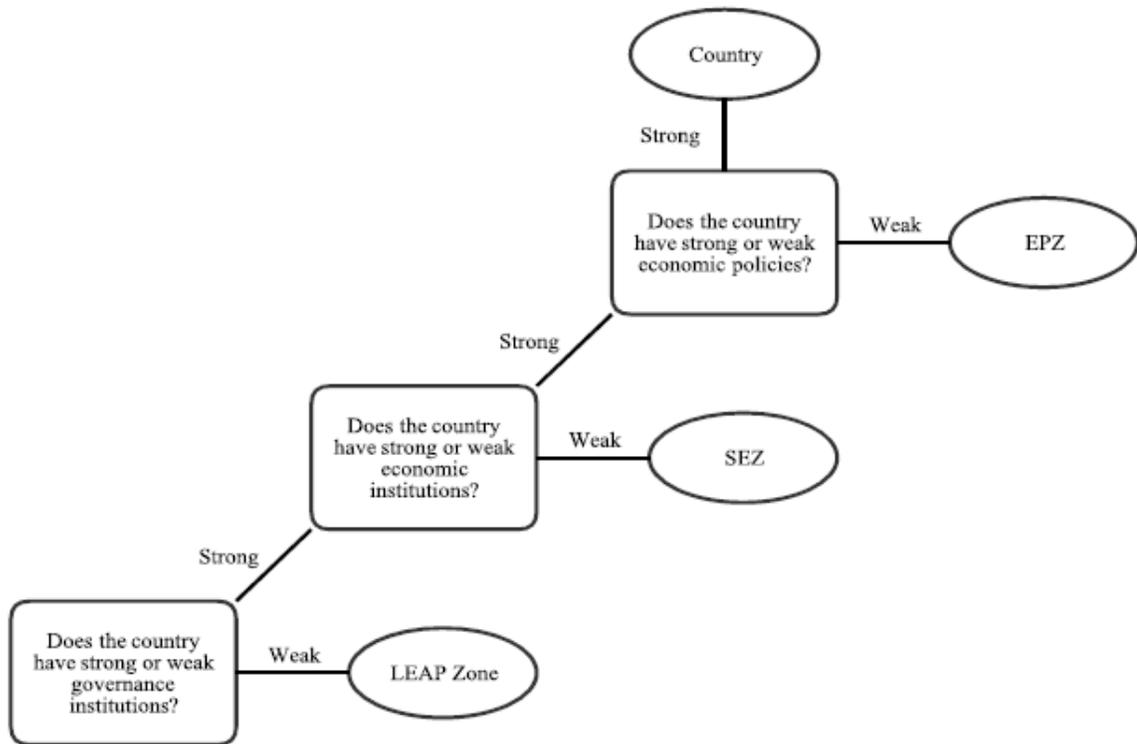
#### *4.4.2 Prescriptions for LEAP Zones and other SEZs*

The prescription of when to implement each zone can be seen in three steps. First, only the benefits from each zone are analyzed. Second, the economic costs of implementing the zone are introduced. Finally, the political costs of implementing the zone are included. Each step is discussed in turn below.

The above analysis of benefits points to a rough prescription of when to implement each zone. This is summarized in Figure 4.1.<sup>43</sup> The transition from a

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<sup>43</sup> The specifics of any particular situation will blur which zone should be recommended. The hierarchy presented in Figure 4.1 represents a simplified model of reality.



**Figure 4.1.** Economic zone hierarchy

representative country area to an area setup as an EPZ, to one set up as an SEZ, to a LEAP zone can be seen as a hierarchy. If the country is well functioning with sound economic policies, then no special zone is needed. If economic policies need reforming, but good governance institutions are in place, then an EPZ may be implemented. If the economic institutions are weak, then an SEZ may be tried to experiment with new economic reforms. Finally, if a near complete overhaul of governance institutions need to be undertaken, a LEAP zone may be created to be a laboratory for potential economic, legal, and political reforms.

This prescription is overly simplistic, however, because it ignores the costs involved. If there were only economic costs, the prescription can be easily extended as these are fairly easy to project. Each zone should be undertaken given the projected

benefits outweigh the projected costs. This category of costs should not be understated, but the process of calculating economic costs associated with a proposed project is not a new one.

The prescription becomes much more realistic when political costs are included. These costs are transaction costs rather than direct and indirect economic costs of implementing the zone. These political costs may be so high that the zone will not be implemented or will be implemented in a way that prevents any potential benefits from materializing. The costs of a zone implemented poorly may significantly outweigh any benefits.

These costs are especially important for the broad reaching LEAP zones. To illustrate this and the political costs discussed above, consider an example. Suppose there is a country in which a proposed LEAP zone has higher benefits than economic costs – there are weak governance institutions and little foreign investment. However, the governance institutions may be so weak that a true LEAP zone is impossible to implement due to the political costs. A corrupt central government may not have the incentives to implement a true LEAP zone because the direct benefits it receives (e.g., larger budgets, side payments, etc.) are much smaller than the political costs it will experience, such as less control. Instead of a LEAP zone, the government may introduce an EPZ with high proposed benefits and low economic costs. In execution, the government receives side payments, while purporting job growth and an increase in investment.

This example is admittedly pessimistic. However, it illustrates the difficulty in implementing these zones when seen through a political economy lens. Nobel laureate James Buchanan's work on public choice is relevant here (Buchanan & Tullock, 1962).<sup>44</sup> When trying to change the economic rules of the game, one is changing the constitution. However, economic zones are typically policies – not constitutional changes – embedded within the overarching constitution. EPZs and many SEZs are in fact policy changes because the rules of the game are not modified – only economic policies are changed. When they fail, it is because the benefit-cost analysis was incorrect or another zone was called for. However, far-reaching SEZs and LEAP zones create fundamentally new political structures and are therefore changing the rules of the game. Therefore, these zones call for proper constitutional changes. These constitutional changes, however, are difficult to implement as they are made within a context of weak governance institutions. Additionally, the zones are designed to benefit specific areas while a constitution is designed to be all encompassing.

This analysis of the political costs leaves a pressing question. How can the reforms needed to strengthen weak governance institutions be implemented in the face of weak governance institutions? The subsequent conceptual analysis of firm decision-making takes the benefits and costs from the LEAP zone as given. Additionally, this analysis is from the perspective of the firm, not from the country looking to introduce a LEAP zone.

#### 4.5 Multinational Firm International Decision Process

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<sup>44</sup> This reference is to the body of Buchanan's work. Perhaps the most fundamental and well-known is (Buchanan & Tullock, 1962).

When a multinational firm looks to solve a problem, take advantage of a new opportunity, or, generally, execute a new transaction, it may look to do so in a foreign country. In looking to execute this transaction in a foreign country, it faces different risk levels compared to its home country. These risks can be broken into several categories: financial, political, economic, legal, and so on. However, the most important categories, without knowing the transaction, are short-run and long-run risks. Short-run risks affect the success of the transaction in buying, making, moving, and selling a firm's products and services with a short time horizon. Long-run risks are associated with structural issues in a location. These affect future operational success (i.e., how well the transaction is performed), and the underlying success of the strategy (i.e., how the transaction is performed).

Examples of short-run risks include infrastructure quality, skilled labor availability, bureaucratic hurdles, production uncertainty, exchange rate fluctuations, and tax and trade policies. Examples of long-run risks include contract enforcement, political stability, the prevalence of corruption, education policy, and the strength of the rule of law. Additionally, some short-run risks are also long-run risks like infrastructure quality – current quality affects current payoffs, but there may be long-run, structural problems in the infrastructure system that affects long-run success.

These risks have several features. First, governance institutional quality affects the magnitude of these risks, and each governance institution may affect each risk differently. For example, production risk is likely to be directly affected by research and development institutions but is unlikely to be affected by exchange rate policies directly.

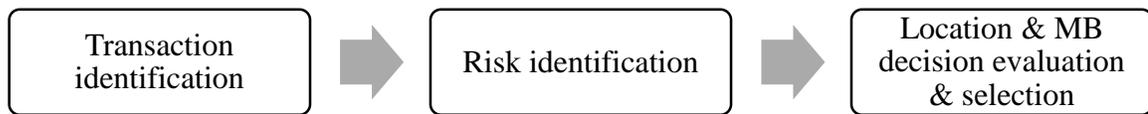
Moreover, research and development institutions are unlikely to affect bureaucratic hurdles. Second, risks may be interrelated by governance institutions and other underlying factors. For example, high inflation may affect short-run risks by creating uncertain financial returns and long-run risks by putting pressure on the government to implement policies to control the high inflation. Finally, foreign country risks affect different aspects of the firm's decision. For example, risks due to poor infrastructure may affect where a firm locates because it affects how much product it can produce, but it may play less of a role in how it executes the transaction as this risk is present regardless of how the firm executes the transaction. In contrast, contract enforcement may affect the decision of where a firm locates operations and how the firm executes the transaction because contract enforcement affects how the firm interacts with other companies.

Both short- and long-run risks combine to affect the expected potential profits of potential foreign-country-partner firms and the multinational firm. The risks factor into the probabilities of successfully executing the transaction and achieving various profit forecasts. Importantly, these risks also vary by location because governance institutional quality varies. Therefore, the risks factor into the multinational firm's location and "make-or-buy" (MB) decisions.<sup>45</sup> Whether the multinational firm "makes in" the foreign country or "buys from" foreign-country-partner firms determines the impact these risks have on each probability.<sup>46</sup>

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<sup>45</sup> In the short-run, from the perspective of the country, it will want to attract the companies regardless of their MB decision. However, in the long-run, the country will want to improve the governance institutions such that local firms can compete and work with multinational firms via the "buy" decision.

<sup>46</sup> The buy option of the MB decision requires that there is a local firm to "buy from". This essay assumes that this local firm will "sell to" the multinational firm if the multinational firm wants to "buy from" it. The local firm's decision process to "sell to" the multinational firm is an area for future research.



**Figure 4.2.** Multinational firm international location decision process

Risks in each risk category affect these probabilities differently. Typically, short-run risks play an important role in determining income from the transaction because they affect production levels and prices received and paid. If the probability of having high income is higher when the transaction is executed by “buying”, the local firm is more likely to own it, holding all else equal. Long-run risks play an important role in determining asset values. If the probability of retaining an asset with high value is higher when the asset is owned locally, the local firm is more likely to own it, holding all else equal. Each combination of location and MB provides a level of investment, income, and asset value based on the location’s risk profile. The profit-seeking multinational firm chooses the combination which provides the highest income and asset values above investment costs.

The preceding discussion points to a decision process that models a firm’s decision to expand internationally. Figure 4.2 presents this process. The first step is to identify the problem or opportunity the firm is facing. This creates the transaction that the firm wants to execute and potential locations in which it can take place. The nature of the transaction predisposes the firm to either execute it by making or by buying. If the transaction involves very unique and potentially patented products, making it very costly to determine the true cost and quality of the product or service in the transaction, or requires firms to invest in relationship-specific assets, then the transaction is more likely to be executed by making rather than buying.

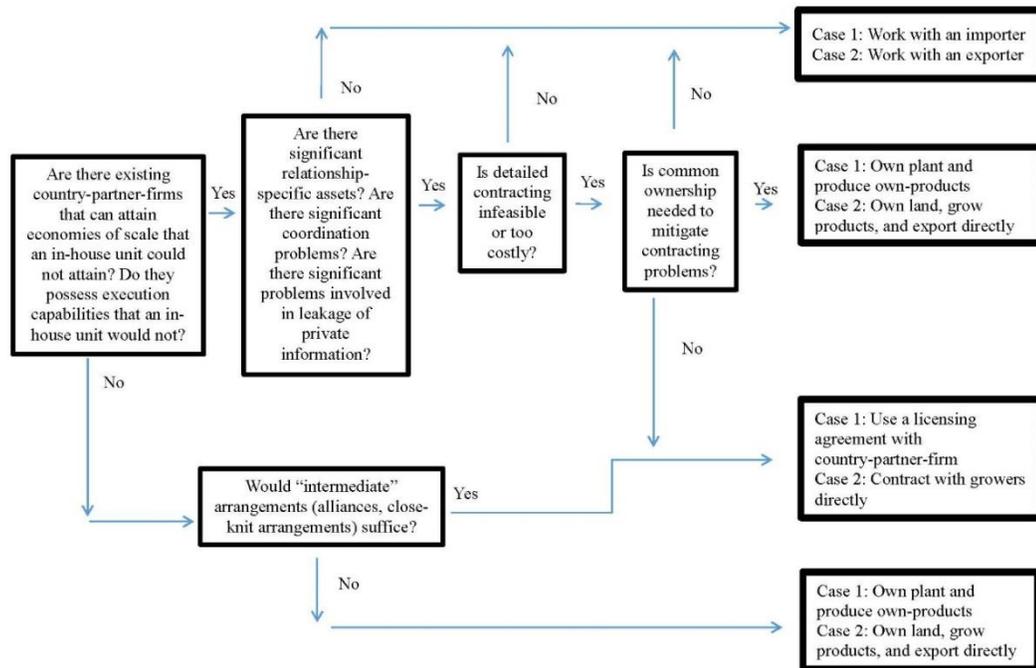
However, the institutional environment in which the transaction is taking place affects the make-or-buy decision as well. The institutional environment of each location identified in this step affects the short- and long-run risks faced by the multinational firm. The locations identified may be at various levels, such as country, state, or city. Importantly, at any level, various economic zone options must be considered when they change the institutional ownership structure because this changes the risks faced by the firm.

The next steps identify and evaluate these risks and the options the multinational firm has to execute the transaction. The second step of the process is to identify the most important risks to the transaction. In this step the multinational firm takes into account the nature of the transaction and determines which risks must be evaluated. These will include overall risk factors for the success of the transaction and risk factors specific to the mode of the transaction. In the third and final step, the firm evaluates and selects the location-MB combination. It begins by evaluating the option to “make or buy” for each location in the context of the location and transaction risks. This determines how the transaction will occur – within the firm (make) or with another firm (buy) – and where it will occur. This evaluation is done for each location taking into account both the location risks and the nature of the transaction. Given this evaluation, a location and a mode for the transaction are selected based on this evaluation. The location-MB decision combination in which the transaction provides the highest payoff is selected.

#### *4.5.1 Decision Process Applied to the Multinational Food Economy Firm*

There are two cases to consider when applying the general firm decision process presented above to the case of the multinational food economy firm (MFEF). In the first case, the international location is the final market for the MFEF's final products. These final products often involve manufacturing and processing of raw inputs that may be sourced from the foreign country or imported. An example of this case is Cargill's feed and animal agriculture operations in Central America. In the second case, the international location is the source of the MFEF's inputs or final products, but not a major market for these products. These products may be exported in a raw or processed form. An example of this case is Dole Food Company which has pineapple and other fruit plantations in Central America. Some MFEFs fit into both categories. Consider the case of Nestle for inputs, such as sugar, dairy products, etc., sourced in the United States for final products sold in the United States.

The MB decisions available to the MFEF are different depending on each case. For the case one MFEF, the buy decision implies that the MFEF works with a local partner to import its product(s) into the target country. The make decision implies that the MFEF locates production facilities within the target country and makes the final product there. A hybrid option is that the MFEF works directly with a local manufacturer to produce the MFEF's products in a type of licensing agreement. For the case two MFEF, the buy decision implies that the MFEF works with a local partner to export products from the target country. The make decision implies that the MFEF owns land, grows the product, and exports the product itself. In the second case, there is also a hybrid decision in which the MFEF contracts directly with growers and maintains its own export and/or



**Figure 4.3.** MFEF MB decision

Source: Adapted from (Bensako, Dranove, Shanley, & Schaefer, 2010, p. 145)

processing facilities. Figure 4.3 summarizes these options for the MFEF. It adapts a decision framework for the MB decision based solely on the nature of the transaction from *Economics of Strategy* (Bensako, Dranove, Shanley, & Schaefer, 2010, p. 145).

As in the general process, the MFEF begins by identifying a problem or opportunity. In case one, the MFEF identifies an opportunity by expanding into an international market with a product or set of products. This market may be a specific country, or it may be regional (e.g., Southeast Asia, Central America, etc.). In case two, the MFEF typically identifies a problem in its sourcing operations. The broadest problem in this context is that the MFEF needs a new source of an agricultural product. The

potential locations capable of providing the product are those that can physically (e.g., climatologically, geographically, etc.) produce it.

In the second step, the MFEF identifies short- and long-run risks in order to evaluate the MB and location decisions. However, in each case the MFEF has risks that are present that directly affect the success of the transaction due to the nature of the transaction regardless of the MB decision. In the first case, the MFEF faces risks affecting demand for their product regardless of the MB decision. This is because the ultimate driver of success is having an international market for your product. Some country risks most relevant to final demand include labor risks, education levels, macroeconomic factors, brand reputation, urbanization trends, and political crises.

The MFEF in the second case faces risks affecting supply of their product regardless of the MB decision. This is because the entire exercise is to find a reliable, long-term source for the product they need. Some of the risks most relevant to supply are production risks, infrastructure quality, trade policy, labor issues, urbanization trends, and political instability.

In both cases, for step two, the MFEF analyzes short-run and long-run risks in detail in order to evaluate the make-or-buy options in the next step. There are some nuances between both cases, but the most important location-specific risks that affect the MB decision are those around property rights protection, private contract enforcement, and production. As contract enforcement and product risks decrease, the MFEF tends to “buy”, *ceteris paribus*. As property rights protection increases, the MFEF tends to “make”, *ceteris paribus*.

The case one MFEF is most concerned about the relative risks of private contract enforcement between itself and the local firm, importing risks, and production by the local firm in the buy option versus own-production of final products and property rights protection in the make option. The case two MFEF is most concerned about the relative risks of contracting production and exporting risks in the buy option versus own-production of agricultural products risks and property rights protection in the make option.

The third step evaluates potential partnerships with firms in the target countries and potential production locations. MFEFs typically commit to locations for the long-term. Therefore, in evaluating the MB options, long-term payoffs and relationships are considered. After the evaluation, the MFEF firm decides which location-MB combination(s) to pursue, if any. The option chosen is the one that provides the highest long-term payoff.

An additional risk for case two MFEFs importing into the United States that deserves special attention is the Food Safety Modernization Act (FSMA). FSMA requires MFEFs ensure that any products they import into the United States have been grown, processed, and stored at the same standard that firms in the U.S. must use. There are current risks at each stage from farm to processor to warehouse to ship to port. These risks include weather, production, labor, health and safety, environmental, and legal risks. Moreover, these risks are in play all over the world. Traditionally, the nature of the agricultural product supply transaction pushes it into contracting or making arrangements.

Recently, case two MFEFs have increased supplier monitoring and traceability to address some of the risks more fully and consumers' desires to know about where their food comes from. FSMA now requires this for all MFEFs importing into the United States. This is an enormous task as current MFEF supply chains are large and complex. For example, Nestle operates in nearly every country and has factories in 86 of them (Nestle, 2014).

The changes in FSMA increase the supply risk for case two MFEFs. This increases risk from importing products because there are higher standards that now must be met, from producing the products itself because of new standards, and from contracting because they must verify the practices of each farmer. In light of FSMA, location risks associated with the case two MFEF with agricultural production and processing for imports have become particularly important.

#### 4.6 A Case Study: Honduran ZEDEs

This section discusses the Honduran ZEDEs as a case study for LEAP zones. In this section, the ZEDE concept is placed in context with LEAP zones and the other economic zones discussed. Also, it uses the MFEF decision framework to determine if MFEFs are more likely to locate in the ZEDEs relative to another area in Honduras and how they might do this (i.e., make or buy).

##### *4.6.1 Background of Honduras*

Honduras is located in central Central America with coastlines on both the Pacific Ocean and Caribbean Sea. Figure 4.4 provides a map of Honduras. In 2015, Honduras had approximately 8.75 million residents with 1.1 million in the capital of Tegucigalpa and



**Figure 4.4.** Map of Honduras  
 Source: *The World Factbook* (2015)

just over 0.85 million in the major, northern commercial center San Pedro Sula. The population is split approximately evenly between urban and rural areas (*The World Factbook*, 2015). These geographic and demographic factors point to the potential a charter city or LEAP zone may have. There are many residents that may move to a city as the urbanization trend is not complete. Additionally, with access to both the Pacific Ocean and Caribbean Sea, there is a great potential for trade in a LEAP zone that offers better institutions and lower risks.

Additional economic factors point to the opportunities a LEAP zone may create. The Honduran economy has officially been strong with GDP growth between 3% and 4% over the past three years, unemployment at 4.5% in 2013 and 2014, and real-GDP growth per capita of 4.5% between 2012 and 2014. However, 60% of Hondurans lives in poverty and approximately one-third are underemployed (*The World Factbook*, 2015). The combination of these factors show that a LEAP zone may be successful. From the firm side, firms may be interested in the LEAP zone because the GDP growth and low unemployment point to positive economic factors that support demand for final products. From the labor side, workers may be interested in the LEAP zone because the underemployment and the wide-spread poverty point to a desire for more and better jobs.

The agricultural industry is a significant driver of success in a Honduran LEAP zone because of Honduras's mix of sectors. Agriculture accounts for 14% of GDP with industry accounting for 27% and services accounting for 59%. However, agriculture has a disproportionate share of employment: the agriculture employs 39% of the labor force (industry – 21% and services – 40%). Within agriculture, the most important sectors are sugar, coffee, bananas and other tropical fruit, and timber products (*The World Factbook*, 2015). This shows that agriculture is an important driver of the economy and that many workers are familiar with agriculture. Additionally, Table 4.2 shows the importance of Honduran exports in the region. Table 4.2 presents the value of Honduran exports to the United States and its share of total Central American exports to the U.S. for selected product categories. Within these categories, Honduras dominates particular products. For

**Table 4.2.** Value and shares of Honduran exports to the U.S., 2008-2014

Product	2008	2009	2010	2011	2012	2013	2014
Bananas and Plantains	153,511 (19.2%)	157,050 (18.9%)	175,783 (17.5%)	182,473 (15.0%)	200,818 (15.4%)	221,828 (16.4%)	223,255 (15.8%)
Coffee, Unroasted	131,618 (13.6%)	74,440 (9.7%)	76,957 (9.9%)	230,703 (15.5%)	281,685 (19.5%)	158,581 (15.4%)	198,363 (19.4%)
Fresh Vegetables	21,240 (14.0%)	23,565 (15.2%)	20,565 (13.0%)	21,699 (11.6%)	24,875 (13.2%)	26,180 (12.1%)	30,206 (14.1%)
Other Fresh Fruit	39,761 (6.5%)	44,364 (7.0%)	44,247 (6.8%)	56,081 (8.3%)	56,619 (8.1%)	57,438 (7.6%)	58,034 (6.8%)
Processed Fruit and Vegetables	20,271 (10.9%)	24,404 (15.3%)	22,034 (14.4%)	25,417 (13.4%)	27,352 (12.3%)	31,052 (12.8%)	32,401 (11.7%)

Notes: Value of exports are in thousands of 2014 USD. Shares of Central American exports to the United States are in parentheses under values. Central American countries include Costa Rica, Guatemala, Nicaragua, El Salvador, Belize, and Panama.

example, nearly 65% of organic bananas from Central America came from Honduras in 2014. A Honduran LEAP zone will likely tap into this sector in order to be successful.

The political setting in Honduras points to why a LEAP zone is a potential avenue for development. Honduras is a democracy but has experienced political instability since democratic elections were first held in the 1980s. Additionally, illegal drug trafficking has contributed to Honduras having the highest murder rate in the world. Finally, corruption has plagued the country (*The World Factbook*, 2015). These all point to a LEAP zone, independent of the current political system, as a potentially successful way to experiment with and implement new reforms. However, as discussed in the literature above, how this may be accomplished by a country with poor institutions is an area of future research.

#### 4.6.2 Description of ZEDEs

Honduras first experimented with economic zones by implementing EPZs called Macquilas. These were very successful at attracting manufacturing firms especially in the textiles sector. These Macquilas generated many jobs and increased FDI significantly. However, many investors in these zones are attracted to the economic advantages (e.g., low labor costs, tax breaks, etc.), rather than the structural changes of the zone. Therefore, these investors often leave to take advantage of other zones in other countries.

As the Macquilas become inferior to zones in other countries, Honduras has looked to the next generation SEZs. For several of the previously discussed reasons, Honduras is a country in which LEAP zones may be very successful. ZEDEs are not the first attempt at LEAP zones or charter cities. Honduras attempted to create REDs, or model cities, with direct involvement from Romer. The law authorizing these REDs was passed in 2010 by the Honduran Congress and then-President Lobo. However, in 2012, the RED law was struck down by the Honduran Supreme Court.

ZEDEs are Honduras's follow-on attempt at LEAP zones. These ZEDEs are promoted by Mark Klugman who was a former student under Romer. The ZEDE law was passed in September 2013, and was found to be constitutional by the Honduran Supreme Court. Bell, Marin, and Landgrave (2015) translate the ZEDE law to English.

The ZEDEs are designed to help Honduras's economy grow and integrate with the world economy. In order to do this, each ZEDE is created for a specific purpose. These include financial centers, logistics hubs, special tourism areas, and agribusiness zones. These special areas are carved out of Honduras's current territory. In a low-density area, no consent must be obtained from the current residents. However, if the ZEDE will

be in a high-density area, the residents must vote in favor of the ZEDE's creation. Once the ZEDE is created, any residents may continue to live there or sell their land if they do not wish to live in the ZEDE. The ZEDE has the right to take property with compensation to the resident if the resident does not wish to be part of the ZEDE or sell their property. This is similar to the eminent domain concept in the United States. Unlike in the U.S., however, the purchase need not be used directly for public goods or services.

The ZEDE law specifies that the laws enacted within the ZEDE should be international best practices that help the ZEDE become a destination for investment. The ZEDE is given a tremendous amount of autonomy to do this. In its administration, the ZEDE may create its own economic policies, enact its own fiscal policy including levying taxes, provide public services like education and police, enforce laws with Honduran judges or through the use of another country's court system, and enter into international trade agreements independently from the rest of Honduras. The ZEDE law specifies that 12% of tax revenues are shared with Honduras for national public goods, such as the military, and economic development projects to improve other areas of Honduras. In the hierarchy of which laws take precedence, the Honduran Constitution is the most important, then international treaties, then the ZEDE law, and then laws made within the ZEDE. No national laws, except the Constitution and the ZEDE law, apply to the ZEDE.

In order to implement these best practices, the ZEDE law sets up a Committee of Best Practices (CBP) that has complete control over laws within the ZEDE. The CBP is composed of 21 members with the first 12 being appointed by the Honduran president

and the remaining being appointed by the initial 12 members of the committee. The CBP appoints a Technical Secretary as an administrator of the zone for a seven year term. This Technical Secretary is responsible to the CBP.<sup>47</sup> Importantly, the administrative setup does not create any feedback from the stakeholders of the ZEDE to the CBP and Technical Secretary. This is a potentially major flaw that is discussed in the subsequent section.

The ZEDE law provides some guidance and parameters on the economic policies that the CBP may put in place. First, the ZEDE is established as a free trade, low-tax zone. Personal income taxes may not be more than 12%, business taxes no more than 16%, and value-added tax no more than 5%. In free trade, the ZEDE must allow any country's goods and services to enter and these goods and services will not be taxed.

From the labor side, the citizens of the ZEDE have the same rights as other citizens in Honduras according to the Honduran Constitution and cannot be discriminated against. At least 90% of a firm's employees must be Honduran, and they must make 85% of the wages. Exemptions to these ratios may be made by the Honduran Congress. Importantly, any Honduran citizen is free to enter, reside in, and exit the ZEDE. This allows the residents to vote with their feet. The ZEDE will grow if people find it attractive, and the ZEDE will shrink if residents do not like it.

Figure 4.5 provides a map of three potential ZEDEs. The first ZEDE will be in Southern Honduras on the Gulf of Fonseca. The first three sites developed in this zone, Amapala, Alianza, and Nacaome, are represented by white dots in the southern part of

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<sup>47</sup> The Technical Secretary must be a Honduran by birth, but no one is required to be Honduran on the CBP.



**Figure 4.5.** Potential ZEDE locations in Honduras

Source: <https://file.ejatlaz.org/img/Conflict/zonas-de-empleo-y-desarrollo-economico-zede-ciudades-modelo-o-charter-cities-honduras/dt.common.streams.StreamServer.jpg>

Honduras. The Honduran government has invested \$4.5 million to complete feasibility studies for this ZEDE completed by the Korean Development Agency.

Each site within this ZEDE serves a specific purpose. In Amapala, a deep water port and major bridge will be built. In support of this, a logistics corridor will connect this port to the major Atlantic port in Puerto Cortes. This logistics corridor will create a dry canal which is a transportation corridor with a superhighway. This dry canal may take up to 5% of the traffic from the Panama Canal. Alianza will represent the logistics hub for this ZEDE connecting it to the dry canal and thus, the rest of Honduras. Figure 4.6 shows



**Figure 4.6.** Honduras's location in relation to other countries

Source: <https://bostontohonduras.files.wordpress.com/2008/07/honduras-map-context.jpg>

that Honduras may be a good candidate for a dry canal because of its location relative to Panama and major United States ports like New Orleans and Miami.

The Nacaome valley is part of a dry desert corridor in Central America. This area may generate particular interest for agribusiness exporters if irrigation systems are installed in the area as proposed. Dry land with artificial irrigation would allow agribusinesses to easily export fresh produce and fresh aquaculture products to the United States market. Examples of such products include melon, mangoes, oriental vegetables, shrimp, and tilapia. This strategy has been used in Peru which is among the biggest

exporters of asparagus, and very important exporters of mangoes, organic bananas, avocados, artichokes, chili peppers, and other crops.

#### *4.6.3 ZEDEs in Context*

This subsection places the ZEDEs in context with the other economic zones in the institutional ownership structure section. After doing so, the proposed benefits and costs are discussed and, given the Honduran setting, determine if these benefits and costs are likely to accrue.

Table 4.3 adds the ZEDE to the institutional ownership structure table above and compares it to EPZs, SEZs, LEAP zones, and the country (as the baseline). Table 4.3 shows that the ZEDE is setup as a LEAP zone in that Honduras retains and relinquishes control over the same governance institutions. However, there is a difference in what controls those ceded governance institutions. In a ZEDE, all control is given to the CBP. There is no direct feedback mechanism to the CBP except in a provision to abolish the ZEDE by popular vote if there is a sufficient number of people in the ZEDE. In contrast, in a LEAP zone, the LEAP controls the governance institutions. This implicitly assumes some sort of feedback mechanism between those who control the governance institutions and those who live, work, or invest in the LEAP.

The lack of direct feedback in the ZEDE implies that many of the potential benefits from decentralization and federalism may not occur. This is because these benefits rely on political accountability of the ruling entity. Additionally, this feedback mechanism does not fit within the research by Moberg (2014) which recommends

**Table 4.3.** Institutional ownership structure of ZEDEs in principle

Institution	Country	EPZ	SEZ	LEAP	ZEDE
<i>Voice and Accountability</i>					
- Type of political system	C <sup>a</sup>	C	C	LEAP <sup>a</sup>	CBP <sup>a</sup>
- “Bill of Rights” freedoms	C	C	C	C	H <sup>a</sup>
- Citizenship decisions	C	C	C	C	H
<i>Political Stability and Absence of Violence</i>					
- Military	C	C	C	C	H
- Police	C	C & Co. <sup>a</sup>	C	LEAP	CBP
<i>Government Effectiveness</i>					
- Infrastructure	C	C & Co.	C & SEZ <sup>a</sup>	LEAP	CBP
- Education	C	N/A	C	LEAP	CBP
- Bureaucratic implementation	C	C	C & SEZ	LEAP	CBP
<i>Regulatory Quality</i>					
- Anti-competition regulation	C	C	C & SEZ	LEAP	CBP
- Trade policies	C	C	C & SEZ	LEAP	CBP
- Tax policies	C	C	C & SEZ	LEAP	CBP
<i>Rule of Law</i>					
- Contract enforcement	C	C	C	LEAP	CBP
- Judicial administration	C	C	C	LEAP	CBP
- Equal treatment of foreigners	C	C	C	LEAP	CBP
- Expropriation with compensation	C	C	C	LEAP	CBP
- Private property protection	C	C	C	LEAP	CBP
<i>Control of Corruption</i>	C	C	C	LEAP	CBP

a. C – Country, Co. – Company, SEZ – Special economic zone, LEAP – LEAP zone, CBP – Committee of Best Practices, H – Honduras

democratic political institutions or privatization. These two options provide a mechanism for accountability through an electorate or the market.

However, Tiebout (1956) provides some hope. In his model, there are no feedback mechanisms other than the population voting with their feet. The underlying assumptions of this model are unlikely to be met, but the intuitive idea from Tiebout

provides an alternative mechanism for some decentralization and federalism benefits to still accrue. Additionally, the decentralization literature indicates that political stability is an important benefit from decentralization. This may be provided because the political power is controlled by the CBP alone.

#### *4.6.4 MFEF Decision Process for the Gulf of Fonseca ZEDE*

In applying the MFEF decision framework to the Gulf of Fonseca ZEDE, this essay assumes that the MFEF has identified a problem or opportunity that may be solved or capitalized on in Honduras. The two alternative locations are the Gulf of Fonseca ZEDE (referred to as the ZEDE) and the area of Honduras outside of the Gulf of Fonseca ZEDE (referred to as Honduras). This discussion focuses on step three of the decision framework. Step one was performed in the general discussion about MFEF cases and in this paragraph. Step two was performed for the MFEF cases in the general discussion above. Step three entails determining risk levels in Honduras and the ZEDE and evaluating the MB decision in each location for both cases of the MFEF.

Step three begins with assessing the risk levels in Honduras and the ZEDE. Tables 4.4 and 4.5 present two quantitative business environment assessments for Honduras from the World Bank and BMI Research. Table 4.4 presents the World Bank Doing Business (DB) report rankings and distance to the frontier (DTF) measure for Honduras in several topic areas for domestic companies and the average for Latin American and Caribbean countries (World Bank, 2015). Table 4.5 presents the Business Monitor International (BMI) Research Country Risk Assessment (CRA) for Honduras, an Emerging Markets average, and a Global Markets average (Business Monitor

**Table 4.4. Doing Business in Honduras: 2016, World Bank**

Topics	Rank	DTF	Latin America
<i>Overall</i>	<i>110</i>	<i>58.06</i>	-
Starting a Business	150	74.92	78.52
Dealing with Construction Permits	87	69.24	65.83
Getting Electricity	143	53.39	70.59
Registering Property	88	64.24	54.86
Getting Credit	7	85	50
Protecting Minority Investors	134	43.33	48.70
Paying Taxes	155	57.28	62.75
Trading Across Borders	136	55.98	66.02
Enforcing Contracts	150	45.54	54.18
Resolving Insolvency	139	31.67	39.25

Notes: Rank is out of 189 countries. The lower the number the better (1 is best).

DTF is the distance-to-frontier measure. It is on a scale of 0-100. Higher is better (100 is best). It measures the percentage of Honduras's score relative to the best country's score.

International Research, 2015). These CRA indicators evaluate short- and long-term political, economic, and operational risks. The DB and CRA indicators combine to inform the short- and long-run risks present in Honduras.

The indices and rankings show that Honduras is a risky developing country. Overall it has low scores, and few scores exceed the emerging country average in Table 4.5. In the Overall Country Risk Index, Honduras ranks poorly relative to other Central American countries with Nicaragua being the only country that is riskier than Honduras (Business Monitor International Research, 2015). Additionally, it ranks in the bottom 30<sup>th</sup> percentile for 7 of 10 topics in Table 4.4. Also, Table 4.4 shows that Honduras does not perform well compared to the Latin American average. Honduras is in the middle of the pack for Central American countries in overall scores with Belize and Nicaragua being the only lower ranked countries (World Bank, 2015).

However, Honduras has two strong areas: the economy and financial markets. The overall economy in Honduras is growing steadily as discussed above, and the short-

**Table 4.5. Country Risk Assessment in Honduras: Nov. 2015, BMI Research**

Risk Index	Honduras	Emerging Markets	Global Markets
<i>Short Term Political Risk</i>	44.4	61.7	64
- Policy-making process	46.7	63.8	65.6
- Social stability	47.5	54.9	57.5
- Security/external threats	43.3	64.1	66.3
- Policy continuity	40.0	64.2	66.4
<i>Long Term Political Risk</i>	51.1	58.2	61.3
- Characteristics of polity	49.4	55.6	59.9
- Characteristics of society	57.5 <sup>^</sup>	56.1	59.3
- Scope of State	45.0	60.1	62.7
- Policy Continuity	50.0	64.1	65.9
<i>Short Term Economic Risk</i>	51.3 <sup>^</sup>	47.7	49.9
- Economic Growth	63.3 <sup>^</sup>	45.7	45.5
- Monetary Policy	55.0	64.3	66.1
- Fiscal Policy	40.0	47.5	49.7
- External Factors	46.7 <sup>^</sup>	45.3	47.3
- Financial Markets	47.5 <sup>^</sup>	45.3	50.4
<i>Long Term Economic Risk</i>	49.1 <sup>^</sup>	48.5	50.9
- Structural Characteristics	49.1	50	52.7
- Economic Growth	75 <sup>^</sup>	45.3	45.3
- Monetary Policy	45.0	67	69.6
- Fiscal Policy	43.3	48.8	50.3
- External Factors	30.0	43.9	45.8
- Financial Markets	47.5 <sup>^</sup>	45.3	50.4
<i>Operational Risk</i>	41.7	47.2	49.9
- Labor Market Risk	41.1	48.5	50.5
- Logistics Risk	47.8 <sup>^</sup>	46.3	49.4
- Trade and Investment Risk	46.5	47.5	49.9
- Crime and Security Risk	31.5	46.6	50
<i>Country Risk Index</i>	46.2	51.8	54.4

Notes: <sup>^</sup> indicates a risk measure for Honduras that is better than the emerging market average. Numbers are scores on a scale of 0-100. Higher scores are better (100 is best).

and long-run risks associated with the economy are accordingly low as seen in Table 4.5.

Additionally from Table 4.5, financial market risks are low in the short- and long-term.<sup>48</sup>

Table 4.4's DB indicators show similar strength from the getting credit indicator.

<sup>48</sup> This may be due to the strong link between the Honduran Lempira and the U.S. Dollar despite the Honduran Lempira being a floating currency.

Table 4.4 indicates that Honduras has problems enforcing contracts, protecting minority investors, providing electricity, facilitating trade, and administering taxes. Each of these indicators is more than forty percentage points away from the best country and ranks in the bottom 30<sup>th</sup> percentile of countries. CRA indicators in Table 4.5 indicate that Honduras has particularly high political and social risks that appear to be a structural issue. The CRA indicators for short-run political risks are very low in comparison to even the emerging market average. Long-run political risks are also very low except for the characteristics of society measure. Additionally, labor market and crime and security risks are much lower than other emerging markets. These point to potential structural, societal issues that increase short-run and long-run risks.

Because the ZEDE does not yet exist, quantitative risk measures are not available. However, in assessing LEAP zones and the ZEDEs specifically, one can determine the risks relative to Honduras and why they are different. An important caveat is that these relative risks are theoretical ones. Actual relative risks may be different. The reasons for differences and how they may differ in reality are discussed in addition to the theoretical risk differences.

In theory, the ZEDE reduces many short- and long-run risks such as economic policy risk, contract enforcement and arbitration risk, and political stability risks in some respects. First, the ZEDE law specifically addresses economic policy instituting a low tax environment and free trade. Second, the ZEDE law also specifies that English common law should be used and sets up formal arbitration rules. Additionally, the ZEDE may use

courts in other countries to provide more credibility and quicker decisions.<sup>49</sup> These address risks around property rights protections and contract enforcement. Third, the ZEDE law creates a policy making body, the CBP and the ZEDE's Technical Secretary, independent of the Honduran political system. This provides political stability and isolates it from corruption from the Honduran political system.

In practice, the ZEDE may not achieve these risk reductions or they may not accumulate significantly for three reasons. First, the ZEDE may be dissolved at any time by the Honduran congress and the residents. In the law, two factors mitigate this risk. First, there is an "evergreen" provision that keeps the ZEDE structure in place for ten years after the vote to dissolve it. Second, the ZEDE law can only be changed with a two-thirds majority, rather than a simple majority. Additionally, if there are 100,000 residents, they must also vote, by simple majority, to dissolve or change the ZEDE law.

Second, there is no guarantee that the policies put in place by the CBP and the ZEDE's Technical Secretary will be better than Honduran policy. This may be due to incompetence. However, the larger issue is the lack of direct feedback between the ZEDE success and the CBP. Not only does this bring up issues discussed in the previous subsection, it also implies that the CBP may change policy at any time. This is possible in theory in Honduras, but is less likely due to the democratic process.

Finally, who and which firms are attracted to the ZEDE determine much of the de facto risk levels like those related to violence prevalence and property rights protections. This alludes to an adverse selection problem. If the ZEDE attracts firms and citizens that

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<sup>49</sup> The details of these arrangements are made on a case by case basis. For example, Mauritius uses the Privy Council in the United Kingdom as its highest court of appeal.

are there to only take advantage of the new policies, the structural problems within the society may not be resolved. This risk is compounded due to the lack of direct feedback between the ZEDE and its governing body, the CBP.

Shifting gears to evaluating the location and MB decisions for the MFEF cases in both Honduras and the ZEDE. This discussion is organized as follows. The location risks for overall success are evaluated for both Honduras and the ZEDE for the case one MFEF. Then, the risks most relevant to the MB decision are evaluated for the case one MFEF. With this information, a selection is made for the case one MFEF. These steps are repeated for the case two MFEF. Because these decisions are very general, no profitability analysis can be done. Therefore, selections can only be made based on the risks contingent on equal risk-free profits.

#### 4.6.4.1 Case one: Locate in the ZEDE because of contract enforcement

In case one, the location risks related to final demand drive overall success. Honduras's strong overall economy pushes the final demand risk lower. However, labor and political risks are high indicating this strong economic growth may disappear, in turn negatively affecting final demand. These three factors combine to give moderate final demand risk in Honduras. The ZEDE itself will likely have a small population relative to the rest of Honduras. This indicates that the MFEF will likely sell its product(s) to Honduras even if it locates in the ZEDE. Therefore, the most relevant final demand risks are those of Honduras regardless of location decision.

In case one, the location risks affecting the MB decision are property rights protection, contract enforcement, production risks, and potential trade policy risks. For

Honduras, the buy decision of importing carries moderate risk. Honduras has many free trade agreements with other countries, but the political instability and potential corruption mean there is still considerable risk in trade especially when exporting perishable food products to Honduras. The make decision carries with it moderate risk. Property rights are enforced fairly well and direct control over relationships with local suppliers and labor pushes this option's risk down. However, the risk of holdup is high because you have sunk assets in the country and contract enforcement is weak. The hybrid decision of licensing has high risks. Intellectual property rights like ingredient formulations and proprietary processes are weak; arbitration avenues are slow and convoluted; and contract enforcement is poor.

The ZEDE has moderate risks for the buy decision. It is setup as a free trade zone and this cannot change without changing in the underlying ZEDE law. However, there is likely a tax to transport goods into Honduras. Additionally, the ZEDE is relatively far from the major population centers so infrastructure risks in Honduras are high even though infrastructure within the ZEDE is of high quality. The make decision has low-moderate risks. In comparison to Honduras, the ZEDE has special arbitration rules and better contract enforcement. Additionally, production risks are likely lower than Honduras because of the ZEDE's improved infrastructure. However, the distance to major population centers keeps the risks from being low. Finally, the hybrid decision has moderate risks in the ZEDE. Contract and intellectual property rights are enforced better in the ZEDE compared to Honduras. However, the MFEF is ceding control to another firm where labor and holdup may still be an issue.

From a risk perspective the best options for the case one MFEF are to locate in the ZEDE. The best MB option is to make, which takes full advantage of the better contract enforcement, property rights protection, and higher quality infrastructure. Additionally, this minimizes trade risks and allows the MFEF to reduce in-country production risks.

The make option is the strategy pursued by Cargill in Central America, but currently outside of the ZEDE. Therefore, Cargill or a similar company likely would find the ZEDE beneficial in relocating or locating their facilities. SABMiller may use this strategy in a similar way to protect its beer recipes and re-locate facilities within the ZEDE. A case one MFEF like Wal-Mart may find the ZEDE beneficial for importing products because it must import many products like electronics, furniture, and medicine. However, they must locate their stores throughout Honduras to meet local demand. Therefore, locating a distribution center (i.e., a make decision) in the ZEDE is a good strategy for a MFEF retailer like Wal-Mart to pursue. An agricultural input supplier like DuPont Pioneer which cannot source inputs from the country may also use this distribution center strategy.

#### 4.6.4.2 Case two: Locate in the ZEDE because of coordination benefits

In case two, the location risks related to supply are the most important to overall success. Honduras's location in Central America provides an ideal location for growing tropical fruits while being close to major North American markets as seen in Figure 4.6. In Honduras, the northern regions have traditionally had most of the tropical fruit production. This was particularly advantageous because of the climate and the proximity to the United States market. The central, mountainous regions have temperate climates

which support timber, coffee, and beef production. The southern region has a tropical climate, but is drier than the north. This southern region produces sugar cane, melons, and other crops.

Supply risk for the case two MFEF can be broken down into agricultural risk, transportation risk, and exporting risk. For the most part, agricultural risks are the same across Honduras because major weather events likely affect the whole country, not particular regions. Therefore, agricultural risks are the same for Honduras and the ZEDE. Major risks facing Honduran agriculture are extreme weather events like droughts or hurricanes. However, this is offset by the ideal climate for growing fruits and vegetables. Thus, agricultural risk is moderate because of the offsetting risks of ideal climate versus rare, major weather events.

Transportation risk varies based on location because of the poor infrastructure in Honduras. The longer the crop must be transported the higher the risk for spoilage or damage. Moreover, this induces firms to build processing facilities close to the growing area to reduce this risk losing out on potential economies of scale. Large MFEFs may need agricultural products from both inside and outside of the ZEDE regardless of their location decision. The major port in Honduras has been the Puerto Cortes on the Caribbean Sea. Thus, risks were traditionally lower in northern Honduras. However, with the proposed investments in irrigation in Nacaome, the world-class port in Amapala, and the logistics hub in Alianza, the risks in southern Honduras near or in the ZEDE have reduced significantly. Now, MFEFs may shift much of their production to areas in or near the ZEDE to take advantage of this new infrastructure. The risk difference between

Honduras and the ZEDE is now small with both being low-moderate. The ZEDE may have slightly lower transportation risks because of the updated infrastructure.

Exporting risk is moderate for Honduras and low-moderate for the ZEDE. These are similar to the trade policy reasons in case one. Honduras has fairly good trade policy, but exporters are left with a fair amount of holdup risk when wanting to export highly perishable agricultural products. The ZEDE has low-moderate risk because of its policy and updated infrastructure. These infrastructure improvements are particularly important as FSMA requires higher standards for processing and storage that other ports in Honduras may not be able to meet as readily.

In case two, the location risks affecting the MB decision are property rights protection, contract enforcement, and production risks. For Honduras, the buy decision of exporting in the MB decision carries moderate risk. The make decision carries with it low-moderate risk. Property rights are enforced fairly well and direct control over land, equipment, and labor pushes this option's risk down. However, the risk of holdup is moderate because the MFEF has sunk assets in the country and as seen above production risks are moderate. The hybrid decision of contracting with growers and processing its own products has low-moderate risks. Contract enforcement is weak and so this option exposes the MFEF to more of this risk. However, this option lowers the risks of own-production. Additionally, having relationships with growers directly and controlling the processing reduces risks associated with complying with FSMA.

The ZEDE has low-moderate risks for the buy decision. The make decision has low-moderate risks. Much of the production must take place in Honduras, so there is not

any risk reduction here in locating in the ZEDE. Some small risk reduction is gained in using the infrastructure of the new ZEDE. However, this is countered by needing to potentially transport products from far reaches of Honduras increasing infrastructure risks. Finally, the hybrid decision has low risks in the ZEDE. The same contract enforcement is an issue with growers, but with the better infrastructure, it has lower risks of complying with FSMA during the processing and storage stages.

From a risk perspective the best options for the case two MFEF are to locate in the ZEDE. The best MB option is the hybrid which takes full advantage of the better infrastructure and minimizes its exposure to production risks and poor property rights in the rest of Honduras. This option involves the case two MFEF investing in processing facilities within the ZEDE. Additionally, this minimizes risks associated with complying with FSMA. Companies like Dole Fruit, Chiquita, and Del Monte pursue similar strategies in Central America. Several of these companies directly contract with growers and have storage and processing facilities in the Central American country. The particular attraction of the ZEDE is improved infrastructure, free trade setup, and better property rights and contract enforcement. These companies also typically have land and grow their own products. The attraction of the ZEDE in this strategy may also shift production to the ZEDE or very close to it to take advantage of the infrastructure improvements.

#### 4.6.4.3 Summary

Both case one and two MFEFs will likely find the new ZEDE in Honduras attractive. The ZEDE's better infrastructure minimizes production risks. Additionally, the ZEDE will likely better enforce contracts and property rights in the long-run which will allow the

MFEFs to more easily work with other firms and protect their assets especially intellectual property. The case two MFEF may find the ZEDE particularly interesting because of new standards and regulations put in place by FSMA.

#### 4.7 Conclusions

LEAP zones are new economic zones designed to alter the legal, economic, administrative, and political institutional landscape. They are a generalized concept of Romer's charter cities. The first economic zones in this vein are being created in Honduras, locally called ZEDEs. This essay addresses several topics in this area. First, this essay finds that LEAP zones are fundamentally different from other economic zones because of the dynamic policy-making the LEAP zone has. Additionally, the LEAP zone is different from colonies and Banana Republics because the areas must still obey the constitution of the country. The best approximation to true LEAP zones is sub-national areas in federalist countries. These areas have their own policy-making ability, but must still follow the national government's main laws.

Second, this essay finds that the benefits from LEAP zones may be much larger than from other economic zones. These benefits accrue through decentralization and the creation of a federalist structure, not just through facilitating trade (EPZs) and implementing economic reforms (SEZ). These benefits include better services for residents and better governance institutions. However, the costs may also be larger. The significant costs come from political transaction costs in setting up the LEAP zone as well as typical physical, economic costs. These consist of giving up control over the zone

and potential side benefits. LEAP zones should be implemented when both economic policies need reform and governance institutions are weak.

Third, this essay shows that multinational firms looking to locate some operations in international areas may find LEAP zones attractive because they reduce short- and long-run risks. Some risks affect the decision of where to locate such as infrastructure quality, production risks, and the strength of the economy. Others affect the decision of how to enter the location such as contract enforcement and property rights protections. These risks combine in the firm's decision process in which it selects the location-strategy combination that provides the best payoff. In applying this process to multinational food economy firms, two cases were discussed. The international location represented a new market and a source for products for cases one and two, respectively. Demand and supply risks were the most important risks for overall success for each case, respectively. Both cases were concerned with contract enforcement, property rights protections and production risks in evaluating the make-or-buy decision.

Fourth, in analyzing the case study of Honduran ZEDES, this essay provides two findings. First, the LEAP zone may be difficult to implement fully in practice. The entity in charge of the Honduran ZEDES' is the Committee of Best Practices which has no direct oversight from the ZEDE participants (i.e., residents or firms). Moreover, the CBP has no direct oversight from the Honduran government. Although the ZEDES are independent from the central government, the lack of check and balance on the CBP implies many of the benefits from the ZEDES may not accrue. The second finding is that if the ZEDE is setup properly, despite the structural, governance issues, MFEFs will

likely find the ZEDE an attractive area to locate. The ZEDE is especially attractive for United States MFEFs who export food products from Honduras as the United States has implemented the Food Safety Modernization Act.

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