The Financial Performance of U.S. Sugar-Consuming Agribusinesses

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Vasileios Siokos
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DEDICATION

I dedicate my work to Konstantinos Siokos, Liza Myrgioti, Serafeim Myrgiotis, Agapoula Siokou, Periklis Siokos, Minas Politis, Chrysoula Siokou, Angeliki Siokou, Tereza Duran, Athanasios Politis, Vasiliki Siokou, Elena Siokou, Ioannis Deligiannis, Panagiotis Dimitriou, Eirini Georgiou, Alexios Damianidis, Zoi Fotopoulou, Evangelos Fotopoulos, Panagiota Fotopoulou, Olga Charisi, Voula Kasidakou, Moonwon Soh, Meagan Merritt and Di Sheng.

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ABSTRACT

U.S. sugar policy is contained in the Agricultural Act of 2014. U.S. sugar policy contains domestic marketing allotments and a tariff-rate quota on foreign sugar imports which results in U.S. raw and wholesale refined beet and cane sugar prices typically being higher than the world sugar prices. Sugar growers are in favor of U.S. sugar policy; however, sugar-using manufacturers (e.g., Hershey Co.) claim that sugar prices have significant impact on their financial performance. Sugar-using companies argue that U.S. sugar policy results in higher costs of production for sugar-containing products. Therefore, the second Chapter of this thesis examines whether changes in the U.S. sugar prices affect the financial performance of U.S. publicly-traded sugar-using agribusinesses. Quarterly accounting and stock market data from COMPUSTAT and the Center for Research in Security Prices are analyzed. The findings indicate that U.S. sugar prices has no major impact on the profitability of sugar-using agribusinesses. However, sugar prices are a small part of firms' cost of goods sold. In the third Chapter, a sugar related business segment analysis is conducted along with a financial ratio analysis, to provide further insights about whether U.S. sugar prices affect the performance of sugar-using business segments. Annual accounting segments data are gathered from COMPUSTAT Historical Segments and S&P's Capital IQ. The results of both the financial ratio analysis and the panel data analysis indicate that U.S. sugar prices do not have any impact on sugar-related business segments' profitability. These findings are consistent with the results of Chapter II.

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CHAPTER I
INTRODUCTION

U.S. sugar policy is contained in the Agricultural Act of 2014. U.S. sugar policy contains domestic marketing allotments and a tariff-rate quota on foreign sugar imports which results in the U.S. raw and wholesale refined cane and beet sugar prices typically being higher than the world sugar price. Therefore, sugar-using companies such as Hershey Co. claim that their financial performance is being affected by the current sugar program due to higher domestic sugar prices. From 2000 through 2016 U.S. raw and wholesale refined cane and beet sugar prices were higher than world sugar prices. Therefore, the financial performance of publicly-traded sugar-using manufacturers is examined to determine if changes in the U.S. sugar prices have a significant impact on their profitability. Various methods can be implemented such as the fixed-effect estimator to estimate the profitability model, while accounting for unobserved heterogeneity.

In Chapter II, the financial performance of sugar related agribusinesses is examined. More specifically, a sample of actual sugar-using manufacturers is examined with quarterly accounting and stock market data utilized. In this Chapter three different type of models are estimated; the baseline model without the use of sugar prices and two alternative models with the use of sugar prices as a substitute for cost of sales. This was done to examine whether sugar prices are an important part of cost of goods sold for the selected agribusinesses. Thus, whether the price variability affects the financial performance of the selected agribusinesses. The results of this Chapter shed light on whether the U.S. sugar prices have a significant impact on the profitability of the sugar related corporations.

In Chapter III, whether the sugar prices affect the financial performance of the sugar related business segments is examined. Annual financial data for business segments were utilized for the selected sample of agribusinesses. In this Chapter the same type of profitability models estimated to examine if the price variability affects the profitability of the sugar related segments. Moreover, a financial ratio analysis was conducted along with mean equality tests for key financial ratios. The results of this Chapter provide further insights into the impacts of the U.S. sugar prices on the performance of the sugar related corporations, given there is not a large amount of literature on this topic in the field of agricultural finance.

Chapter IV summarizes the conclusions and implications from the analyses presented in Chapters II and III.

CHAPTER II
THE FINANCIAL PERFORMANCE OF U.S. SUGAR-CONSUMING AGRIBUSINESSES

Abstract

Sugar-using manufacturers (e.g., PepsiCo Inc.) claim that U.S. sugar policy increases domestic sugar prices which negatively affects their financial performance. This chapter evaluates whether changes in the U.S. sugar prices (higher domestic sugar prices for the period 2000-2016) affects the financial performance of U.S. publicly-traded sugar consumer agribusinesses. The accounting and stock market data for this analysis was gathered from COMPUSTAT and the Center for Research in Security Prices for 2000 through 2016. To account for unobserved heterogeneity, a fixed effects estimator was used to estimate all the profitability models. The baseline model is estimated with cost of goods sold as a substitute for U.S. sugar prices, whereas three alternative models are estimated with the U.S. raw and wholesale refined beet and cane sugar prices. Furthermore, a finite distributed lag model with a lag of four quarters was estimated for every type of sugar to account for potential recurring effects of the U.S. sugar prices on profitability. Usually, companies maintain large inventories, thus a change in sugar prices may affect their profitability in future periods. The results of the alternative models indicate that sugar prices do not follow the same direction as cost of goods sold does for the sample of agribusinesses, thus sugar prices seem not have any impact on firms' profitability. Moreover, from the finite distributed lag models, U.S. sugar prices do not seem to have a major impact on sugar-using manufacturers' profitability. This is because sugar purchases represent a small fraction of cost of goods sold for the selected U.S. sugar-using agribusinesses and does not affect their performance in a major way.

Introduction

The U.S. food processing and manufacturing agribusiness sub-sector encompasses all the industries that maintain a critical role for the viability of the agribusiness supply chain. Processing industries convert raw materials to ready-to-consume products that will be available to consumers through retailers. The U.S. sugar and confectionery industry, along with firms that produce sugar-containing products are among the processors that might be affected by the fluctuations of sugar prices.

The U.S. government implements the U.S. sugar program under the Agricultural Act of 2014 (2014 Farm Bill). The program uses price supports, an overall allotment quantity (OAQ), and tariff-rate quotas (TRQs) to determine the final amount of sugar available to the U.S. market. Domestic price supports consist of loans that the United States Department of Agriculture (USDA) makes available to domestic processors of sugarcane and sugar beets (United States Department of Agriculture, 2016). The marketing allotment is the portion of the sugar market allocated each year to the U.S. sugar producers and cannot be less than the 85 percent of the domestic market (USDA, 2016). Finally, the tariff-rate quota determines the amount of foreign sugar that can enter the country tariff-free (USDA, 2016). U.S. is the world's largest sugar importer with imports of sugar from 41 countries (American Sugar Alliance, 2017). U.S. raw sugar prices had an increasing trend after the recession years until 2011, with a decline and a return to the pre-recession levels after 2011. Moreover, U.S. raw sugar prices have been higher than world sugar prices since 2000. Figures A-1 and A-2[1] present the average fiscal U.S. raw and wholesale refined beet and cane sugar prices in comparison with the average fiscal world prices for the period from 2000 to 2016.

There is an ongoing debate about the effects of U.S. sugar policy on employment and prices. Critics argue against the sugar policy and claim that it sustains a small number of jobs in the sugar industry, while causing a bigger loss of jobs in sugar using industries (Triantis, 2016). Moreover, critics say the sugar program artificially increases sugar prices to benefit an exclusive group of sugar processors (Bobkoff, 2013). Triantis examined the economic effects of the U.S sugar policy and tried to debunk the existing claims regarding the negative economic effects of U.S. sugar policy on employment and prices. Specifically, the author examined the financial performance of the nine largest U.S. sugar using publicly-traded firms. Triantis (2016) concluded that the U.S. sugar policy does not affect negatively the profitability of sugar-using manufacturers. Concluding that the industry is thriving, and the industry employment is stronger than in the other manufacturing industries. Moreover, the author argues that the sugar using firms have been doing very well under existing U.S. sugar policy and that the examined sugar using companies have experienced strong revenue growth over time.

[1] All tables and figures are placed in the Appendix at the end of this Chapter.

Research problem

This study examines the relationship between U.S. sugar prices and the financial performance of the U.S. publicly-traded food processing firms that use sugar as their input for the period from 2000 to 2016. U.S. Sugar Policy under the Agricultural Act of 2014 regulates the U.S. sugar market on the notion that supply, and demand should be in balance. There is an ongoing debate about the current U.S. sugar policy and the effect of changes in sugar prices on the financial performance of the sugar-consuming agribusinesses.

Significance of the problem

The results of this analysis may provide insights of the performance of those processing companies under the fluctuations of the sugar prices and potential answers to the question raised from the sugar users (e.g., Hershey Co., and Mars Inc.) about the effects of these prices.

Objective

The objective of this study is to determine whether changes in the U.S. sugar prices affect the performance of U.S. sugar-using agribusinesses as sugar users suggest by examining the relationship between U.S. raw, wholesale refined beet, and cane sugar prices and the financial performance of U.S. publicly-traded sugar-using manufacturers for the period 2000-2016.

Literature review

The relevant literature can be divided into two different groups of studies. The first group examines U.S. sugar policy and the relationship between sugar prices and the performance of sugar-using agribusinesses. However, the literature focusing on the relationship between sugar prices and financial performance is very limited. The second group focuses on the use of different proxies of firm's profitability and the key determinants of profitability.

Sugar-related studies

U.S. sugar policy began in 1798 with the imposition of the first tariff on sugar by the U.S. government. During the long period of implementation there has been a lot of controversy regarding the effects of this policy and its cost to the economy. Maskus (1989) examined the political economy of the U.S. sugar program in the 1980s and the effects of the program to international trade relations. The study concluded that these relationships appeared to be affected negatively, thus recommending imposed quotas be abolished.

The General Accounting Office (GAO) in 2000 concluded that the U.S. sugar program has increased the cost for sugar-using manufacturers about $1.9 billion for 1998 (GAO, 2000). While the same time the main beneficiaries from this program were sugar producers, with benefits around $1 billion for 1998. The American Sugar Alliance (ASA) argues that U.S. sugar policy was implemented at no cost for the Federal Budget, since the 2014 Farm Bill was signed

(ASA, 2016). Additionally, ASA states that while the sugar program has no cost for taxpayers, the candy industry have received more than $2 million in marketing subsidies under the current Farm Bill (ASA, 2016). These funds were made available to sugar-using manufacturers through the market access program by USDA to boost sales of confectionery products on the international market.

Sugar-related studies also assessed the economic impacts of a potential abolishment of the U.S. sugar policy. Elobeid (2013) found that a potential removal of the U.S. sugar program would increase the welfare of consumers from $2.9 to $3.5 billion per year and generate approximately 20,000 jobs in industries related to food and manufacturing. The author concluded that imports of products that contain sugar would fall dramatically, whereas sugar imports would rise in a substantial way.

The relationship between U.S. sugar prices and the performance of the sugar-using agribusinesses may be affected by the type of sugar the agribusinesses use in their production process. Genetically modified (GM) sugar beets were authorized to be planted in the U.S. in 2005 (Kennedy, Lewis & Schmitz, 2017). The adoption rates of GM sugar beets in the U.S were higher than any other GM crop (Kennedy et al., 2017). While the productivity gains from GM varieties are tremendous, many consumers are opposed to GM products as unsafe (Kennedy et al., 2017). Thus, because of a potential reduction in demand for sugar products containing GM beet sugar, sugar-using manufacturers may switch to cane sugar as an input for their products.

U.S. sugar policy has caused controversy among sugar industry organizations and the food and beverage sugar-using companies. An industry report, prepared for the ASA (Triantis, 2016), examined the economic effects of U.S. sugar policy on sugar prices and job creation. The author analyzed a sample of the nine U.S. largest sugar-using manufacturers based on the cost of sugar as an input as a proportion of the total cost of production. To identify whether the financial performance of the sugar-using manufacturers has been affected by the higher-than-world and increasing sugar prices, the author performed a financial performance analysis using accounting and financial market data for the period 2001-2015. Triantis (2016) concluded that sugar policy had no negative effect on the financial performance of sugar-using manufacturers. In fact, the author finds that these companies have improved their performance during that period. Some commentators have argued that the relocation of the operations of U.S. confectioners to Canada and Mexico was driven by artificially-high domestic U.S. sugar prices (ASA, 2009). However, Buzzannell & Associates Inc. argues that the major economic factor that led to this movement were lower wage rates (ASA, 2009). Buzzannell & Associates Inc. also documents a relatively high profit margin, around 35%, in the confectionery industry (ASA, 2009). The high-profitability finding is consistent with the results in Triantis (2016).

Profitability

Measures of profitability

Empirical studies of the economic performance of firms or industries are often forced to rely on proxies for firm profitability given an absence of data. These studies have used different proxies, including return on equity (ROE) and return on assets (ROA). ROA, defined as net income divided by total assets, is widely used, with minor variations, in empirical studies. Thus, ROA is used as a proxy for profitability in this study. Lee (2009), for instance, studied the key drivers of

firm performance and more specifically the effect of size of firm on profitability, using ROA as a proxy.[2] Goddard, Tavakoli and Wilson (2005) examined the key determinants that affect profitability for companies that belong to the manufacturing and service sector in Belgium, France, Italy and the UK, from 1993 through 2001, using ROA as a proxy of profitability. Hirsch, Schiefer, Gschwandtner and Hartmann (2014) examined the key drivers of firms' profitability proxied by ROA in the food industry of selected European Union countries. Asimakopoulos, Samitas and Papadogonas (2009) examined the key factors that affect ROA for a list of Greek firms registered in the Athens Stock Exchange for the period from 1995 through 2003. Additionally, Sorana (2015) analyzed the key factors affecting ROA among a list of Romanian firms for the period 2003-2015, defining ROA as the earnings before interest and taxes (EBIT) divided by total assets. Liargovas and Skandalis (2010) studied the key drivers that affect profitability of 102 Greek companies for the period 1997-2004. In addition to ROA, the authors also used two similar proxies: ROE and return on sales (ROS). Wadsworth and Bravo-Ureta (1992) assessed the performance of a sample of 124 New England dairy producers using both ROA and ROE as proxies for profitability.

Determinants of profitability

There are many factors that may affect firm profitability, including leverage, liquidity and asset management. Lee (2009) implemented a fixed-effects dynamic panel data model for U.S. publicly-traded firms during 1987–2006. The explanatory variables of the model were the size of the firm, measured by taking the logarithm of total assets (a proxy also used in this study) along with other financial variables and firm characteristics.[3] The author concluded that profits were positively related with firm size but with a non-linear way. Thus, the larger are the firms the more profitable they are than their smaller counterparts. However, Goddard et al. (2005), also measuring firm size by estimating the natural log value of total assets, documented a negative relationship between firm size and profitability using a dynamic panel model. Hirsch et al. (2014) decomposed the variance of ROA into different effects such as year, country, industry, and firm effects using a hierarchical linear regression model (HLM). The firm characteristics studied included market share, age of company, size of firm (natural logarithm of total assets),

[2] Lee (2009) excluded advertising expenses from profits, defining ROA as: 100 × (net income + advertising expenses)/total assets.

[3] Other explanatory variables in Lee (2009) include, the annual growth rate of Gross Domestic Product (GDP), market concentration ratio, market share, capital, advertising and research and development (R&D) intensity measured by total assets over revenues, advertising expenses over revenues and R&D expenses over revenues respectively. Moreover, Lee (2009) included debt management ratio estimated by debt expenses over total revenue, inventory management ratio estimated by total inventory over total revenue, the stock beta coefficient and firm's sales growth proxied by the percentage change in sales from the previous year.

firm growth, short-run risk and the firm's gearing ratio.[4] Industry concentration, size, growth and R&D were the industry characteristics used. The authors found that firm effects were more significant than industry effects in the determination of food industry's profitability. The results suggest that, size of companies and industry concentration are key determinants of profitability while risk and age of firm as well as industry growth impact negatively profitability.

Asimakopoulos et al. (2009) examined the key determinants of profitability using both panel Ordinary Least Squares (OLS) estimation and fixed effects with explanatory variable size measured by the natural logarithm of revenues, solvency measured by the total debt over total assets ratio, sales growth, investment, and natural logarithm of current assets, among other control variables. The authors found that firm profitability was positively impacted by size of firm, sales growth and investments, and negatively affected by solvency and the natural logarithm of current assets. Batra and Kalia (2016) implemented an OLS regression model to identify the relationship of selected determinants and corporate profitability. The independent variables in both models were net sales by net average fixed assets ratio, the current ratio, and the total debt to total equity ratio. In both models, the authors found that size and leverage factors significantly impact profitability. Firm size had a positive effect on profitability, whereas leverage ratio had a negative effect in both models. Liquidity did not have a significant impact in either model.

Liargovas and Skandalis (2010) included leverage, liquidity, size, age of firm, location, a dummy variable indicating if the company is an exporter, management efficiency and the capitalization ratio in their panel regression model. The authors concluded that leverage, export activity, location, management efficiency and size significantly impact profitability. Age was found significant in only two of the three models, whereas the capitalization ratio was significant in all three models.

Sorana (2015) included leverage (total debt to total assets ratio), firm size (log value of sales turnover) and other firm characteristics in a profitability model.[5] The author implemented several methods to estimate the profitability model such as pooled OLS, fixed effects estimation (FEE), random effects estimation (REE), a corrected model and finally a factor analysis. The study concluded that Romanian companies tend to be more profitable when their operation is characterized by limited borrowings. The tangible ratio and risk had a negative relationship with ROA, whereas the level of taxation had a positive. Size was found to positively impact performance, while liquidity did not have a significant impact. According to the factor analysis,

[4] The gearing ratio was defined by Hirsch et al. (2014) as the ratio of non-current liabilities and the loans to the funds of the company's shareholders.

[5] Other explanatory variables in Sorana (2015) included tangible ratio proxied as fixed assets divided by firm's total assets, liquidity estimated as current assets divided by short-term debt, risk, proxied by the standard deviation of ROA, taxation factor estimated as taxes divided by EBIT and the unstable economic conditions estimated as the inflation rate multiplied by a dummy variable that indicates the presence of the financial crisis for the period of study.

three factors were considered: the first factor incorporates debt and size, the second integrates tangibility and liquidity and the third variability of earnings according to the level of taxation. All three factors affected ROA.

The ratio of firm market-to-book value is used in the current literature as a proxy of firm prospects, with higher values suggesting brighter prospects from an investors' perspective. The ratio reflects firm growth, efficiency and risk (Sharma, Branch, Chgawla & Qiu, 2013). After testing these two distinctive interpretations (firm's prospects and risk), the authors found that growth and efficiency explain most of the variance in market-to-book value, whereas risk's contribution is limited. Moreover, the empirical results suggested that market-to-book value significantly reflects the achievement of managers to deliver strong operating performance and growth.

Monisola and Funlayo (2015) examined the impact of changes in commodity prices on the value of food and beverage companies in Nigeria, according to changes in raw material prices and inflation. The authors implemented a regression model to identify the relationship between commodity price and firm value. More specifically, they used a multiple linear regression model to examine the relationship between commodity price (proxied by revenues, cost of goods sold and stock price) and the value of firm (proxied by earnings per share, EBIT and total assets). They document that commodity prices and firm value have a positive and significant relationship, while revenue, cost of goods sold, stock price and firm value have a joint relationship. More specifically, the price variability impacts the price of inputs such as raw materials and the production of goods and services.

Wadsworth and Bravo-Ureta (1992) used a Logit regression method to identify key drivers of the financial performance of dairy firms. The authors concluded that the statistically significant drivers were cow's production, per cow farm operating expenses, price of milk, sources of the income that are not come from milk, location and size of the farm, and the land purchases made in a period of the last five years.

There is no consensus among the studies examined regarding the factors that affect firm profitability. Table A-1 presents a summary of the related literature discussed above. In this study, firm prospects, sales growth, firm size (proxied by the logarithm of total assets), leverage (proxied by interest to sales), investment (proxied by property, plant and equipment (PPE) divided by total assets), liquidity (current assets divided by firm's total assets) and cost of sales (proxied by the cost of goods sold margin) are used as control factors.

Data

Databases

The period of study is from 2000 through 2016. The focus of the study is on U.S. publicly-traded firms from the food and beverage sub-sector for which quarterly financial data can be found in the COMPUSTAT North America Databases (COMPUSTAT). These databases consist of fundamental economic data for publicly-traded companies of the U.S., Canada and Mexico and are frequently used in the agribusiness finance literature (Katchova and Enlow, 2013). The

companies in Compustat are organized under different identification code systems including the North America Industry Classification System (NAICS), which was used in the study. The NAICS code system is updated every five years with frequent changes in some industries (the NAICS 2017 version is used for this study). Additionally, IBIS World database utilized. This database contains industry reports (for industries classified according to the NAICS system) and information regarding industry concentration, major industry players and key financial ratios for each player.

Sample selection

The identification of the sample of sugar-using food and beverage companies utilized information from the firms' annual reports, the industry report by Triantis (2016), and the IBIS World database. This process requires several steps, starting with the identification of sugar-using industries. Table A-2 summarizes this process along with the number of observations with available financial data from COMPUSTAT for each step of the process.

Industries identification

The industries analyzed by Triantis (2016) were used to form an initial list of industries. Triantis (2016) in his report on behalf of ASA, studied the economic effects of the U.S. sugar policy through the increasing sugar prices on the financial performance of the sugar-using companies and on employment. Triantis (2016) studied sugar-using companies according to the 2012 Economic Census data[6]. This list is supplemented with industries with NAICS codes 311, 31142, 3121, 31211 and 312111, which correspond mainly to the beverage industry (Table A-3 provides the complete list of industries used for the initial screening).[7]

Initial list of agribusinesses

Financial statement (balance sheet and income statement) items from the quarterly fundamentals section in COMPUSTAT were obtained for companies with the NAICS codes shown in Table A-3. For the selected variables, available data were found for a sample of 204 agribusinesses (164 food manufacturers and 40 beverage companies). This sample was further screened to identify the potential sugar-using agribusinesses.

[6] Triantis (2016) in his industry report identified the industries that consume sugar by using the Economic Census 2012 data. More specifically, the cost of sugar as a percentage of the total material cost used to identify the sugar-using industries.

[7] In some cases, beverage companies use High Fructose Corn Syrup (HFCS) as a sugar substitute, thus these companies have to be examined closely to identify those companies that still utilize sugar as a sweetener.

Identification of potential sugar users according to annual reports

The firms' annual reports[8] (10-K documents) for the period 2000-2016 were examined to identify whether these companies use sugar as an input. 10-K's were obtained from the following databases: EDGAR[9] (U.S. Securities and Exchange Commission), Morningstar[10] (UT library version) and SEDAR[11] (Canadian Securities Administrators). Some companies using sugar disclose this information on the "Raw Material" part under the "Item 1-Business" section of the 10-K document. Some annual reports mention the use of sugar in the "Risk Factors" part under the section "Item1 - Business" of the 10-K or in the part "Products and Brands" under the "Item 1-Business" section. The former section provides information about potential economic risks the companies may face mainly from volatility in commodity prices (e.g., raw sugar), changes in legislation and changes in consumer preferences. The latter, provides information about the products and brands the company offers. The 10-Ks in most cases have the same structure for all companies, however some firms present incomplete information or use a different structure to present their data. From the food manufacturing industry, 38 companies were selected as potential sugar users (e.g., sugar was mentioned as a production input in one of the 10-K sections described above), whereas from the beverage industry, 21 companies were selected for further examination as potential actual sugar users[12]. Table A-4 provides information on the 59 selected potential sugar users. Table A-4 also shows the years with available 10Ks for each company (column "Period of 10-K") and the years on these annual reports on which sugar was mentioned in those reports (column "Period of sugar use").

Companies that purchase sugar from suppliers outside the U.S. or have their main operations outside the U.S. were excluded from the sample because the U.S. sugar prices may not have any economic effect on their performance. Those companies operate mainly in Canada, Europe and Latin America; thus, their main sources of sugar are Mexico, Brazil and other major sugar-producing countries. In most cases these companies explicitly mention in the "Raw Material" section of the 10-K document that their main sugar suppliers are outside the U.S., or that they purchase sugar on the world market. Moreover, multinational companies do not specify

[8] All the annual reports were available for most of the companies. For the rest of the companies, only the annual reports that were available were examined.
[9] The database EDGAR was accessed through the following link: https://www.sec.gov/edgar/searchedgar/companysearch.html
[10] The database Morningstar was accessed through the University of Tennessee, Knoxville library services.
[11] The database SEDAR was accessed through the following link: https://www.sedar.com/homepage_en.htm
[12] Hain Celestial Group Inc., Campbell Soup Co, Smucker JM Co. and Flowers Foods Inc. do not consistently report the use of sugar in their annual reports, however they are included in the sample based on their products.

the source of sugar in their annual reports are excluded from the analysis. For instance, Danone is a multinational company with headquarters outside the U.S. that does not specify their main source of sugar in their 10-Ks. However, Nestle SA/AG, which is also a multinational company, is included in the sample because the company explicitly mentions (on its website[13]) that one of their major sources of sugar is the U.S. The bottom of Table A-4 (column "Outside the U.S.") shows the eight companies excluded from the sample based on the aforementioned criteria.

The 51 companies in Table A-4 are classified as potential sugar users. However, one additional step is required to narrow this list to the actual sugar-using companies to be included in the final sample.

Identification of actual sugar users

In this last step of the sample selection process, information in Triantis (2016), IBIS World industry reports and a more focused screening of 10-Ks guided the final sample selection. The IBIS World database, specifically, the demand industries related to the sugar processing industry in the U.S. provides detailed information about all the industries that demand sugar as an input, along with the major players for each industry (Figure A-3). By utilizing this information[14], 15 of the 51 potential sugar users from the previous screening step were identified as actual sugar users[15]. These companies are presented in Table A-5 along with the industry name and the specific industry report.

In addition to these 15-actual sugar-using agribusinesses, an additional seven actual sugar-users (Flower Foods Inc., Ralcorp Holdings Inc., J&J Snack Foods Corp., Smucker (JM) Co., Tootsie Roll Industries, B&G Foods Inc. and Hain Celestial Group Inc.) were identified as such by Triantis (2016)[16].

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[13] After the examination of the 10-K documents of both Danone and Nestle SA/AG, the conclusion was that those companies do not specify the source of sugar as multinational companies. For those two cases, the companies' websites were utilized to gather this information. Only Nestle SA/AG specified that major part of its sugar is from the U.S. market.

[14] To identify actual sugar users the following industry reports from the IBIS World database were collected and examined: Cereal Production in the US (May 2017 report), Candy Production in the US May (2017), Chocolate Production in the US (December 2016), Ice Cream Production in the US (June 2017), Cookie, Cracker & Pasta Production in the US (August 2017), Snack Food Production in the US (February 2017), Syrup & Flavoring Production in the US (April 2017), Baking Mix & Prepared Food Production in the US (January 2017), Soda Production in the US (September 2017) and Juice Production in the US (January 2017).

[15] The industry reports refer to sugar as one of the main input primarily in the following report sections: Industry Definition, Industry Performance, Key Success Factors and Key External Drivers.

[16] Triantis (2016) examined nine sugar-using companies only due to a lack of consistent financial data. Since we were able to access additional financial data, our sample is larger. The companies analyzed by

Finally, an additional seven actual sugar-users were identified from the rest of the potential sugar users based on a more focused screening of their 10-Ks. This second, more focused screening of the 10-Ks, consisted of an analysis of the products offered by these companies (under the products section of the10-Ks).More specifically, the agribusinesses Eagle Family Food Holdings Inc., Sherwood Brands Inc., Rocky Mountain Chocolate Factory Inc., Wrigley (WM) JR Co., Tasty Baking Co., PepsiAmericas Inc. and Chase General Corp. are included in the final sample based on information about their products gathered from the 10-K documents. The companies Sherwood Brands Inc., Rocky Mountain Chocolate Factory Inc. and Chase General Corp. produce sugar and confectionery products (Table A-6) such as candies, seasonal candies, cookies, chocolates, frozen yogurts and other confectionery products. Wrigley (WM) JR Co. is a manufacturer of chewing gum and other confectionery products, utilizing sugar as a raw material. Tasty Baking Co. manufactures and markets cakes, pies, donuts, snack bars, pretzels, brownies, chocolate enrobed cakes and other seasonal products. Eagle Family Food Holdings Inc. is a manufacturer of sweetened condensed canned milk and evaporated canned milk and the primary raw materials used in the company's operations include milk, sugar, and packaging materials. Finally, the beverage company PepsiAmericas Inc., manufactures and distributes a variety of beverage products and utilizes sugar as the main sweetener for its products. Table A-7 contains the final sample of the actual sugar using agribusinesses evaluated in this study along with their ticker symbol and their classification in the 2017 NAICS code.

In summary, the final sample consists of 29 firms selected through two stages. In stage one, 51 potential sugar-users (59 firms based on evaluation of 10-Ks minus 8 firms buying sugar outside the US) were identified. In the second stage, the list of potential sugar-users was narrowed to 29 actual sugar-users, based on IBIS reports (evaluation of sugar supply chain), a previous study by Triantis (2016), and a second, more focused, screening of the products section of the company's 10-Ks.

Triantis (2016) are: Campbell Soup, Flowers Foods, General Mills Inc., Kellogg Co., Hain Celestial Group Inc., Hershey Co., Smucker JM Co., J&J Snacks Foods Corp., and Tootsie Roll Industries Inc.

Model and methods

There are several methods that can be used to estimate models using panel data, including pooled OLS, FEE or REE and the General Method of Moments (GMM), which belongs to the dynamic panel data methods. This study utilizes FEE for unbalanced panel data. Three different models are estimated using FEE: a baseline model, an alternative model with a substitute for one of the critical variables (e.g., the use of U.S. raw, wholesale refined beet and wholesale refined cane sugar prices instead of cost of goods sold), and a finite distributed lag (FDL) model. The latter was used because sugar prices may have a recurring effect on firms' profitability (Wooldridge, 2012).

Sugar-using companies do not indicate in their 10-K document whether they use cane or beet sugar in their products. However, it is known that certain companies (e.g., Hershey Co.) avoid the use of beet sugar, since it originates from genetically modified sugar beet seeds (Charles, 2016). Instead, they source only cane sugar, which does not originate from GM seeds (Charles, 2016). Thus, to account for potential differences in the type of sugar used by each company, separate profitability models were estimated using each of the three different types of sugar. It should be noted that the prices of all three types of sugar are highly correlated. Thus, we had to estimate separate models due to multicollinearity issues that would have occurred if we included all three sugar prices in one model.

Baseline model

Model specification

The baseline model, incorporated the cost of goods sold (COGS) margin (CM) instead of U.S. sugar prices along with market-to-book value (MB), firm size (SIZE), sales growth (SALES), the first order lag of property plant and equipment (PPE) to total assets (LPPETA) and current assets to total assets (LCATA) and finally the interest-to-sales ratio (IS). Moreover, a fiscal quarter dummy variable was included to account for potential impacts of a specific quarter on profitability.
The baseline form of the panel data model is as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot SALES_{i,t} + \beta_4 \cdot MB_{i,t} + \beta_5 \cdot CM_{i,t} + \beta_6 \cdot LPPETA_{i,t-1} + \beta_7 \cdot LCATA_{i,t-1} + \beta_8 \cdot FQ_t + \beta_9 \cdot FQ_t + \beta_{10} \cdot FQ_t + a_i + e_{i,t} \quad (5.1)$$

Where: $ROA_{i,t}$ = Return on assets for firm i in quarter t

$SIZE_{i,t}$ = Logarithm of real (CPI adjusted) total assets of firm i in quarter t

$IS_{i,t}$ = Interest-to-sales ratio for firm i in quarter t

$SALES_{i,t}$ = Percentage change in real total sales from the previous quarter for firm *i* in quarter *t*

$MB_{i,t}$ = Market-to-book value for firm *i* in quarter *t*

$CM_{i,t}$ = Cost of goods sold margin for firm *i* in quarter *t*

$LPPETA_{i,t-1}$ = First order lag value of PPE to total assets for firm *i* in quarter *t*

$LCATA_{i,t-1}$ = First order lag value of current assets to total assets for firm *i* in quarter *t*

FQ_t = Fiscal quarter dummy variable (with t= 2…4) for quarter *t*

a_i = Unobserved firm-specific effects

$e_{i,t}$ = Idiosyncratic error

Variable construction and expected signs

ROA was used as a proxy for profitability as common in the literature (Asimakopoulos et al., 2009). ROA can be used as a proxy of firm performance and indicates how efficiently a company can generate net income from its assets. The components of ROA are the profit margin and the asset turnover ratio (Bernstein & Wild, 1999). The former is a proxy of a firm's profitability, whereas the latter is a proxy for asset management. ROA has been discussed in detail by Hansen and Wernerfelt (1989), Schumacher and Boland (2005) and Hirsch et al. (2014). To calculate ROA for each quarter, net income be transformed from quarterly income to Trailing Twelve Months (TTM) income, by adding together the last four quarter values. TTM transformations were performed for all income statement items used in this study. TTM income was divided by the nominal values of total assets to construct ROA.

Several studies include the size of the company as a determinant of firm's performance. There are several proxies for size such as total assets, total sales and market capitalization. Hansen and Wernerfelt (1989) used the natural logarithm of firm's total assets as a measure of size, whereas Lee (2009) used the logarithm of total assets. Based on previous literature, the logarithm (with a base of 10) of the real total assets was used to proxy firm's size. Real assets (with the use of 2016 as base year) was adjusted according to the consumer price index (CPI). The expected relationship of size and performance is ambiguous. Lee (2009) found that size and firm performance were characterized by a positive relationship. In some cases, size negatively affects profitability (Goddard et al., 2005). Bigger companies tend to face increasing competition in their industry, hence this affects their profitability (Goddard et al., 2005).

An important ingredient of a company's net income is COGS. COGS contain all the direct and indirect costs related to the production process and provides information about how efficient the company is in terms of production costs. COGS is directly related to sugar prices; hence it may be affected by sugar price variations. In this study, CM, which is calculated dividing COGS by total sales was used as a control factor. This ratio shows the portion of the company's revenues used to cover the production costs. Efficient companies have lower margins.

The expected sign of this ratio is negative because COGS is part of income statement and directly affects net income. Companies with high cost margins tend to have lower performance rates either because costs are increasing, or sales are decreasing.

To control for future growth, as perceived by the stock market, of sugar-using manufacturers, the MB is used. MB indicates what value the stock market attributes to the company relatively to its book value. Jordan, Rice, Sanchez and Wort (2011) examined the MB ratio for the U.S. bank sector. Benston, Hunter and Wall (1995) proxied the efficiency of the acquirer company with the MB ratio. If the market values the company more than its book value, then the manager's performance is considered to be better than the normal manager (Benston, Hunter & Wall, 1995). In such cases MB values are higher than one. To calculate the MB value for the 29 sugar-using companies, data from the quarterly section of COMPUSTAT and the monthly section of Center for Research in Security Prices (CRSP) were used. The MB ratio is estimated by taking the nominal total assets minus the book value of equity plus the market value of equity, all divided by nominal total assets. COMPUSTAT provides quarterly data for the market value of equity but with some missing observations. Most of the missing observations for the market value of equity were fulfilled by using stock market information from CRSP. The market value of equity can be estimated by multiplying the (corresponding end-of-the-month) stock price by the total number of shares outstanding. Because this study uses quarterly data (based on fiscal quarters rather than calendar quarters), the fiscal quarter data for each company was matched with the stock price according to month and fiscal quarter. For example, if a fiscal quarter ends in December, the stock price at the end of December was used. Missing observations of the market value of equity were removed from the analysis, hence the final sample of companies contains 25 sugar-using manufacturers from the initial sample of 29.[17] MB is a widely used ratio by investors to depict the potential growth ability of the company, hence the relationship with the ROA is positive.

IS is a leverage ratio. This ratio shows the portion of revenues the company uses to pay interest expenses on borrowed money. If the ratio is very high, it means that the company is not efficient and pays a high percentage of its revenues on interest. Higher IS affects negatively firm's ROA, hence the expected sign in the analysis is negative. Lee (2009) used as a proxy of firm leverage the bad debt expenses over sales ratio. The estimated parameter was negative, which is expected as the increasing level of bad debt expenses affects negatively firm's profitability.

Another variable that depicts firm's growth ability is sales growth, measured by the percentage quarter to quarter change of total revenues. Lee (2009) used the sales growth from the previous year. The estimated relationship was positive. Moreover, Asimakopoulos et al. (2009) also used the rate of growth in sales in their study. The authors concluded that the relationship of

[17] The companies without market value of equity values in CSRP are Nestle SA/AG, Sherwood Brands Inc., Eagle Family Food Holdings Inc. and Chase General Corp.

sales growth and performance is positive. Hence, the relationship between sales growth and profitability is positive.

The last type of variables used in this analysis include two financial ratios that can provide information to investors relative to the structure of the company's assets which may be useful for future investment decisions. The first ratio is the CATA, current assets to total assets. Current assets are the main part in the estimation of working capital that refers to firm's short-term liquidity[18]. Thus, investors might be interested to know the extent to which total funds are invested in current assets. In this study, the first order lag of CATA was used because the performance in period *t* is assumed to be affected by the investment made in the previous period *t-1*. The relationship of this variable with profitability is positive because increasing levels of investment in current assets tends to positively affect performance.

Finally, the second investment related ratio is the PPETA, PPE by total assets. This ratio represents the company's fixed asset structure. PPE refers to fixed assets and can vary significantly across different industries. Companies with high values of this ratio have made large investments in tangible assets. The relationship between this variable and ROA is expected to be negative. Companies that invest more in PPE, invest less in current assets such as inventories. Lower levels of inventories may cause less sales, which directly affects profitability. Companies, by investing in fixed assets usually anticipating the effects of these investment one quarter after the investment made. The level of a company's investment in PPE in period *t-1* may affect the company's performance in the next period, hence use of the first order lag of PPETA. In addition, fixed asset investment increases depreciation and amortization, which is an expense that reduces profitability. Table A-8 presents the expected signs of all variables used in this study.

Fixed effects estimation

By using firm accounting panel data, the researcher needs to account for unobserved heterogeneity a_i which captures the unobserved effects that affect $Y_{i,t}$ and are time-constant (Wooldridge, 2012). The unobserved factors that affect the dependent variable may include firm's manager skills, tenure and other factors. The unobserved effects a_i can cause serious issues if the pooled OLS method is used in the case they are correlated with the $X_{i,t}$ (Wooldridge, 2012). These unobserved effects can be captured by using either REE or FEE for panel data. To determine which method (between FEE & REE) is appropriate for the estimation of the profitability model, the Hausman specification test was conducted. Hausman specification test

[18] Current assets represent the value of all assets of a company that reasonably be converted into cash within one year. Working capital is estimated by subtracting firm's current liabilities from current assets. The working capital ratio also referred as current ratio which is a proxy of firm's liquidity.

compares the FEE (within estimation) with the alternative REE estimated by generalized least squares (GLS), feasible generalized least squares (FGLS) or estimated generalized least squares (EGLS) (Baltagi, 2005). Under the null hypothesis both estimators are consistent, but the fixed effects model is inefficient. If the null hypothesis is violated then the within estimator is still consistent but the GLS is not (Baltagi, 2005). This study implemented, according to the existing literature (Asimakopoulos et al., 2009) and the nature of the research problem[19], the FEE.[20] To account for potential serial correlation and heteroskedasticity issues, robust standard errors were estimated.

Alternative model with the use of U.S. sugar prices

Model specification

The alternative profitability model includes three different types of sugar prices. These prices are U.S. raw sugar (RAW), wholesale refined beet sugar (BEET) and wholesale refined cane sugar (CANE) sugar as a substitute for the COGS margin to test whether the variability in those prices affects profitability. The rest of the independent variables are the same as in the baseline model.

The alternative form of the panel data models can be written as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot SALES_{i,t} + \beta_4 \cdot MB_{i,t} + \beta_5 \cdot RAW_t + \beta_6 \cdot LPPETA_{i,t-1} + \beta_7 \cdot LCATA_{i,t-1} + \beta_8 \cdot FQ_2 + \beta_9 \cdot FQ_3 + \beta_{10} \cdot FQ_4 + a_i + e_{i,t} \quad (5.2)$$

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot SALES_{i,t} + \beta_4 \cdot MB_{i,t} + \beta_5 \cdot BEET_t + \beta_6 \cdot LPPETA_{i,t-1} + \beta_7 \cdot LCATA_{i,t-1} + \beta_8 \cdot FQ_2 + \beta_9 \cdot FQ_3 + \beta_{10} \cdot FQ_4 + a_i + e_{i,t} \quad (5.3)$$

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot SALES_{i,t} + \beta_4 \cdot MB_{i,t} + \beta_5 \cdot CANE_t + \beta_6 \cdot LPPETA_{i,t-1} + \beta_7 \cdot LCATA_{i,t-1} + \beta_8 \cdot FQ_2 + \beta_9 \cdot FQ_3 + \beta_{10} \cdot FQ_4 + a_i + e_{i,t} \quad (5.4)$$

[19] Most studies that examined the determinants of firm profitability used the FEE to account for unobserved heterogeneity.

[20] The general form of the FEE is $Y_{it} = \beta_i \cdot X_{i,t} + a_i + u_{i,t}$ with a_i called the unobserved effect and $u_{i,t}$ often called the idiosyncratic error (Wooldridge, 2012).

Sugar price as a substitute of cost of goods sold

Input prices are the main ingredient of a firm's COGS[21]. To test whether the variability of sugar prices affects firm's profitability, sugar prices are considered as a substitute for COGS. Hence, sugar prices should have the same significant effect on profitability (negative) as COGS margin in the baseline model. If sugar prices cannot be considered as a substitute of COGS (do not satisfy both conditions), then they are a small part of firm's total cost and they do not affect profitability in a major way as claimed by sugar-using companies. Moreover, since sugar prices are a part of firms' cost of goods sold, both variables cannot be included in the regression model for potential correlation issues.

Variable construction and expected signs

Sugar prices are available from the USDA under the section of sugar and sweeteners yearbook tables.[22] Prices are available on an annual, monthly and quarterly basis. This study utilizes fiscal quarterly financial data. For some companies, fiscal date does not match with the respective calendar date. For instance, financial data for the 4th fiscal quarter may be reported prior the end of December. To estimate the sugar prices series, the calendar date[23] was used along with the monthly sugar prices. More specifically, for every fiscal quarter the calendar date was recorded and then the specific monthly sugar price was used. For instance, if one company reported its financial information for the 1st quarter on April instead of March, the sugar price of April was used. The same methodology was followed for all types of sugar prices. This method creates a more accurate series of sugar prices to be used with the available financial data.

Finite distributed lag model with the use of U.S. sugar prices

Model specification

In a FDL model, one or more variables are allowed to affect $Y_{i,t}$ with a lag of specific order (Wooldridge, 2012). The order of lag is dependent on the nature of the problem. In this study a four quarters order lag was used under the assumption that the duration of the recurring effects of sugar prices on profitability is one fiscal year. Often, companies maintain large number of

[21] COGS encompass all the direct costs of production for a company, such as cost of materials (input prices) and labor costs.
[22] U.S. wholesale refined cane sugar prices are not publicly available, thus access was requested through the USDA official website https://www.ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx
[23] As calendar date (or data date) according to COMPUSTAT is defined the date in which the company reports its financial data. This date may be different from the fiscal quarter date.

inventories, thus a change in the sugar prices in period *t* may affect the company's profitability in the following periods. The lag distribution states that the largest effect is in the first lag and as the lag order increases the effect becomes weaker (Wooldridge, 2012). Moreover, the long-run multiplier (LRP) is of interest in this type of models. LRP is estimated by adding the parameter estimates of both the lagged and the contemporaneous variables. LRP shows the change in $Y_{i,t}$ for a permanent increase in the independent variable of interest.

The main difference between the FDL model and the alternative models is the inclusion of four quarters order lag of sugar prices. The rest of the independent variables remain the same as in the previous models. Variables for all the U.S. sugar prices again estimated by assigning the calendar date of each fiscal quarter with the specific monthly sugar price. For the estimation of the FDL model (for every type of sugar price) the fixed effects estimator was used.

The form of the FDL model can be written algebraically as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot SALES_{i,t} + \beta_4 \cdot MB_{i,t} + \beta_5 \cdot RAW_t + \beta_6 \cdot LRAW_{t-1} + \beta_7 \cdot LRAW_{t-2} + \beta_8 \cdot LRAW_{t-3} + \beta_9 \cdot LRAW_{t-4} + \beta_{10} \cdot LPPETA_{i,t-1} + \beta_{11} \cdot LCATA_{i,t-1} + \beta_{12} \cdot FQ_2 + \beta_{13} \cdot FQ_3 + \beta_{14} \cdot FQ_4 + a_i + e_{i,t} \quad (5.5)$$

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZEi,t + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot SALES_{i,t} + \beta_4 \cdot MB_{i,t} + \beta_5 \cdot BEET_t + \beta_6 \cdot LBEET_{t-1} + \beta_7 \cdot LBEET_{t-2} + \beta_8 \cdot LBEET_{t-3} + \beta_9 \cdot LBEET_{t-4} + \beta_{10} \cdot LPPETA_{i,t-1} + \beta_{11} \cdot LCATA_{i,t-1} + \beta_{12} \cdot FQ_2 + \beta_{13} \cdot FQ_3 + \beta_{14} \cdot FQ_4 + a_i + e_{i,t} \quad (5.6)$$

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot SALES_{i,t} + \beta_4 \cdot MB_{i,t} + \beta_5 \cdot CANE_t + \beta_6 \cdot LCANE_{t-1} + \beta_7 \cdot LCANE_{t-2} + \beta_8 \cdot LCANE_{t-3} + \beta_9 \cdot LCANE_{t-4} + \beta_{10} \cdot LPPETA_{i,t-1} + \beta_{11} \cdot LCATA_{i,t-1} + \beta_{12} \cdot FQ_2 + \beta_{13} \cdot FQ_3 + \beta_{14} \cdot FQ_4 + a_i + e_{i,t} \quad (5.7)$$

Variable construction and expected signs

As mentioned in the previous section, this study utilizes lag order of four quarters for all three types of sugar prices. The rest of the independent variables remain the same as in the alternative model. Moreover, FDL models require the use of the contemporaneous variable of sugar in the estimation process.

Results and discussion

Descriptive statistics

Table A-9 presents the summary statistics for the variables used in this analysis. The average profitability is around 7.6% annually. Average sales growth for the agribusinesses is around 1% per quarter. This low average growth in sales may justify the fact that sales growth does not affect profitability in the models (the next section). ROA accounts for the lowest standard deviation in the sample.

Table A-10 presents the spearman correlation coefficients for all variables. ROA has a significant and positive correlation with MB, LPPETA, and LCATA, whereas a significant negative correlation with CM and IS. The strong and negative relationship between ROA and COGS is expected according to the theory because cost of sales incorporates all the direct costs of production. The correlation between U.S. wholesale refined cane and beet sugar prices and CM is statistically significant and positive. Moreover, sugar prices have a negative correlation with ROA. However, this relationship is not statistically significant. Leverage as proxied by the IS, has a negative correlation with ROA, MB, LPPETA, LCATA and SALES.

Model results

Baseline model and statistical tests

The final step in this preliminary analysis is the identification of potential misspecification issues in the data such as first order serial correlation, heteroskedasticity and multicollinearity. For autocorrelation, the Wooldridge test for panel data was used[24], whereas for heteroskedasticity and multicollinearity the modified Wald[25] test for group wise heteroskedasticity in fixed effect regression model and the condition number[26] were used. Tables A-11, A-12 and A-13 present the results of the misspecification tests for all the models. First order autocorrelation (Table A-11) and heteroskedasticity (Table A-13) were detected. The condition number (Table A-12) is lower than the threshold of 30, suggesting no multicollinearity problems. Only for the FDL models the condition number is above 30. This finding is common in this type of models because of the included lagged variables. However, in this study multicollinearity should not be considered as an issue in the FDL models because the condition number is not very high, and the standard

[24] Wooldridge test in panel-data models implemented by utilizing STATA 13 (StataCorp., 2013a).
[25] The modified Wald test for a fixed effect regression model implemented by utilizing STATA 13 (StataCorp., 2013a).
[26] The condition number found by the implementation of a regression collinearity diagnostic procedure with the use of STATA 13 (StataCorp., 2013a).

errors did not change in comparison with the respective FEE. To correct for autocorrelation and heteroskedasticity, robust standard errors adjusted for 25 clusters were obtained[27].

One way to estimate a fixed effect model is with the use of the Least Square Dummy Variable technique (LSDV). To test for the significance of fixed-effects the F-test can be used, which compares the LSDV model with the Pooled OLS (Greene, 2002). The F-test is a joint significance test with the null hypothesis that all dummy variables (except one) are zero. If the null hypothesis rejected, then there is a significant fixed effect in the model. The results of the F-test for fixed effects indicated that for all models the efficient estimator is the LSDV. To decide between the use of FEE or REE, the Hausman test was implemented. The Hausman test indicated that FEE is preferred over the REE almost for all the models. (only for the alternative model with the raw sugar prices, the Hausman test indicated the use of random effects as more appropriate estimation technique). The F-test for the fiscal quarter dummy variables indicated that the use of quarter dummies will provide no significant information about any specific fiscal quarter.

Table A-14 presents the results of the FEE for the baseline model. The overall performance as measured by the R^2 value, is around 25%, which is close to previous studies (Asimakopoulos et al., 2009). All the independent variables have a significant impact on profitability except sales growth. The signs of the control variables are as expected, with MB, SALES and LCATA having a positive impact on profitability, whereas the rest impacting profits negatively. CM has a negative impact on ROA, hence sugar prices should follow the same direction to be considered as a substitute for COGS. For one unit[28] increase in MB and LCATA, ROA will increase approximately 0.01 and 0.07 units respectively. The highest negative impact on profitability was observed for leverage, with a decrease of profitability close to one unit. SIZE, LPPETA and CM affect profitability with a decrease not higher than 0.12 units for every one-unit increase. Finally, real sales growth has no statistically significant impact on firms' profitability.

Alternative models with U.S. sugar prices

The alternative model examined whether sugar prices could be considered as a substitute for CM. If so, sugar prices would be a major part of cost of sales and would significantly affect profitability. Tables A-15, A-16 and A-17 present the panel regression results for the three types of sugar prices. The overall performance as measured by the R^2 value of the three models is close to 24%, lower than the baseline model but still satisfactory for these types of studies. In all

[27] The robust standard errors obtained above are identical to those obtained by using the clustering method according to the STATA manual technical note accessed through https://www.stata.com/manuals13/xtxtreg.pdf (StataCorp., 2013b)

[28] All the analysis variables except SIZE, SALES are expressed as ratios (%). SALES expressed as percentage change in revenues from the previous quarter and SIZE is the Log_{10} values of real total assets.

estimated models, U.S. sugar prices have the expected negative sign but there is no statistically significant impact on profitability.

From all the models' results it is observed that all control variables have the expected signs and are consistent with the baseline model. More specifically, SALES, MB and LCATA have a positive sign, whereas the rest are negative. SALES consistently have no impact on ROA. Both lagged investment ratios (LPPETA and LCATA) in every model do not have any impact[29] on firms' profitability in comparison with the baseline model. MB has a positive impact on profitability with an increase close to 0.02 units in ROA. Leverage was observed to have the biggest negative impact on profitability. More specifically, for every unit increase in IS, ROA decreases approximately 0.95 units. SIZE has a consistent negative impact on profitability in every model which is approximately 0.05 units. Finally, all three regression model results indicated that there is no specific fiscal quarter that has an impact on firm's profitability.

Finite distributed lag model with U.S. sugar prices

The results of the FLD models (for all the three types of sugar prices) are reported in Tables A-18, A-19 and A-20. In general, the explanatory power of all the estimated models reached satisfactory levels with R^2 value above 20%. Most lagged variables of U.S. sugar prices are found to have a negative impact on ROA in two out of the three models (wholesale refined beet and cane sugar prices). There is a contemporaneous, a first and a second order lag effect on profitability. This indicates that the effect of a change in the refined beet and cane sugar prices on profitability is observed after one and two quarters. Companies often maintain inventories, hence a change in sugar price in a specific quarter may have a recurring effect in the following quarters.

While sugar prices are statistically significant in two out the three models, their impact on profitability is not as expected. A one unit increase in refined sugar prices, for instance, increases profitability by 0.0009 units (Tables A-18 and A-19) while one-unit change of COGS (Table A-14) decreases profitability by 0.105 units. It is interesting to find that an increase in sugar prices causes an *unexpected positive* contemporaneous impact on profits (positive 0.0009) while the negative impact (-0.0009 and -0.0003) occurs one and two quarters after the price increase. A possible explanation is that companies increase prices of their products immediately following an increase in sugar prices. As companies sell their products using cost from inventories bought previously (at lower prices) they experience an increase in profits. One and two quarters later, as inventories are replenished, profits are negatively impacted. However, this negative impact disappears after the second quarter.

[29] LPPETA and LCATA marginally found to be statistically insignificant with P-values close to 10% in every model.

The signs of the rest of the explanatory variables are consistent with all the previous models. Finally, the estimated long-run multipliers (LRP) for the FDL models using raw, refined beet and cane sugar is -0.0007, -0.0001 and -0.0002[30] respectively. The LRP is negative as expected and indicates the long run effect of sugar prices on ROA.

Conclusions

The present Chapter attempted to examine if the U.S. sugar prices significantly affect the U.S. sugar-using manufacturers' profitability for the period 2000-2016, by utilizing quarterly financial data for publicly-traded agribusinesses. A panel data analysis applied with the use of fixed-effects estimator to account for unobserved firm-specific effects (unobserved heterogeneity). Additionally, because sugar prices assumed to have a recurring effect on firm's profitability, the finite distributed lag model estimated for all the three types of sugar prices.

The results indicated a minor impact of sugar prices on profitability. More specifically, only the wholesale refined beet and cane sugar prices[31] seemed to have an impact on profitability. Firms' prospects, size and leverage consistently have a significant impact on profitability. Only firms' prospects have a positive impact on profitability. Firm size observed in the related literature to have either positive or negative impact on firm profitability. However, in this study found to have negative impact. Larger companies may face increasing competition in their industry and in general are less risky than their smaller counterparts. Real sales growth does not affect profitability (in every model) and this may be justified by the fact that the average growth in sales per quarter from the selected agribusinesses is lower than 2%.

Sugar seems to be small part of cost of goods sold for the selected U.S. sugar-using manufacturers. U.S. refined beet and cane sugar prices do not seem to have a major and significant impact on profitability of sugar-using manufacturers, consistent with Triantis (2016). Finally, these findings may contribute to ongoing debate regarding the economic effects of the U.S. sugar prices on the performance of sugar-using agribusinesses.

[30] The LRP estimated by adding the parameter estimates of the contemporaneous and the lagged values of the sugar price variables.

[31] Both the contemporaneous and the first and second order lag value of refined beet and cane sugar prices.

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Appendix



Figure A-1. Average Fiscal U.S. and World Raw Sugar Prices

Source: United States Department of Agriculture, Economic Research Service, using data from the sugar and sweeteners yearbook tables 3b and 4.

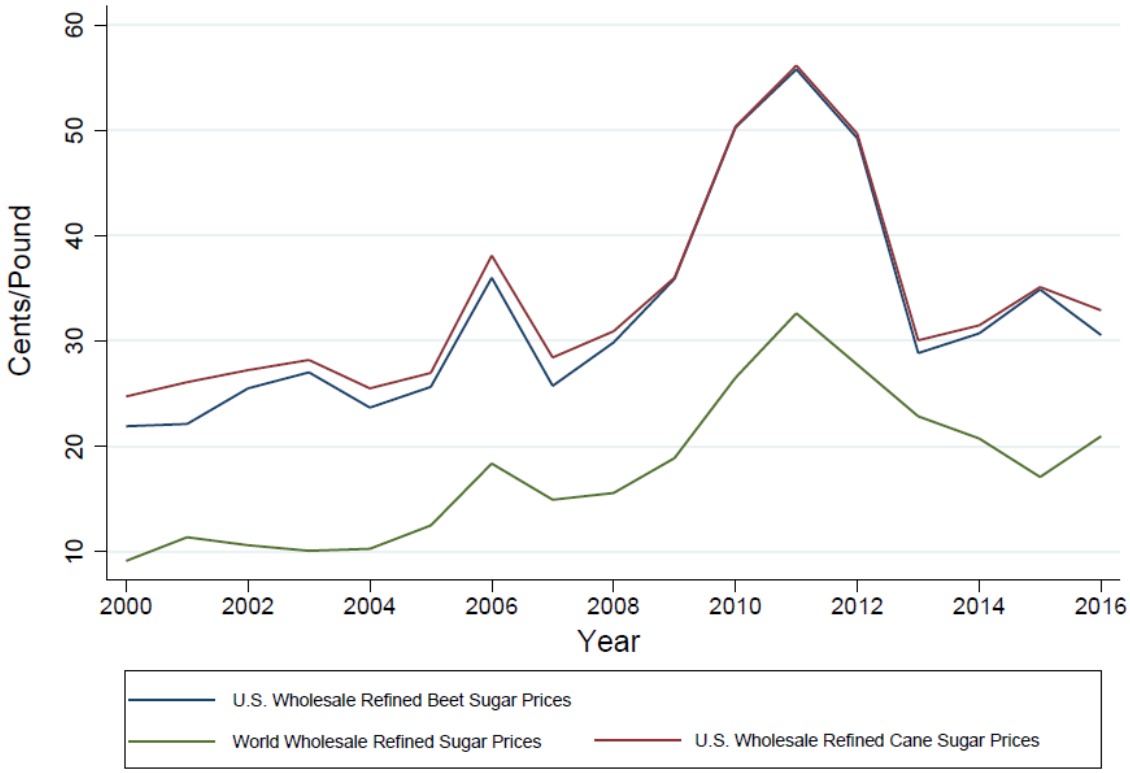


Figure A-2. Average Fiscal U.S. Wholesale Refined Cane and Beet Sugar Prices and World Wholesale Refined Sugar Prices

Source: United States Department of Agriculture, Economic Research Service, using data from the sugar and sweeteners yearbook tables 2 and 5.

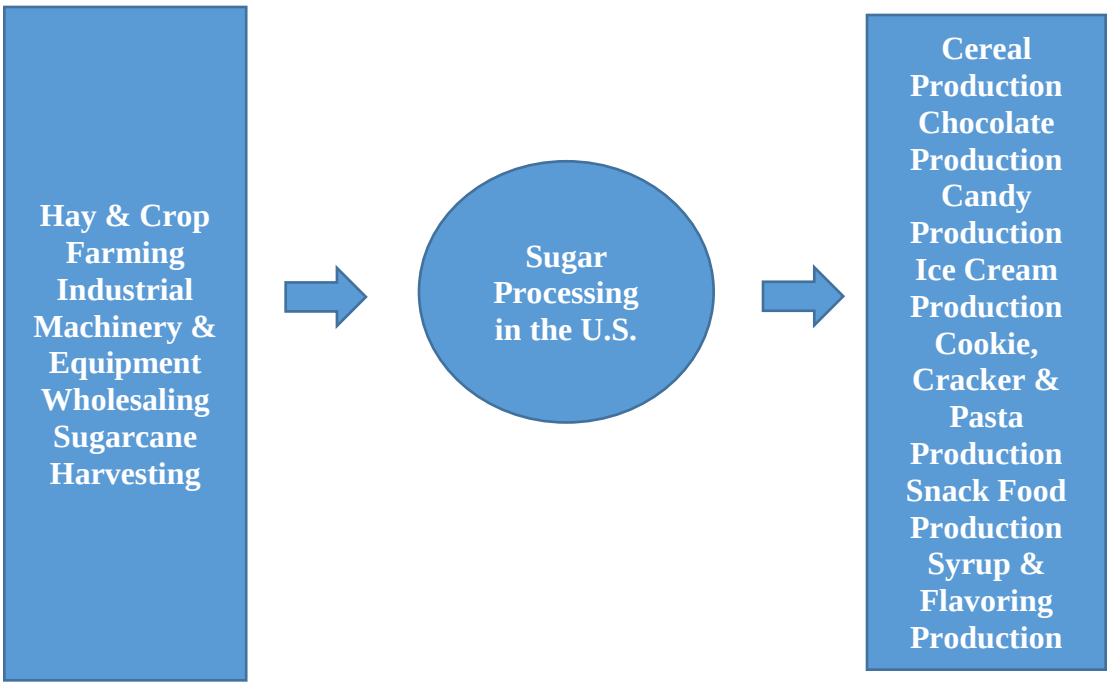


Figure A-3. Supply Chain of the Sugar Processing Industry in the U.S. According to IBIS World

Table A-1. Proxies and Determinants of Profitability

Study	Dependent Variable Proxy	Determinant
Sharma et al. (2013)		Firm prospects
Lee (2009)	ROA	Leverage
Asimakopoulos, Samitas and Papadogonas (2009)	ROA	
Batra and Kalia (2016)	RCE and RNW	
Liargovas and Skandalis (2010)	ROE and ROS	
Sorana (2015)	ROA	
Asimakopoulos, Samitas and Papadogonas (2009)	ROA	Liquidity
Batra and Kalia (2016)	RCE and RNW	
Liargovas and Skandalis (2010)	ROE and ROS	
Sorana (2015)	ROA	
Lee (2009)	ROA	Firm size
Hirsch et.al (2014)	ROA	
Asimakopoulos, Samitas and Papadogonas (2009)	ROA	
Batra and Kalia (2016)	RCE and RNW	
Liargovas and Skandalis (2010)	ROE and ROS	
Goddard, Tavakoli and Wilson (2005)	ROA	
Wadsworth and Bravo-Ureta (1992)	ROE and ROA	
Sorana (2015)	ROA	
Monisola and Funlayo (2015)		Cost of sales
Asimakopoulos, Samitas and Papadogonas (2009)	ROA	Investment
Batra and Kalia (2016)	RCE and RNW	
Liargovas and Skandalis (2010)	ROE and ROS	
Sorana (2015)	ROA	
Hirsch et al. (2014)	ROA	Growth
Asimakopoulos, Samitas and Papadogonas (2009)	ROA	

Note: Monisola and Funlayo (2015) and Sharma et al. (2013) did not examine firm's profitability. Thus, column "Proxy" remains empty for these studies.

Table A-2. Steps for the Sample Determination Process

Step	Activity Performed	Number of Firms	Number of Observations
Step 1	Definition of industries based on Triantis (2016) plus added industries by authors		
Step 2	Download initial sample	204	7,143
Step 3	Preliminary sample: potential sugar users according to annual reports	59	2,939
Step 4	Final sample: actual sugar users	29	1,822

Table A-3. Classification of Sugar-Using Industries Using the 2017 NAICS System

NAICS Code	Industry Name
311230	Breakfast cereal manufacturing
311351	Chocolate & confectionery manufacturing from cocoa beans
311352	Confectionery manufacturing from purchased chocolate
311340	Non-chocolate confectionery manufacturing
311813	Frozen cakes, pies, and other pastries manufacturing
311821	Cookie and cracker manufacturing
311824	Dry pasta, dough and flour mixes manufacturing from purchased flour
311812	Commercial bakeries
311423	Dried and dehydrated food manufacturing
311520	Ice cream and frozen dessert manufacturing
311999	All other miscellaneous food manufacturing
311930	Flavoring syrup and concentrate manufacturing
311514	Dry, condensed, and evaporated dairy product manufacturing
311941	Mayonnaise, dressing, and other prepared sauce manufacturing
311511	Fluid milk manufacturing
311942	Spice and extract manufacturing
31142	Fruit and vegetable canning, pickling and drying
311421	Fruit and vegetable canning
311411	Frozen fruit, juice and vegetable manufacturing
311911	Roasted nuts and peanut butter manufacturing
311991	Perishable prepared food manufacturing
311412	Frozen specialty food manufacturing
311111	Dog and cat food manufacturing
311422	Specialty canning
311119	Other animal food manufacturing
311919	Other snack food manufacturing
311811	Retail bakeries
311211	Flour milling
311513	Cheese manufacturing
311	Food manufacturing
3121	Beverage manufacturing
31211	Soft drink and ice manufacturing
312111	Soft drink manufacturing

Source: Adapted from Triantis (2016).

Table A-4. Potential Sugar Consumer Agribusinesses According to Annual Reports (10-Ks)

Company Name	In Triantis (2016)?	Period of 10-K	Period of Sugar Use	Confectioners	Outside U.S.
Annie's Inc.	No	2012-2014	2012-2014	No	No
Aurora Foods Inc.	No	2000-2002	2000-2002	No	No
Kraft Foods Group Inc.	No	2012-2014	2012-2014	No	No
Mondelez International Inc.	No	2001-2016	2001-2016	No	No
Nestle SA/AG	No	2001-2016	2001-2003, 2005-2016	No	No
Ralcorp Holdings Inc.	Yes	2000-2012	2000-2012	No	No
Associated Brands Income Fund	No	2003-2005	2004-2005	No	No
Hain Celestial Group Inc.	Yes	2000-2016	2011-2013	No	No
Cott Corp. Quebec	No	2000-2002, 2004-2008, 2010-2016	2010-2016	No	No
Dr. Pepper Snapple Group Inc.	No	2008-2016	2008-2016	No	No
Jones Soda Co.	No	2006-2016	2006-2016	No	No
Long Island Iced Tea Corp.	No	2015-2016	2015-2016	No	No
Monster Beverage Corp.	No	2000-2016	2000-2016	No	No
PepsiAmericas Inc.	No	2000-2010	2004-2010	No	No
PepsiCo Inc.	No	2000-2016	2000-2016	No	No

Table A-4 (Continued). Potential Sugar Consumer Agribusinesses According to Annual Reports (10-Ks)

Company Name	In Triantis (2016)?	Period of 10-K	Period of Sugar Use	Confectioners	Outside U.S.
Pulse Beverage Corp.	No	2008-2016	2011-2016	No	No
Reeds Inc.	No	2008-2016	2008-2016	No	No
Coca-Cola Bottling Consolidated	No	2000-2016	2004-2006, 2008-2016	No	No
Coca-Cola Co.	No	2000-2016	2000-2016	No	No
SunOpta Inc.	No	2000-2016	2005-2006, 2009-2010, 2016	No	No
New Age Beverages Corp.	No	2014-2016	2015-2016	No	No
Cirtran Corp.	No	2008-2013	2008-2013	No	No
Global Future City Holdings Inc.	No	2002, 2008-2016	2008-2014	No	No
Coca-Cola HBC AG	No	2001-2016	2001-2008, 2011-2015	No	Yes
B&G Foods Inc.	Yes	2000-2016	2004-2016	No	No
Big Heart Pet Brands	No	2011-2014	2011-2014	No	No
Campbell Soup Co.	No	2000-2016	2010-2011	No	No
Chase General Corp.	No	2000-2016	2009-2012, 2014, 2016	Yes	No
ConAgra Brands Inc.	No	2000-2016	2004-2016	No	No
Eagle Family Foods Holdings Inc.	No	2000-2006	2000-2006	No	No
Flowers Foods Inc.	Yes	2000-2016	2000-2009, 2011-2013	No	No
General Mills Inc.	No	2000-2016	2000-2016	No	No

Table A-4 (Continued). Potential Sugar Consumer Agribusinesses According to Annual Reports (10-Ks)

Company Name	In Triantis (2016)?	Period of 10-K	Period of Sugar Use	Confectioners	Outside U.S.
Hershey Co.		2000-2016	2000-2016	Yes	No
Interstate Bakeries Corp.	No	2000-2008	2000-2002, 2004-2008	No	No
J & J Snack Foods Corp.	Yes	2000-2016	2000-2016	No	No
Keebler Foods Co.	No	2000	2000	No	No
Kellogg Co.	No	2000-2016	2000-2016	No	No
Kraft Heinz Co.	No	2016	2016	No	No
Rocky Mountain Chocolate Factory Inc.	No	2000-2016	2000-2016	Yes	No
Sherwood Brands Inc.	No	2001-2004	2001-2004	Yes	No
Post Holdings Inc.		2012-2016	2012-2016	No	No
Smucker (JM) Co.	Yes	2000-2016	2006-2011	No	No
Snyder's-Lance Inc.	No	2000-2016	2000-2016	No	No
Tootsie Roll Industries Inc.	Yes	2000-2016	2000-2016	Yes	No
Treehouse Foods Inc.	No	2005-2016	2015-2016	No	No
Wrigley (Wm) Jr Co.	No	2000-2007	2000-2007	Yes	No
Dean Foods Co.	No	2000-2016	2012-2016	No	No
Tasty Baking Co.	No	2000-2010	2002-2006	No	No
Lifeway Foods Inc.	No	2008-2016	2008-2016	No	No
Lincoln Snacks Co.	No	2000	2000	Yes	No

Table A-4 (Continued). Potential Sugar Consumer Agribusinesses According to Annual Reports (10-Ks)

Company Name	In Triantis (2016)?	Period of 10-K	Period of Sugar Use	Confectioners	Outside U.S.
American Lorain Corp.	No	2007-2016	2007-2016	No	No
E.D. Smith Income Fund	No	2005-2006	2005	No	No
Fomento Economico Mexicano	**No**	**2001-2016**	**2003-2016**	**No**	**Yes**
Coca-Cola FEMSA SAB DE CV	**No**	**2000-2016**	**2000-2016**	**No**	**Yes**
Panamerican Beverages Inc.	**No**	**2000-2002**	**2000-2002**	**No**	**Yes**
Embotelladora Andina SA	**No**	**2000-2016**	**2000-2016**	**No**	**Yes**
Coca-Cola European Partners	**No**	**2014-2016**	**2014-2016**	**No**	**Yes**
Leading Brands Inc.	**No**	**2000-2016**	**2009-2011, 2013-2016**	**No**	**Yes**
Danone	**No**	**2007-2016**	**2007-2016**	**No**	**Yes**
Coca-Cola HBC AG	**No**	**2001-2016**	**2001-2008, 2011-2015**	**No**	**Yes**

Notes: Column "Period of 10-K" contains the years of annual reports (10-K) with available annual reports (10-K) either in EDGAR, Morningstar or SEDAR. Column "Period of Sugar Use" contains annual reports' years on which these companies mention sugar as an input their relevant production processes. Column "Confectioners" includes a "Yes" if the company belongs to the industry with four-digit 2017 NAICS 3113. Column "Outside the U.S." includes a "Yes" if the company have mainly operations outside the U.S. and/or mentions that they buy sugar outside the U.S. Column "In Triantis (2016)?" contains a "Yes" if the company belongs to the sample of the 9 agribusinesses analyzed by Triantis (2016).

Table A-5. Sugar Consumer Agribusinesses Based on IBIS World Industry Reports

Industry Name	Source	Major Companies	Number of Companies
Cereal Production in the U.S.	Masterson (2017)	General Mills Inc. PepsiCo Inc. Kellogg Co. Post Holdings Inc.	4
Chocolate Production in the U.S.	Stivaros (2017a)	Hershey Co. Nestle SA/AG	2
Candy Production in the U.S.	D'Costa (2017)	Mondelez International Inc.	1
Ice Cream Production in the U.S.	Madigan (2017)	Dean Foods Co.	1
Cookie, Cracker & Pasta Production in the U.S.	Stivaros (2017b)	Campbell Soup Co.	1
Snack Food Production in the U.S.	Stivaros (2017c)	Snyder's-Lance, Inc. ConAgra Brands Inc.	2
Syrup & Flavoring Production	Stivaros (2017d)	Coca-Cola Co. Dr. Pepper Snapple Group	2
Baking Mix & Prepared Food Production in the U.S.	Guattery (2017)	Kraft Heinz Co.	1
Soda Production in the U.S.	Stivaros (2017e)	Monster Beverage Corp.	1
Juice Production in the U.S.	Stivaros (2017f)		0
Total			15

Note: Column "Source" contains the date of the corresponded industry report and the name of the author. Column "Major Companies" contains the name of the major players of the corresponded industry based on information provided by the IBIS World.

Table A-6. Product Information According to Annual Reports

Company Name	Products	Selected Companies
Annie's Inc.	Meals, snacks, and dressings, condiments and other	No
Aurora Foods Inc.	Baking mixes, frostings, seafood, syrup and mixes, breakfast products and bagels	No
Kraft Foods Group Inc.	Cheese, beverages, refrigerated meals, grocery, coffee, peanut butter, meals & desserts, enhancers & snack nuts	No
Associated Brands Income Fund	Drink mixes, iced tea, hot chocolate, various dessert mixes, soups, party snacks, baking powder, bouillon, side dishes and artificial sweeteners and household products	No
Cott Corp. Quebec	Bottled water, coffee, brewed tea, water dispensers, coffee and tea brewers and filtration equipment, carbonated soft drinks (“CSDs”), 100% shelf stable juice and juice-based products, clear, still and sparkling flavored waters, energy drinks and shots, sports drinks, new age beverages, ready-to-drink teas, liquid enhancers, freezable, ready-to-drink alcoholic beverages, hot chocolate, coffee, malt drinks, creamers/whiteners, cereals and beverage concentrates	No

Table A-6 (Continued). Product Information According to Annual Reports

Company Name	Products	Selected Companies
Jones Soda Co.	Beverages, products online, including soda with customized labels, wearables, candy and other items	No
Long Island Iced Tea Corp.	Premium iced tea beverage	No
Pulse Beverage Corp.	all-natural, ready-to-drink lemonades/limeades and coconut water	No
Reeds Inc.	Beverages and candies or other ginger related products	No
Coca-Cola Bottling Consolidated	Beverage products (sparkling and still)	No
SunOpta Inc.	Beverages, fruits and snacks	
New Age Beverages Corp.	Healthy functional beverage products	No
Cirtran Corp.	Energy drinks, flavored water beverages	No
Global Future City Holdings Inc.	Beauty, nutrition/supplements, energy drink, tea and tea ware	No
Big Heart Pet Brands	Pet food and pet snacks brands	No
Interstate Bakeries Corp.	White breads, variety breads, reduced calorie breads, English muffins, croutons, rolls, buns and baked sweet goods,	No
Keebler Foods Co.	Cookies and crackers	No

Table A-6 (Continued). Product Information According to Annual Reports

Company Name	Products	Selected Companies
Treehouse Foods Inc.	Snack nuts, cookies and crackers, cereals, pasta and dry dinners, beverages, salad dressings, soups and infant feeding, sauces, pickles, jams, beverage enhancers and aseptic products	No
Lifeway Foods Inc.	Drinkable kefir, soft cheese, frozen kefir and kefir for children	No
Lincoln Snacks Co.	Roasted, dry roasted, coated, raw and mixed nuts	No
American Lorain Corp.	Chestnut products, convenience foods (including ready-to-cook foods and ready-to-eat foods) and frozen food products.	No
E.D. Smith Income Fund	Jams, pie fillings, ketchup, sauces and oil-based products	No
Wrigley (Wm) Jr Co.	Chewing gum and other confectionery products	Yes
Tasty Baking Co.	Single portion cakes, pies, donuts, snack bars, pretzels, and brownies	Yes
Rocky Mountain Chocolate Factory Inc.	chocolate candies, clusters, caramels, creams, mints and truffles	Yes
Sherwood Brands Inc.	Candies, cookies and gift items that include candies and cookies	Yes
Chase General Corp.	Candies, coconut, peanut, chocolate, and fudge confectioneries	Yes

Table A-6 (Continued). Product Information According to Annual Reports

Company Name	Products	Selected Companies
Eagle Family Foods Holdings Inc.	Sweetened condensed and evaporated milk, eggnog, mincemeat pie filling and instant coffee	Yes
PepsiAmericas Inc.	Beverage products and snack foods	Yes

Note: Column "Products" contains information about the companies' products according to the last available 10-K document for the period 2000-2016.

Table A-7. Final Sample of Actual Sugar-Using Companies for the Period 2000-2016

Company Name	Ticker Symbol	2017 NAICS Code
Campbell Soup Co.	CPB	311422
Coca-Cola Co.	KO	312111
ConAgra Brands Inc.	CAG	31142
Flowers Foods Inc.	FLO	311812
General Mills Inc.	GIS	311230
Kraft Heinz Co.	KHC	31142
Hershey Co.	HSI	311351
Kellogg Co.	K	311230
Snyder's-Lance Inc.	LNCE	311821
PepsiCo Inc.	PEP	311919
Smucker (JM) Co.	SJM	311421
Tasty Baking Co.	TSTY	311812
Tootsie Roll Industries Inc.	TR	311340
Wrigley (Wm) Jr. Co.	WWY	311340
Rocky Mountain Chocolate Factory Inc.	RMCF	311352
J & J Snack Foods Corp.	JJSF	311812
Nestle SA/AG	3NSRGY	311
PepsiAmericas Inc.	PAS	312111
Monster Beverage Corp.	MNST	312111
Hain Celestial Group Inc.	HAIN	311
Ralcorp Holdings Inc.	RAH	311
Dean Foods Co.	DF	311511
Sherwood Brands Inc.	SHDBQ	311340
Eagle Family Foods Holdings Inc.	SJM1	311514
Mondelez International Inc.	MDLZ	311
Chase General Corp.	5168B	311352
B&G Foods Inc.	BGS	311421
Post Holdings Inc.	POST	311999
Dr. Pepper Snapple Group Inc.	DPS	312111

Table A-8. Description of Variables Used in the Analysis

Variables	Descriptions	Expected Sign
ROA	Net Income/Total Assets	
Independent Variables		
MB	Market value of equity/Total assets	+
RAW	U.S. raw sugar prices	-
BEET	U.S. wholesale refined beet sugar prices	-
CANE	U.S. wholesale refined cane sugar prices	-
CM	COGS/Sales	-
IS	Interest expenses/Sales	-
LCATA	First order lag of current assets/Total assets	+
LPPETA	First order lag of property plant and equipment/Total assets	-
SIZE	Log_{10} of real total assets	+/-
SALES	Percentage change in real total sales over quarter	+

Table A-9. Summary Statistics of the Analysis Variables

Variable	Number of Observations	Mean	Standard Deviation	Variance	Minimum	Maximum
U.S. Wholesale Refined Cane Sugar Prices (¢/lb)	1,397	34.6829	9.7696	95.4445	23.2000	59.5000
U.S. Raw Sugar Prices (¢/lb)	1,397	24.5672	5.7323	32.8593	17.6400	40.1600
U.S. Wholesale Refined Beet Sugar Prices (¢/lb)	1,397	33.2603	10.4851	109.9366	19.0000	59.5000
Return-on-assets	1,397	0.0765	0.0632	0.0040	-0.2973	0.3680
Market-to-book value	1,397	2.3271	1.3973	1.9525	0.1242	16.4767
Interest-to-sales	1,397	0.0168	0.0181	0.0003	0.0000	0.1222
Log_{10} of real total assets	1,397	3.5641	0.8383	0.7028	1.2505	5.0995
PPE to total assets	1,397	0.2540	0.1273	0.0162	0.0149	0.7127
COGS margin	1,397	0.5832	0.1207	0.0146	0.2702	0.9863
Current assets to total assets	1,397	0.3035	0.1376	0.0189	0.0552	0.9132
Sales growth (%)	1,397	1.1051	4.7747	22.7982	-41.1476	93.3018

Table A-10. Spearman Correlation Coefficients for the Analysis Variables

	CANE	RAW	BEET	ROA	MB	IS	SIZE	LPPETA	CM	LCATA	SALES
CANE	1.0000										
RAW	0.8043*	1.0000									
BEET	0.9814*	0.7782*	1.0000								
ROA	-0.0104	-0.0207	-0.0131	1.0000							
MB	-0.0443	-0.0119	-0.0444	0.8276*	1.0000						
IS	0.0331	0.0310	0.0235	-0.3149*	-0.2539*	1.0000					
SIZE	0.0849*	0.0988*	0.0895*	0.0441	0.0933*	0.5001*	1.0000				
LPPETA	-0.2203*	-0.2029*	-0.2286*	0.1657*	0.1230*	-0.2124*	-0.3169*	1.0000			
CM	0.0776*	0.0432	0.0812*	-0.5491*	-0.5758*	0.1121*	-0.2644*	-0.1180*	1.0000		
LCATA	-0.0927*	-0.0874*	-0.0985*	0.5453*	0.5186*	-0.5210*	-0.3359*	0.2528*	-0.0876*	1.0000	
SALES	0.0023	-0.0679*	0.0119	0.0142	0.0118	-0.0869*	-0.1022*	-0.1411*	-0.0151	0.0082	1.0000

Note: * indicates significance at level of 5%. The number of observations used is 1,370.

Table A-11. Results of Wooldridge Test for the Baseline, the Alternative and the FDL Models

Model	F-statistic	P-value
Baseline	428.339	0.0000
U.S. raw sugar prices	407.143	0.0000
U.S. wholesale refined cane sugar prices	410.199	0.0000
U.S. wholesale refined beet sugar prices	408.312	0.0000
FDL with U.S. raw sugar prices	369.631	0.0000
FDL with U.S. wholesale refined cane sugar prices	334.255	0.0000
FDL with U.S. wholesale refined beet sugar prices	350.776	0.0000

Note: Under the H_o hypothesis there is no presence of first-order autocorrelation. Rejection of H_o indicates presence of first-order autocorrelation. The number of observations used is 1,370 for the FEE models and 1,289 for the FDL models.

Table A-12. Results of Multicollinearity Test for the Baseline, the Alternative and the FDL Models

Model	Condition Number
Baseline	14.12
U.S. raw sugar prices	12.02
U.S. wholesale refined cane sugar prices	11.05
U.S. wholesale refined beet sugar prices	10.60
FDL with U.S. raw sugar prices	56.84
FDL with U.S. wholesale refined cane sugar prices	56.45
FDL with U.S. wholesale refined beet sugar prices	50.05

Note: Condition number above 30 indicates presence of multicollinearity (Belsley, Kuh, & Welsch, 1980). The number of observations used is 1,370 for the FEE models and 1,289 for the FDL models.

Table A-13. Results of Modified Wald Test for the Baseline, the Alternative and the FDL models

Model	X^2 (25)	P-value
Baseline	14812.02	0.0000
U.S. raw sugar prices	13167.57	0.0000
U.S. wholesale refined cane sugar prices	16614.38	0.0000
U.S. wholesale refined beet sugar prices	16291.53	0.0000
FDL with U.S. raw sugar prices	8763.59	0.0000
FDL with U.S. wholesale refined cane sugar prices	7950.81	0.0000
FDL with U.S. wholesale refined beet sugar prices	8422.57	0.0000

Note: Under the H_o hypothesis the data are homoscedastic. Rejection of H_o indicates presence of heteroskedasticity. The number of observations used is 1,370 for the FEE models and 1,289 for the FDL models.

Table A-14. Results Applying FEE for the Baseline Model

	FEE with time dummies			
Variable	**Coefficient**	**Standard Error**	**t-value**	**P-value**
MB	0.0143***	0.0042	3.39	0.002
IS	-0.9692***	0.3482	-2.78	0.010
SIZE	-0.0439*	0.0232	-1.89	0.071
CM	-0.1049*	0.0538	-1.95	0.063
SALES	0.0006	0.0005	1.03	0.312
LPPETA	-0.1123*	0.0605	-1.86	0.076
LCATA	0.0706*	0.0348	2.03	0.053
Constant	0.2848**	0.1191	2.39	0.025
Fiscal Quarter				
2	-0.0013	0.0009	-1.44	0.162
3	-0.0009	0.0010	-0.84	0.407
4	-0.0012	0.0008	-1.46	0.156
σ_u	0.0400			
σ_e	0.0344			
ρ	0.5754			
F-test for fixed effects	F (24, 1335) =18.13***			
F-test for time effect	F (3, 1335) = 0.10			
Hausman test	X^2 (10) = 25.34*			
R^2 (within)	0.2441			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity and autocorrelation. The number of observations used is 1,370.

Table A-15. Results Applying FEE for the Alternative Model Using U.S. Raw Sugar Prices

FEE with time dummies				
Variable	**Coefficient**	**Standard Error**	**t-value**	**P-value**
MB	0.0148***	0.0045	3.26	0.003
IS	-0.9467**	0.3419	-2.77	0.011
SIZE	-0.0410*	0.0218	-1.88	0.072
RAW	-0.0004	0.0006	-0.69	0.496
SALES	0.0005	0.0005	1.01	0.322
LPPETA	-0.0982	0.0586	-1.68	0.106
LCATA	0.0627	0.0371	1.69	0.104
Constant	0.2204**	0.1037	2.12	0.044
Fiscal Quarter				
2	-0.0013	0.0009	-1.49	0.149
3	-0.0007	0.0011	-0.64	0.526
4	-0.0011	0.0008	-1.28	0.213
σ_u	0.0435			
σ_e	0.0346			
ρ	0.6132			
F-test for fixed effects	F (24, 1335) =21.70***			
F-test for time effect	F (3, 1335) = 0.09			
Hausman test	X^2 (10) = 7.45			
R^2 (within)	0.2349			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity and autocorrelation. The number of observations used is 1,370.

Table A-16. Results Applying FEE for the Alternative Model Using U.S. Wholesale Refined Beet Sugar Prices

FEE with time dummies				
Variable	**Coefficient**	**Standard Error**	**t-value**	**P-value**
MB	0.0149***	0.0047	3.18	0.004
IS	-0.9354**	0.3460	-2.70	0.012
SIZE	-0.0429*	0.0217	-1.97	0.060
BEET	-0.0001	0.0003	-0.36	0.720
SALES	0.0006	0.0005	1.04	0.309
LPPETA	-0.0984	0.0614	-1.60	0.122
LCATA	0.0610	0.0376	1.63	0.117
Constant	0.2213**	0.1048	2.11	0.045
Fiscal Quarter				
2	-0.0013	0.0009	-1.41	0.171
3	-0.0007	0.0011	-0.66	0.514
4	-0.0011	0.0009	-1.25	0.225
σ_u	0.0446			
σ_e	0.0346			
ρ	0.6239			
F-test for fixed effects	F (24, 1335) =21.65***			
F-test for time effect	F (3, 1335) = 0.09			
Hausman test	X^2 (10) = 16.90*			
R^2 (within)	0.2329			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity and autocorrelation. The number of observations used is 1,370.

Table A-17. Results Applying FEE for the Alternative Model Using U.S. Wholesale Refined Cane Sugar Prices

FEE with time dummies				
Variable	**Coefficient**	**Standard Error**	**t-value**	**P-value**
MB	0.0149***	0.0047	3.20	0.004
IS	-0.9338**	0.3438	-2.72	0.012
SIZE	-0.0429*	0.0218	-1.97	0.060
CANE	-0.0001	0.0004	-0.35	0.728
SALES	0.0006	0.0005	1.04	0.310
LPPETA	-0.0981	0.0611	-1.61	0.121
LCATA	0.0609	0.0376	1.62	0.118
Constant	0.2216**	0.1050	2.11	0.045
Fiscal Quarter				
2	-0.0013	0.0009	-1.44	0.163
3	-0.0007	0.0010	-0.67	0.508
4	-0.0011	0.0009	-1.24	0.226
σ_u	0.0446			
σ_e	0.0346			
ρ	0.6238			
F-test for fixed effects	F (24, 1338) =21.64***			
F-test for time effect	F (3, 1335) = 0.09			
Hausman test	X^2 (10) = 16.84*			
R^2 (within)	0.2328			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity and autocorrelation. The number of observations used is 1,370.

Table A-18. Results Applying FDL Model Using U.S. Raw Sugar Prices

FDL with time dummies				
Variable	**Coefficient**	**Standard Error**	**t-value**	**P-value**
MB	0.0148***	0.0044	3.34	0.0030
RAW	0.0005	0.0003	1.55	0.1330
L1RAW	-0.0005	0.0006	-0.87	0.3940
L2RAW	-0.0002	0.0003	-0.90	0.3750
L3RAW	-0.0001	0.0003	-0.45	0.6560
L4RAW	-0.0004	0.0003	-1.35	0.1900
IS	-1.0071***	0.3493	-2.88	0.0080
SIZE	-0.0390*	0.0219	-1.78	0.0870
SALES	0.0006	0.0006	1.01	0.3210
LPPETA	-0.0999	0.0592	-1.69	0.1040
LCATA	0.0674*	0.0359	1.88	0.0730
Constant	0.2210**	0.1034	2.14	0.0430
Fiscal Quarter				
2	-0.0013	0.0009	-1.50	0.1470
3	-0.0008	0.0011	-0.77	0.4470
4	-0.0008	0.0008	-1.08	0.2920
σ_u	0.0425			
σ_e	0.0344			
ρ	0.6035			
F-test for fixed effects	F (24, 1328) =21.77***			
F-test for time effect	F (3, 1328) = 0.08			
R^2 (within)	0.2444			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity and autocorrelation. The number of observations used is 1,289.

Table A-19. Results Applying FDL Model Using U.S. Wholesale Refined Beet Sugar Prices

FDL with time dummies				
Variable	**Coefficient**	**Standard Error**	**t-value**	**P-value**
MB	0.0149***	0.0046	3.27	0.0030
BEET	0.0009***	0.0002	3.80	0.0010
L1BEET	-0.0009**	0.0004	-2.22	0.0360
L2BEET	-0.0003**	0.0001	-2.25	0.0340
L3BEET	0.0003	0.0003	0.94	0.3580
L4BEET	-0.0001	0.0002	-0.52	0.6100
IS	-0.9949***	0.3573	-2.78	0.0100
SIZE	-0.0406*	0.0220	-1.85	0.0770
SALES	0.0006	0.0006	1.04	0.3100
LPPETA	-0.1021	0.0618	-1.65	0.1110
LCATA	0.0639*	0.0365	1.75	0.0930
Constant	0.2166**	0.1042	2.08	0.0490
Fiscal Quarter				
2	-0.0018	0.0011	-1.64	0.1140
3	-0.0017	0.0013	-1.34	0.1940
4	-0.0007	0.0009	-0.82	0.4230
σ_u	0.0432			
σ_e	0.0344			
ρ	0.6111			
F-test for fixed effects	F (24, 1328) =21.67***			
F-test for time effect	F (3, 1328) = 0.20			
R^2 (within)	0.2434			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity and autocorrelation. The number of observations used is 1,289.

Table A-20. Results Applying FDL Model Using U.S. Wholesale Refined Cane Sugar Prices

FDL with time dummies				
Variable	**Coefficient**	**Standard Error**	**t-value**	**P-value**
MB	0.0149***	0.0045	3.28	0.0030
CANE	0.0009***	0.0002	3.57	0.0020
L1CANE	-0.0009*	0.0005	-2.05	0.0510
L2CANE	-0.0003**	0.0001	-2.24	0.0340
L3CANE	0.0002	0.0003	0.88	0.3900
L4CANE	-0.0001	0.0002	-0.38	0.7080
IS	-0.9855***	0.3516	-2.80	0.0100
SIZE	-0.0415*	0.0220	-1.88	0.0720
SALES	0.0006	0.0006	1.04	0.3100
LPPETA	-0.1019	0.0617	-1.65	0.1120
LCATA	0.0633*	0.0366	1.73	0.0970
Constant	0.2202**	0.1047	2.10	0.0460
Fiscal Quarter				
2	-0.0014	0.0010	-1.44	0.1630
3	-0.0015	0.0012	-1.17	0.2520
4	-0.0007	0.0009	-0.78	0.4420
σ_u	0.0437			
σ_e	0.0345			
ρ	0.6171			
F-test for fixed effects	F (24, 1328) =21.67***			
F-test for time effect	F (3, 1328) = 0.13			
R^2 (within)	0.2427			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity and autocorrelation. The number of observations used is 1,289.

CHAPTER III
THE FINANCIAL PERFORMANCE OF U.S. SUGAR-CONSUMING AGRIBUSINESSES: A SUGAR RELATED BUSINESS SEGMENT ANALYSIS

Abstract

This Chapter evaluates whether changes in the U.S. sugar prices affect the financial performance of sugar related business segments of the publicly-traded U.S. sugar-using manufacturers. The annual segments' accounting data for this analysis were gathered from COMPUSTAT Historical Segments and S&P's Capital IQ for the period from 2000 through 2016. To account for unobserved heterogeneity, a fixed effects estimator was used to estimate all the profitability models. The baseline models estimated with the use of cost of goods sold as a substitute of U.S. sugar prices, whereas three alternative models estimated with the U.S. raw and wholesale refined beet and cane sugar prices. Furthermore, the finite distributed lag model with a lag of one fiscal year was estimated for every type of sugar to account for potential recurring effects of the U.S. sugar prices on profitability. Often, companies maintain large number of inventories, thus a change in sugar prices may affect their profitability in future periods.

The results of the baseline models indicate that cost margin has a negative and significant effect on profitability. The alternative models indicate that sugar prices cannot be considered as a substitute of cost of goods sold for the sample of the selected agribusinesses, since they have no impact on segments' profitability. Moreover, from the finite distributed lag models results, U.S. sugar prices do not have a significant impact on profitability of sugar related business segments. Thus, sugar prices seem to be small part of cost of goods sold for the selected U.S. sugar-using business segments and do not affect their performance. These results are consistent with the findings of Chapter II, where sugar prices found not to affect in a major way the financial performance of the complete selected sugar-using corporations.

Introduction

Agribusiness companies often maintain a diversified production line, with different segments that may cover a broad spectrum of products. For instance, Unilever NV is a British-Dutch transnational company with different business segments that offer products such as food products (e.g., ice creams), household and personal care products. Thus, sugar is only used in food segments that mainly manufacture sugar-containing products. Companies usually classify their segments into three different types: business, operating and geographical. According to Standard & Poor's COMPUSTAT (Wharton Research Data Services, 2018) segments classification, business segments refer to the method of reporting by product line or divisions. Operating segments often combine information such as country, state, region along with business segments; however, they are similar to business segments[32]. Finally, geographical segments refer to the method of reporting based on country, region or continent. COMPUSTAT, through the database Capital IQ, provides access to historical segments data for publicly-traded companies. The utilization of business and operating segments data provides the opportunity for a more concentrated (compared to the analysis in Chapter II) analysis to segments that are more likely to utilize sugar, hence that may directly be affected by the higher domestic sugar prices. This more focused analysis may offer useful insights regarding the ongoing debate among supporters of the sugar program and the sugar-using manufacturers. ASA in a recently published fact, noticed that sugar producers only receive 2 cents from a $7.99 heart-shaped box of chocolates. Furthermore, the main reason for the increasing candy prices are costs such as labor, transportation and other inputs and not the cost of sugar (ASA, 2018). This fact provides useful information about the portion of cost of sugar in the final product price since sugar-using manufacturers in their 10-K documents do not disclose this piece of information.

Objectives

The general objective of this study is to determine whether the changes in the U.S. sugar prices (higher than world sugar prices for the period 2000-2016) affect significantly the performance of U.S. sugar-using agribusinesses as sugar users suggest by examining the relationship between U.S. raw, wholesale refined beet, and cane sugar prices and the financial performance of publicly-traded sugar-using manufacturers for the period 2000-2016. The specific objective of the study is to evaluate the financials of a portion of the corporation only: business segment(s) related to sugar.

[32] For the purpose of this study, business and operating segments both analyzed and, in the text, referred under the same name "Business Segments".

Importance and limitations of the business segments analysis

U.S. publicly-traded sugar-using manufacturers often maintain business segments that are diversified. For instance, there are companies (e.g., Campbell Soup Co.) that manufacture a broad spectrum of products that are not likely to use substantial amounts of sugar such as soups, sauces and meals. Thus, a closely examination of the financials of the business segments that is more likely to be related with sugar may provide deeper insights about the effect of sugar prices on profitability. However, there are limitations on the use of business segments data. Unlike corporation level information, segments data information is limited to certain variables and certain years. Sugar-using manufacturers disclose information regarding sugar usage in the raw material section of their 10-K reports only. However, they do neither specify the portion of sugar used for every segment nor cost structures. Business segments analysis in the current study is based on the identification of sugar-using segments with information based on the product line each segment offers. Hence, another limitation of the segments data is that firms do not provide information regarding the type of segment or the type of products each segment offers.

Literature review

The literature review consists of studies related to business segments. The availability of studies closely related to business segments for agribusinesses is very limited, thus a broad spectrum of business segments-related studies was reviewed instead. This includes studies that examine the financial performance of business units (not necessarily from agribusiness companies), specific factors (corporate or industry) that may affect the business segments performance and the impact of business segments on various firm aspects (e.g., firm performance), and finally studies that compare the performance of business segments with the whole corporation. A common characteristic of these studies is the use of segments data provided by Standard & Poor's COMPUSTAT databases. Moreover, the literature review consists of studies related to the use of Earning Before Interest and Taxes (EBIT) or Earnings Before Interest Taxes Depreciation and Amortization (EBITDA) as proxies of profitability and the key determinants of profitability[33].

Related studies using business segments data

COMPUSTAT provides ample financial data at the corporation level and provides a more limited dataset for three different types of segments: operating, business and geographical. Hough (2006) used operating segments data (from COMPUSTAT Research Insight) for the period 1995-1999 (four-digit SIC code used) to examine the influence of business segments[34],

[33] The literature review of this chapter refers only to the determinants of profitability that were not discussed in Chapter II. Those are capital expenditures, asset turnover and depreciation and amortization.
[34] Business-level effects included factors such as strategy, structure and climate. Other factors included control systems, management characteristics, R&D and international activity.

industry[35] and corporate[36] factors on business segment performance. The author studied segments' performance (ROA) by applying a multilevel analysis. Hough (2016) found that the business factors explain twice the variation in segments performance as corporate factors do. Moreover, corporate factors explain approximately four times as much variance as the industry factors on business segments performance. Finally, business segments factors explain around eight times the variation industry effects do. Brush, Bromiley and Hendrickx (1999) also examined the impact of factors such as industry and corporate on business unit profitability (proxied by business unit ROA) by implementing a simultaneous equation model. The authors used data from two sources: FTC Line of Business and COMPUSTAT industry segments database. The study concluded that both corporate and industry factors affect business unit profitability, with corporation factors having a larger effect.

Chaddad and Mondelli (2013) examined the determinants of industry[37], corporate and business unit level of firm performance of food economy firms that operate in the following four sectors: processing, wholesale, retail and restaurant (with a four-digit SIC code). The data were gathered from COMPUSTAT Business Segments Reports for the period 1984-2006. The authors implemented the hierarchical linear model (HLM) with the use ROA as the model's dependent variable. The study's results suggested that the business unit level and corporate level factors were more important than industry effects. More specifically, factors such as size of business segment, industry entry barriers, corporate diversification, R&D and capital concentration and the accessibility of resources were found to be significant explanatory variables for firm performance.

The financial performance of business segments and their key determinants is often examined in the related literature. Schumacher and Boland (2005) analyzed firm profitability and tried to determine which factors account for variance in firm profitability. Data were gathered from the database Standard and Poor's Compustat Business Segment for the period from 1980 to 2001 and the SIC code system was used to identify the industries. The authors implemented both FEE and REE to explain profitability. As a proxy of profitability, the business segments ROA was used. Year, industry, firm and the interaction between industry and year effects were used as potential determinants of business segments profitability. Schumacher and Boland (2005) found that firm effects were responsible for the highest fluctuation of business segments profitability in the sample of collected food companies. Moreover, firm factors are less significant for most of companies that do not belong to industry's highest or lowest performers. The structure of industry is important only for companies that do not belong to groups with high or low performance.

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[35] To account for industry effects dummy variables were used. Hough (2006) examined the pharmaceuticals, consumer products, and retail industries.

[36] Corporate factors included a dummy variable indicating if the firm is diversified or not.

[37] Industry factors include seller concentration, capital, R&D and advertising intensity. Corporate factors include capital concentration, availability of resources, long-term debt, R&D and advertising concentration and diversification. Finally, the authors used as business segment determinants the size of the segment proxied by the natural log of net sales and the business segment mean ROA.

Previous literature often examines the differences of business segments and the entire corporation performance. Bowlin (1999) examined the contrast between the business segments that are oriented in defense and those that are not in terms of their financial performance. The author used a sample of 18 random selected firms from a list with the top 100 defense contractors as of 1989. The period of study was from 1983 through 1992 and the financial performance evaluation was performed by utilizing Data Envelopment Analysis[38] (DEA). Moreover, the author supplemented the DEA by a traditional financial ratio analysis. Bowlin (1999) found that defense-oriented segments financially outrun the non-defense oriented most of the time. However, the financial performance of the defense-oriented segments deteriorated during that period.

Often, corporations with multiple segments tend to divest some of their business segments with the objective to incorporate the production process to other segments or completely abandon an unsuccessful product line. Chen and Zhang (2007) examined why firms may have the incentive through corporate divestment to move earnings from one segment to another with the objective to affect the market assessment. The author's developed a valuation model based on accounting and focused only on divestments that involve a complete disposal of a business segment. The authors examined all the discontinued operations for the period from 1990 through 2001 on the COMPUSTAT database. Segments data and stock returns gathered from the COMPUSTAT Industry Segment file and the CRSP. The study's final sample accounted for 554 segments divestments performed from 518 firms (Chen & Zhang, 2007). The authors reached four conclusions: 1) Prior to divestment, it is observed an increasing difference between the divested and non-divested segments in terms of profitability, 2) unusual stock returns occur during the period the divestment announcement and they do not related on expected enhanced future performance, 3) the market reevaluation is increasing along with profitability difference between the divested and the non-divested segments, and 4) firms with a large number of segments and greater uncertainty face greater market reevaluation.

Profitability studies

EBIT and EBITDA as proxies of firm's profitability

Two alternative proxies for firm profitability are the EBIT and EBITDA. EBIT[39] and EBITDA are often used in combination of other profitability ratios, such as ROA. Rashid (2017) examined whether board independence influences firm performance for a sample of 135 companies in Bangladesh registered in the Dhaka Stock Exchange. To control for potential endogeneity, the

[38] DEA inputs were the operating expenses and the total assets, whereas the outputs were the operating income, sales and cash flows from operating activities.

[39] This study uses as proxy of profitability segment EBIT divided segment identifiable total assets (a ratio similar to ROA used in the previous chapter). EBIT was used due to lack of sufficient observations for segment's net income.

author used the simultaneous equation approach (the simultaneous equations estimated with the use of the three-stage least square method). The two estimated equations accounted for firm performance (with ROA and Tobin's Q as measures of performance) and board independence. ROA was estimated as EBIT divided by the book value of total assets. Tobin's Q is the ratio of the firm's market value to the cost of replacement of their average total assets[40]. The study concluded that firm performance and board independence do not positively influence each other. Moreover, board size was found to have a significant and positive impact on firm performance and board independence.

Asche and Sikveland (2015) examined the financial performance and evaluation of Norwegian salmon firms. The authors used financial accounting data from 1986 through 2012 and they measured operating profitability by using EBIT and EBIT per every kilo of fish sold. The authors initially tested for random walk in both measures and finally performed the Eagle-Granger test to identify the relationship between operating earnings and fishmeal. Furthermore, they estimated a regression model with EBIT and EBIT per kilo as dependent variables and fishmeal and tons of fish were sold as independent (a first differences regression model estimated). The study concluded that EBIT is characterized as random walk. Moreover, growth of production does not have any effect on the first difference of EBIT, whereas the most significant impact on EBIT per kilo and the first difference of EBIT is the price of salmon.

Elyasiani and Zhang (2015) examined the relationship between busyness of directors and the economic performance and risk of bank holding companies (BHC). As measures of performance, the authors used EBIT to total assets, ROE and Tobin's Q. The list of the BHC was provided to the authors by the Federal Reserve Bank of Chicago and financial data gathered from the databases BANK COMPUSTAT and ExecuComp (extract information regarding the chief executive officers' compensation). The final sample consisted of 116 BHC for the period 2001-2010. Elyasiani and Zhang (2015) implemented the three stages least square method along with instrumental variables to account for the issue of endogeneity. The study found that BHC performance measures have a positive relationship with the busyness, while risk measures have the opposite relationship with busyness of directors (Elyasiani & Zhang, 2015). Moreover, during the economic crisis of 2007-2009 the performance and risk benefits to have busy directors became stronger and weaker respectively. Finally, Elyasiani and Zhang (2015) found that for busy directors it is not more likely to become problematic and if these directors exist on both financial and non-financial firms, then directors of BHC will attend more board meetings.

[40] As independent variables, Rashid (2017) used size of the board, meetings' frequency, chief executive officer's (CEO) duality and power, insider ownership, total debt ratio, age and size of firm, growth and risk of firm. Variables such as CEO gender, institutional ownership and liquidity were included in the performance equation, while in the board independence equation CEO tenure was included. Finally, both equations controlled for industry and time effects.

Determinants of profitability

Capital expenditures (CAPEX) are funds spent by the company to acquire, maintain or upgrade fixed assets such as property plant and equipment. Hence, CAPEX is a factor that affects firm's profitability. Taipi and Ballkoci (2017) studied the relationship between CAPEX and performance for 30 Albanian companies for the period 2008-2015. The authors estimated a linear regression profitability model. As a performance proxy, ROA was used. CAPEX (a control factor also used in this study), leverage (proxied by firms' total debt divided by total assets) and the log value of total assets (a control factor also used in this study) were used as control variables. The results indicated that CAPEX and leverage positively and significantly impacted ROA, whereas size of firm does not have any significant effect on profitability. CAPEX to depreciation and amortization (D&A) (also used in this study) is another factor that indicates growth for the company (Koening, 2017). A high ratio indicates that the company is investing more in non-current assets such as plants and machinery, which implies an expectation of future growth (Koening, 2017).

Another factor that affects firm's profitability according to previous literature is the total asset turnover ratio, a measure of assets management efficiency. Niresh and Velnampy (2014) examined the relationship between size of firm and profitability for a sample of 15 manufacturing firms in Sri Lanka from 2008 through 2012. The authors implemented a linear regression analysis to estimate the profitability model. As proxies of profitability the ROA and net profit were used, whereas total assets and total sales were used as indicator variables. Finally, as a control variable the asset turnover (total sales divided by total assets) was used. The study results indicated that there is no impact of firm size on profitability for the selected companies. Moreover, the asset turnover was found to be negative and with no impact on profitability in every model estimated. Utami (2017) examined the economic performance of Indonesian real estate and property companies. These companies were selected with the argument that they had been affected by the financial crisis of 2008. The final sample consisted of 27 Indonesian firms. The author examined five financial ratios; current ratio, total debt-to-equity, total assets turnover, net margin, and ROE. Utami (2017) performed the paired sample t-test or the Wilcoxon test for the selected ratios to determine differences before and after the financial crisis. Study's results indicated that only leverage and ROE, were greatly lower after the economic crisis. For the rest of the ratios there were no significant differences before and after the crisis.

Data

S&P's Capital IQ and COMPUSTAT historical segments data

The period of study is from 2000 through 2016. The focus of the business segments analysis is on publicly-traded agribusinesses from the food and beverage sub-sector for which annual financial data can be found in S&P's Capital IQ and COMPUSTAT Historical Segments databases. These databases consist of fundamental economic data for publicly-traded companies of the U.S., Canada and Mexico. S&P's Capital IQ consists of annual financial data available at the corporation and business segments level. This database does not provide financial data of companies delisted from a Stock Exchange (e.g., Ralcorp Holdings Inc.). COMPUSTAT also provides annual financial data for business segments through the Historical Segments database. This database consists only of data for business, operating and geographical segments. Companies in COMPUSTAT are organized under different identification code systems including the North America Industry Classification System (NAICS), which was used in the study.

S&P's Capital IQ contains financial data such as balance sheet, income statement and cash flow items at the corporation level. Moreover, annual key financial ratios regarding profitability, growth rate, margin analysis, asset turnover, short-term liquidity and long-term solvency are provided for the whole corporation. Finally, the segments section provides key annual financial information for business and geographic segments. However, the availability of segments data is not the same for every corporation. For instance, in some cases S&P's Capital IQ provides financial items such as COGS and gross profit margin for business segments, whereas in other cases this information is available only for the whole corporation. COMPUSTAT Historical Segments provides limited annual financial data (e.g., identifiable assets and net income). For this study, COMPUSTAT Historical Segments is the main database utilized due to that fact that the name and number of segments each corporation reports explicitly matches with the information provided in the corporation's 10-K document. However, COMPUSTAT Historical Segments has limitations regarding the amount of data, the variables and the years available. Thus, S&P's Capital IQ is used as a complementary database for the estimation of missing observations for the analysis variables.

Sample selection of companies

For the business segments analysis, this study utilized as a sample of agribusinesses the same 29 companies identified as actual sugar users in the previous chapter[41]. The 29 sugar-using

[41] Chapter II and section "Identification of Actual Sugar Users" describes the process of the identification of the actual sugar-user companies and reports the number of companies in the final sample.

manufacturers are further analyzed based on their business and operating segments[42] to identify which segments are more likely to utilize sugar as main input.

Selection of business segments

We use information from the companies' 10-K documents and the COMPUSTAT Historical Segments to identify business and operating segments that are more likely to use sugar. Companies do not report in their 10-Ks the portion of sugar each segment utilizes; hence the identification of sugar-segments is based only on the type of products each segment manufactures. Information about the products is provided in the "Item 1. Business" section of the 10-K documents under the "Reportable Segments" part. Some companies report their annual financial data under a different structure. Instead, they provide product information under the "Products and Packaging" part of the "Item 1. Business" section of the 10-K. Moreover, COMPUSTAT Historical Segments does not disclose information whether a business or operating segment is classified as sugar-user or not.

The selection process consists of three steps (Table A-21). In the first step, annual information about the number and the name of business and operating segments each corporation reports were gathered from COMPUSTAT Historical Segments. In some cases, companies (e.g., PepsiAmericas Inc.) report only one segment for the entire period of study. These businesses segments were automatically classified as sugar-users. The number of sugar-using agribusinesses that report only one business or operating segment is nine. The rest of agribusinesses report multiple segments, hence a second step in the selection process was performed.

The second step in the identification process of sugar-using business segments utilizes more detailed information from the companies' 10-K documents[43]. For the remaining number of agribusinesses that report multiple segments, information regarding the products each segment reports were gathered. The same process was performed for every company and fiscal year for the period 2000-2016. Reported segments with no production process were excluded from the analysis[44]. The company's annual reports were closely examined for segments whose products are more likely to utilize sugar. For instance, products such as cookies, ice cream, condensed milk products, snacks, candies, beverages and cereals are sugar users. In some cases, companies categorize sugar-using products in segments that also contain non-related sugar products such as cooking oils, sauces and pasta. In such cases, the segments were also considered as sugar-users because the portion of sugar used for every product or the contribution each product has in the segment's total sales is not disclosed by the company.

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[42] Operating segments combine either country, state, region along with business segments.
[43] Initially, for every company the name and the number of business and operating segments reported in the COMPUSTAT Historical Segments matched with the information provided in the 10-K documents.
[44] Segments with no production process often indicated in the annual reports as "Unallocated" "Eliminations" and "Corporate & Eliminations". These segments also report zero net annual sales.

Often agribusinesses implement internal changes regarding the structure and the name of their business and operating segments. These changes consist of products eliminations, segments eliminations, changes in the production process or mergers between closely related segments. However, for most of the cases companies maintain the same number (and name) of segments every year. In such cases, for this study only the first available 10-K document has been examined closely for product information. The rest of the 10-K documents were used to verify that the company maintained the same number and type of products in the other fiscal years.

Finally, in the last step of the selection process from the sample of 29 actual sugar-using agribusinesses a complete list of sugar and non-sugar user segments was created with information for every year available. The non-sugar segments were eliminated from the analysis. Annual financial data for the selected sample was gathered from COMPUSTAT Historical Segments and S&P's Capital IQ databases.

Model and methods

Financial ratio analysis: Comparison between sugar-consuming business segments and sugar related corporations

Gross profit margin, EBIT to total assets, CAPEX to depreciation and amortization, interest margin, sales to assets

Ratio analysis of financial statements (or financial ratio analysis) is a widely used tool of financial analysis (Bernstein & Wild, 1999). Financial ratios provide information about areas of the corporation that may need further investigation. The analysis of ratios also provides information that otherwise could be difficult to be obtained by analyzing only the individual components comprising the ratio (Bernstein & Wild, 1999). Katchova and Enlow (2013) used financial ratio analysis to examine the financial performance of U.S. publicly-traded food manufacturers and processors for the period 1961-2011. Moreover, the authors compared the financial performance of agribusinesses with the rest of the market for the same period. Katchova and Enlow (2013) used different types of financial ratios in their analysis such as profitability ratios, liquidity, solvency, efficiency[45], the DuPont model, and market ratios (e.g., earnings per share). Moreover, the authors used individual balance sheet and income statement financial items[46] as indicators of firm performance. The authors initially estimated the median of financial ratios for both agribusinesses and the U.S. market (i.e., portfolio of assets from

[45] Katchova and Enlow (2013) used the total asset turnover ratio (the same ratio used in this study) as a proxy of firm efficiency.

[46] Balance sheet and income statement items included total assets, equity, sales, total liabilities, net income and retained earnings.

different industries). The final step in their analysis was to plot the ratios over time and compare agribusinesses with the rest of the market. Katchova and Enlow (2013) found that agribusinesses outperform at the median the sample of the market in terms of profitability, liquidity, and market ratios, but not in terms of liquidity and solvency. Finally, the DuPont model showed that agribusinesses have higher return-on-equity mainly due to higher asset turnover values.

Triantis (2016) examined the financial performance of nine sugar-using companies to inquire whether the U.S. sugar policy has an economic impact on their performance. The author used financial ratio and portfolio analysis. More specifically, Triantis (2016) examined for a period of 15 years financial performance indicators such as revenue growth, net margin and return on equity. Additionally, the author examined different risk measures such as the standard deviation of stock returns along with the systematic beta. Triantis (2016) found that sugar-using companies outperform the U.S. economy in all the estimated measures of financial performance.

In this study, a financial ratio analysis was implemented to compare sugar related business segments and sugar related corporations. The ratio analysis included the estimation of the following financial performance indicators: Gross profit margin, EBIT to total assets, CAPEX to D&A, IS, and sales to assets (total asset turnover). The total number of observations for the sample of 29 sugar-using agribusinesses, using business segments data is 773. After the elimination of missing observations[47], the total number of sugar-using agribusinesses in the sample is 19 with 179 observations. Financial data for the estimation of the financial ratios gathered through the S&P's Capital IQ (sugar related corporations' data) and the COMPUSTAT Historical Segments (sugar related business segments' data). The total number of corporations for which annual data were available through S&P's Capital IQ is 18, whereas through COMPUSTAT Historical Segments is 19. Annual Financial data for the corporation Eagle Family Foods Holdings Inc. are not available through S&P's Capital IQ.

Econometric models

Model specification of baseline model

The baseline model incorporated CM instead of U.S. sugar prices along with SIZE, sales-to-assets ratio (ASSET), IS, the first order lag of cost of goods sold (LCM), the ratio of CAPEX divided by D&A (CADA) and finally the first order lag of CAPEX to D&A (LCADA). Baseline model I incorporates only the contemporaneous values of CADA, whereas baseline model II includes also the first order lag values.

[47] Missing observations defined as missing values regarding individual financial statement items.

The baseline forms of the panel data model are as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot CM_{i,t} + \beta_5 \cdot LCM_{i,t-1} + \beta_6 \cdot CADA_{i,t} + a_i + e_{i,t} \quad (5.1)$$

Where: $ROA_{i,t}$ = EBIT to total assets for firm i in year t

$SIZE_{i,t}$ = Logarithm of real (CPI adjusted) total assets for firm i in year t

$IS_{i,t}$ = Interest-to-sales ratio for firm i in year t

$ASSET_{i,t}$ = Asset turnover ratio (total nominal sales divided by total nominal assets) for firm i in year t

$CM_{i,t}$ = Cost of goods sold margin for firm i in year t

$LCM_{i,t-1}$ = First order lag value cost of goods sold for firm i in year t

$CADA_{i,t}$ = CAPEX to D&A for firm i for year t

a_i = Unobserved firm-specific effects

$e_{i,t}$ = Idiosyncratic error

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot CM_{i,t} + \beta_5 \cdot LCM_{i,t-1} + \beta_6 \cdot CADA_{i,t} + \beta_7 \cdot LCADA_{i,t-1} + a_i + e_{i,t} \quad (5.2)$$

Where: $ROA_{i,t}$ = EBIT to total assets for firm i in year t

$SIZE_{i,t}$ = Logarithm of real (CPI adjusted) total assets for firm i in year t

$IS_{i,t}$ = Interest-to-sales ratio for firm i in year t

$ASSET_{i,t}$ = Asset turnover ratio (total nominal sales divided by total nominal assets) for firm i in year t

$CM_{i,t}$ = Cost of goods sold margin for firm i in year t

$LCM_{i,t-1}$ = First order lag value of cost of goods sold for firm i in year t

$CADA_{i,t}$ = CAPEX to D&A for firm i for year t

$LCADA_{i,t-1}$ = First order lag value of CAPEX to D&A for firm i in year t

a_i = Unobserved firm-specific effects

$e_{i,t}$ = Idiosyncratic error

Variable construction and expected signs

In this section, only the variables not discussed in the previous Chapter are discussed. Asset turnover (proxied by the ratio of sales to assets), used as a proxy for asset management efficiency, is commonplace in the literature (Niresh & Velnampy, 2014). The relationship between ROA (proxied by EBIT to total assets) and asset turnover is positive since higher levels of revenues indicate higher levels of EBIT.

Due to the lack of observations regarding the segments' PPE variable, the investment related ratio CAPEX to D&A was used instead. The relationship between CAPEX to D&A and profitability is expected to be positive. CAPEX is carried out to increase company's resources (assets) that are used to generate revenues. The relationship between CAPEX and profitability is discussed in detail by Taipi and Ballkoci (2017).

Fixed effects estimation

Chapter II utilized the FEE for the estimation of the profitability model. In this chapter the same profitability models are estimated, but with fewer variables due to data limitations at the segments level. Thus, to estimate the baseline and the alternative profitability models for the sugar segments, the FEE was again utilized. To verify the use of FEE, the F-test for fixed effects and finally the Hausman specification test are implemented for all models.

Alternative and finite distributed lag models

U.S. sugar price as a substitute of cost of goods sold

As in Chapter II, the alternative profitability models include three different types of sugar prices; U.S. raw sugar (RAW), wholesale refined beet sugar (BEET) and wholesale refined cane sugar (CANE) sugar as a substitute for the CM to test whether the variability in those prices affects segments' profitability. Since sugar prices are a part of cost of sales, both variables cannot be included in the regression model. If sugar prices cannot be considered as a substitute of COGS (do not satisfy both conditions), then they are a small part of firm's total cost and they do not affect profitability in a major way as claimed by sugar-using companies. Furthermore, as in Chapter II COGS and sugar prices cannot be in the same regression model to avoid potential correlation issues since sugar prices are a part of COGS. The rest of the independent variables are the same as in the baseline model. Moreover, for the business segments analysis, the FDL also applied under the assumption that the duration of the recurring effects of sugar prices on profitability is one fiscal year. For the estimation of the FDL model (for every type of sugar price) the fixed effects estimator was used.

The alternative form of the panel data models can be written as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot RAW_t + \beta_5 \cdot CADA_{i,t} + \beta_6 \cdot LCADA_{i,t-1} + a_i + e_{i,t}$$

(5.3)

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot BEET_t + \beta_5 \cdot CADA_{i,t} + \beta_6 \cdot LCADA_{i,t-1} + a_i + e_{i,t}$$

(5.4)

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot CANE_t + \beta_5 \cdot CADA_{i,t} + \beta_6 \cdot LCADA_{i,t-1} + a_i + e_{i,t}$$

(5.5)

The form of the FDL model can be written algebraically as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot RAW_t + \beta_5 \cdot LRAW_{t-1} + \beta_6 \cdot CADA_{i,t} + \beta_7 \cdot LCADA_{i,t-1} + a_i + e_{i,t}$$

(5.6)

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot BEET_t + \beta_5 \cdot LBEET_{t-1} + \beta_6 \cdot CADA_{i,t} + \beta_7 \cdot LCADA_{i,t-1} + a_i + e_{i,t}$$

(5.7)

$$ROA_{i,t} = \beta_0 + \beta_1 \cdot SIZE_{i,t} + \beta_2 \cdot IS_{i,t} + \beta_3 \cdot ASSET_{i,t} + \beta_4 \cdot CANE_t + \beta_5 \cdot LCANE_{t-1} + \beta_6 \cdot CADA_{i,t} + \beta_7 \cdot LCADA_{i,t-1} + a_i + e_{i,t}$$

(5.8)

Variable construction and expected signs

Sugar prices are available from the USDA under the section of sugar and sweeteners yearbook tables.[48] Prices are available in an annual, monthly and quarterly basis. This study utilizes average fiscal sugar prices. As mentioned in the previous section, this study utilizes one-year lag values for all three type of sugar prices. The rest of the independent variables remain the same as in the alternative model. Moreover, FDL models require the use of the contemporaneous variable of sugar in the estimation process.

Results and discussion

Descriptive statistics

Table A-22[49] presents the summary statistics for the variables used in this analysis. The average profitability is around 17% annually. The average sales turnover for the agribusinesses is close to 1.2, which indicates that for every $1 million invested in total assets, the agribusinesses on average generate $1.2 million in sales annually. IS has the lowest standard deviation in the sample.

Table A-23 presents the spearman correlation coefficients for all variables. ROA[50] has a significant and positive correlation with SIZE, ASSET, CADA, and LCADA whereas a significant negative correlation with CM, LCM, IS and all types of sugar prices. The strong and negative relationship between ROA and COGS is expected according to the theory because cost of sales incorporates all the direct costs of production. Moreover, sugar prices, COGS components, have a negative correlation with profitability. Leverage, proxied by the IS, and ROA are negatively correlated. Moreover, IS is also negatively correlated with CADA, LCADA, ASSET but positively with CM and LCM.

[48] U.S. wholesale refined cane sugar prices are not publicly available, thus access was requested through the USDA official website https://www.ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx

[49] All tables and figures are placed in the Appendix at the end of this Chapter.

[50] For the present business segments analysis, given data availability, ROA is estimated as EBIT divided by total assets. Thus, ROA estimated in this chapter slightly differs from ROA in Chapter II. They differ in terms of interests and taxes. In the literature, both ratios are referred to as ROA and used as proxy of profitability (see the literature review section).

Model results

Baseline models and statistical tests

The final step in this preliminary analysis is the identification of potential misspecification issues in the data. For heteroskedasticity the modified Wald test, while for multicollinearity the condition number were used. Tables A-24 and A-25 present the results of the misspecification tests for all the estimated models. Heteroskedasticity was detected in the data (Table A-24), but no presence of multicollinearity (Table A-25). The condition number is lower than the threshold of 30 for all estimated models. To correct for heteroskedasticity adjusted robust standard errors for 18 clusters were obtained. To test whether the FEE is appropriate for the estimation of the profitability models, the F-test for fixed effects was conducted. The test results for all models indicated that the use of FEE is preferred over the Pooled OLS. Finally, the Hausman specification test was conducted and indicated that FEE is preferred over the REE for all the models.

Table A-26 and A-27 present the results of the FEE for the baseline models. The performance as measured by the within R^2 value, is around 84% for both models. For the first model (baseline I) all the independent variables have a significant impact on profitability except ASSET, IS and the LCM. The signs of the control variables are as expected, with SIZE, CM negatively impacting profitability, while CADA positively impacting it. However, ASSET and LCM do not have the expected signs. ASSET have a positive one justification for this may be the fact that the selected agribusinesses do not utilize efficiently their total assets, so the level of investment in total assets do not generate the appropriate level of sales, which in turn results in lower profitability for the companies. The lagged value of CM has a positive sign. For some companies, profitability in period *t* is affected by the cost of production in the previous period *t-1* (one fiscal year). CM has a negative impact on profitability, hence sugar prices should follow the same direction to be considered as a substitute for COGS. For one-unit increase in SIZE and CM, profitability will be decreased approximately 0.34 and 0.85 units respectively. For one-unit increase in CADA, profitability will be increased approximately 0.01 units.

Table A-27 presents the results of the second baseline model (baseline II). The model results are consistent with the previous model. All the independent variables have a significant impact on profitability except ASSET, IS, LCADA and LCM. Again, the signs of the control variables are as expected according to theory, with SIZE, CM negatively impact on profitability, while CADA positively. However, ASSET and LCM do not have the expected sign. For one-unit increase in SIZE and CM, profitability will be decreased approximately 0.36 and 0.84 units respectively. For one-unit increase in CADA, profitability will be increased approximately 0.01 units.

Alternative models with U.S. sugar prices

The alternative model examined whether sugar prices could be considered as a substitute for CM. If so, sugar prices would be a major part of cost of sales and would significantly affect profitability. Tables A-28, A-29 and A-30 present the panel regression results for the three types

of sugar prices. The performance as measured by the within R^2 value of the three models is close to 65%, lower than the baseline models but still satisfactory for these types of studies. In all estimated models, U.S. sugar prices are positive, but there is no statistically significant impact on profitability. Hence, sugar prices cannot be considered as a substitute of CM.

From all the models' results it is observed that all control variables have the expected signs. Apart from ASSET (which has a positive sign in all the alternative models), the signs of all the control factors are consistent with the baseline models. More specifically, SIZE negatively impact profitability. From all the model results it is observed that only SIZE has significant impact on profitability with a decrease close to 0.42 units in ROA. The rest of the control factors do not have any impact on ROA.

Finite distributed lag model with U.S. sugar prices

The results of the FLD models (for all the three types of sugar prices) are reported in Tables A-31, A-32 and A-33. In general, the explanatory power of all the estimated models reached satisfactory levels with R^2 (within) value above 64%. All lagged and contemporaneous variables of U.S. sugar prices are found to have a positive sign. However, both the contemporaneous and the first order lagged variables for all the sugar types do not have any significant impact on profitability. In all the FDL models only SIZE has a significant impact on profitability. For one-unit increase, profitability decreases around 0.42 units. The signs of the rest of the explanatory variables are consistent with all the alternative models. Finally, the estimated long-run multiplier (LRP) for the FDL models using raw, refined beet and cane sugar is 0.0039, 0.0019 and 0.0018[51] respectively. However, the LRP is positive and indicates the long run effect of sugar prices on ROA.

[51] The LRP estimated by adding the parameter estimates of the contemporaneous and the lagged values of the sugar price variables.

Financial ratio analysis and mean equality test results

Utilizing information from the COMPUSTAT Historical Segments and S&P's Capital IQ databases, the average financial ratios (both for sugar related corporations and business segments) were estimated for the period 2000-2016 and presented in Figures A-4, A-5, A-6, A-7 and A-8. Gross profit is a key measure of firm's performance and is measured as total sales less cost of sales. Firms need to produce enough gross profit to be profitable (Bernstein & Wild, 1999) and gross profit needs to be sufficiently large enough to finance expenditures such as R&D, marketing and advertising costs. This study utilizes the gross profit margin, a ratio measured as gross profit divided by total sales. This metric assesses company's financial performance by providing information about the proportion of gross profit left over from sales after accounting for COGS. Figure A-4 shows the average gross profit margin for the sugar related corporations and business segments for the period 2000-2016. Sugar related business segments outperform the respective corporations in every year. Sugar related business segments' gross profit margin averaged around 45% for the period 2000-2016, while for corporations averaged around 38% the same period (with a stable trend). For sugar-using manufacturers, most of their business segments identified as sugar using, thus this may be a potential justification for higher gross profit margins for these segments, since most of companies' sales come from sugar-using products.

Figure A-5 presents the average EBIT (i.e., operating profit) to total assets ratio. EBIT to total assets ratio is another measure of profitability similar to ROA. The only difference is that for ROA firm's net income is used instead. EBIT to total assets indicates firm's profitability relative to total assets. For most of the period of study, sugar related business segments outperform corporations. Sugar related business segments' EBIT to total assets averaged around 17% the period 2000-2016, while for corporations averaged around 12% the same period. Since sugar related business segments account for higher gross profit margins, EBIT to total assets follow the same trend.

CAPEX to D&A is an investment ratio. CAPEX refers to the funds used by the company to acquire, upgrade or maintain PPE (fixed assets). CAPEX to D&A ratio indicates how fast the company is growing through investment decisions. Higher levels of this ratio indicate that company's assets are growing faster than being depreciated. Values less than 1 indicate that the company is not expanding. Figure A-6 presents the average CAPEX to D&A ratio over time. Sugar related business segments' CAPEX to D&A averaged around 110% during 2000-2016, while for corporations averaged around 115% the same period.

Interest expenses are non-operating expenses shown on the income statement. These expenses are incurred by a company for borrowed funds. Interest expenses divided by total sales is a leverage ratio that provides information regarding the proportion of sales that utilized to cover interest by the company. Figure A-7 presents the average interest margin over time. For sugar related business segments, interest margin has higher values for most years. Sugar related business segments' interest margin averaged around 2.25% the period 2000-2016, while for corporations averaged around 1.88% the same period.

Finally, an asset management efficiency ratio was utilized. Total asset turnover ratio measures the amount of total sales generated relative to company's book value. This ratio is often used to describe how efficient is the management of the company. More specifically, how efficient the company is deploying its assets to generate revenue. The higher the ratio is, the better the firm is performing, since the company generates higher amount of revenues relative to its total assets. Figure A-8 shows the average total asset turnover ratio over time. Almost half of the period, sugar related corporations outperform the business segments, whereas the other half the situations is reversed. Sugar related corporations and business segments' total asset turnover ratio averaged around 1.16 the period 2000-2016. Both values are close each other and higher than one.

Mean-comparison tests for the sugar related corporations and business segments

To identify whether there is statistical evidence that the sample means of the estimated financial ratios (for both sugar related corporations and business segments) are significantly different, the two-sample t test[52] on equality of means was performed. Under the null hypothesis the two means are equal. To determine whether the financial ratios (for both sugar related corporations and business segments) have equal variances, the two-sample variance comparison test[53] was performed for every year. Under the null hypothesis the two samples of ratios have the same standard deviation. Table A-34 and A-35 present the results of the aforementioned tests. For most years the two-sample variance comparison test results indicated that standard deviations are equal. Results of the *t* tests indicated that only for 2000 and 2001 there is a statistically significant difference in the mean gross profit margin between sugar related corporations and business segments. Sugar business segments outperform the respective corporations these years, hence sugar prices did not have any negative effect on business segments' performance. For the rest of the financial ratios and the years examined, *t* test results indicated that there the means between sugar related corporations and business segments do not have any statistically significant difference. The performance of sugar business segments and sugar related corporations is not significantly different; thus, sugar business segments have similar average performance as the complete sugar related corporations.

[52] The two-sample t test on equality of means implemented by utilizing STATA 13 (StataCorp., 2013).
[53] The two-sample variance comparison test implemented by utilizing STATA 13 (StataCorp., 2013).

Conclusions

The present Chapter attempted to provide further insights about whether changes in the U.S. sugar prices affect the financial performance of the U.S. publicly-traded sugar-using agribusinesses for the period 2000-2016. Instead of the complete sugar-using corporations, this chapter focused on specific business and operating segments that utilize sugar as input. A panel data analysis applied with the use of fixed-effects estimation to account for unobserved firm-specific effects (unobserved heterogeneity). Additionally, because sugar prices assumed to have a recurring effect on firm's profitability, the finite distributed lag model estimated for all the three types of sugar prices. Finally, a financial ratio analysis (followed by mean equality tests) performed to compare the financial performance between the complete sugar related corporations and their respective sugar related business segments.

The financial ratio analysis results initially (before the mean equality tests conducted) indicated that for the gross profit margin and the earnings before interest and taxes to assets ratio the sugar related business segments outperform the respective sugar related corporations. Moreover, for the rest of the financial metrics the performance of sugar related business segments and corporations is quite similar with no major differences. However, the mean equality test results indicated that the means of all ratios between sugar related corporations and sugar related business segments for the period 2000-2016 do not significantly differ. Only for the years 2000 and 2001 the difference in the average gross profit margin between sugar related corporations and business segments found to be statistically significant. The financial ratio analysis concluded that sugar related business segments and the respective corporations do not differ in their performance. Thus, U.S. sugar prices do not have any significant impact in the performance of the selected sugar-using manufacturers, a conclusion that supports the results of Chapter II.

The results of the two baseline models indicated significance of firm size, the contemporaneous value of the investment ratio and the cost margin. Firm size and cost margin found to have a negative effect on profitability, whereas investments positive. Sugar prices in all the alternative model results found to have no effect on profitability. Thus, raw, cane and beet sugar prices do not impact the performance of sugar related business segments. Only firm size found to have a negative and significant effect on segments' profitability. Finally, the results of all the FDL models were consistent with the previous alternative model results. Only firm size found to be negative and have a significant impact on sugar related segments' profitability. Again raw, cane and beet sugar prices found to have no impact on segments' performance.

Both financial ratio analysis (supported by mean equality tests) and the panel data analysis results indicated that the higher domestic sugar prices do not have any significant effect on the financial performance of the sugar related business segments for the period from 2000 through 2016. These results are consistent with the results of Chapter II; that is, results do not support the idea the higher sugar prices consistently affects in a significant way the financial performance of sugar-using manufacturers.

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Appendix



Figure A-4. Average Gross Profit Margin for Sugar Related Corporations and Business Segments



Figure A-5. Average EBIT to Total Assets Ratio for Sugar Related Corporations and Business Segments

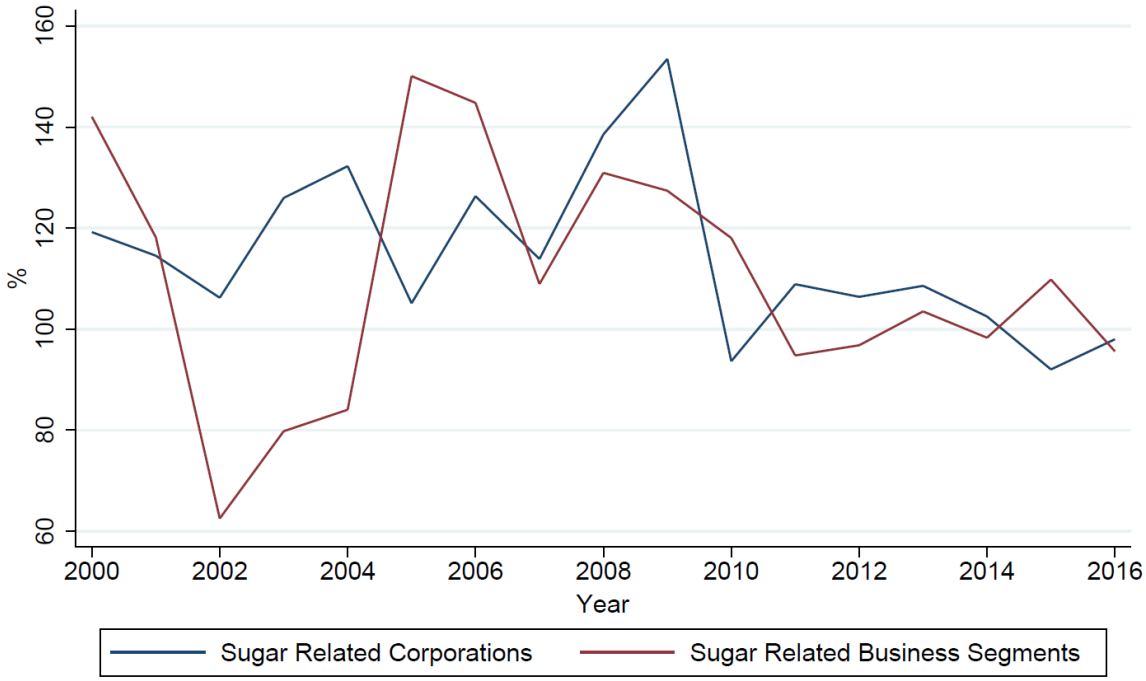


Figure A-6. Average CAPEX to D&A Ratio for Sugar Related Corporations and Business Segments



Figure A-7. Average Interest Expenses Margin for Sugar Related Corporations and Business Segments



Figure A-8. Average Total Asset Turnover Ratio for Sugar Related Corporations and Business Segments

Table A-21. Steps for the Sample Selection Process

Step	Activity Performed	Number of Firms	Number of Observations
Step 1	Download segments information for the initial sample of agribusinesses	29	1,436
Step 3	Identification of business and operating segments that are more likely to utilize sugar as main input with the use of 10-K documents	29	1,436
Step 2	Elimination of non-sugar-related business and operating segments	29	773

Table A-22. Summary Statistics of the Analysis Variables

Variable	Number of Observations	Mean	Standard Deviation	Variance	Minimum	Maximum
U.S. Wholesale Refined Raw Sugar Prices (¢/lb)	179	23.8906	5.2935	28.0208	18.4008	38.4617
U.S. Cane Sugar Prices (¢/lb)	179	33.4560	9.0081	81.1464	24.7267	56.1708
U.S. Wholesale Refined Beet Sugar Prices (¢/lb)	179	31.9808	9.7124	94.3298	21.8983	55.8083
Return-on-assets	179	0.1672	0.2176	0.0473	-0.3808	1.0249
Interest-to-sales	179	0.0228	0.0332	0.0011	0.0000	0.1505
Log_{10} of real total assets	179	3.1445	1.0344	1.0700	-0.0273	5.0988
COGS margin	179	0.5466	0.1964	0.0386	0.0286	1.5096
CAPEX to D&A	179	1.0963	0.8108	0.6574	-3.7037	6.5917
Sales-to-assets	179	1.1582	0.6728	0.4527	0.1491	3.4312

Table A-23. Spearman Correlation Coefficients for the Analysis Variables

	SIZE	ASSET	IS	CADA	LCADA	ROA	CM	LCM	RAW	CANE	BEET
SIZE	1.0000										
ASSET	-0.3037*	1.0000									
IS	0.0324	-0.3336*	1.0000								
CADA	0.3058*	0.1551	-0.2142*	1.0000							
LCADA	0.2700*	0.1333	-0.2512*	0.5747*	1.0000						
ROA	0.3264*	0.3400*	-0.2829*	0.3084*	0.1775*	1.0000					
CM	-0.5092*	-0.1218	0.3511*	-0.3149*	-0.2504*	-0.5904*	1.0000				
LCM	-0.5269*	-0.0308	0.3381*	-0.2615*	-0.2695*	-0.5075*	0.8733*	1.0000			
RAW	0.0689	-0.1132	-0.1062	0.0076	0.0005	-0.1661*	0.1786*	0.2254*	1.0000		
CANE	0.0578	-0.0936	-0.1061	0.0825	0.0471	-0.1721*	0.1852*	0.2280*	0.8838*	1.0000	
BEET	0.0551	-0.0968	-0.1070	0.0743	0.0228	-0.1701*	0.1959*	0.2324*	0.8824*	0.9857*	1.0000

Note: * indicates significance at level of 5%. The number of observations used is 160.

Table A-24. Results of Modified Wald Test for the Baseline, the Alternative and the FDL models

Model	P-value
Baseline I	0.0000
Baseline II	0.0000
U.S. raw sugar prices	0.0000
U.S. wholesale refined cane sugar prices	0.0000
U.S. wholesale refined beet sugar prices	0.0000
FDL with U.S. raw sugar prices	0.0000
FDL with U.S. wholesale refined cane sugar prices	0.0000
FDL with U.S. wholesale refined beet sugar prices	0.0000

Notes: Under the H_o hypothesis the data are homoscedastic. Rejection of H_o indicates presence of heteroskedasticity. Baseline I model includes only the contemporaneous CADA variable, whereas the Baseline II incorporates also the lagged CADA variable. The number of observations used is 160.

Table A-25. Results of Multicollinearity Test for the Baseline, the Alternative and the FDL Models

Model	Condition Number
Baseline I	11.42
Baseline II	12.30
U.S. raw sugar prices	9.51
U.S. wholesale refined cane sugar prices	8.39
U.S. wholesale refined beet sugar prices	7.82
FDL with U.S. raw sugar prices	19.43
FDL with U.S. wholesale refined cane sugar prices	16.74
FDL with U.S. wholesale refined beet sugar prices	15.44

Notes: Condition number above 30 indicates presence of multicollinearity (Belsley, Kuh, & Welsch, 1980). Baseline I model includes only the contemporaneous CADA variable, whereas the Baseline II incorporates also the lagged CADA variable. The number of observations used is 160.

Table A-26. Results Applying FEE for the Baseline Model I

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.3428***	0.0789	-4.3400	0.0000
ASSET	-0.0572	0.0653	-0.8800	0.3940
IS	-0.9440	0.7159	-1.3200	0.2050
CADA	0.0144**	0.0053	2.7000	0.0150
CM	-0.8468***	0.0990	-8.5500	0.0000
LCM	0.0932	0.1172	0.8000	0.4370
Constant	1.7366***	0.2531	6.8600	0.0000
σ_u	0.3751			
σ_e	0.0708			
ρ	0.9656			
F-test for fixed effects	F (17, 136) =14.91***			
Hausman test	X^2 (6) = 66.03***			
R^2 (within)	0.8306			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-27. Results Applying FEE for the Baseline Model II

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.3622***	0.0791	-4.5800	0.0000
ASSET	-0.0745	0.0721	-1.0300	0.3160
IS	-1.0049	0.7300	-1.3800	0.1870
CADA	0.0122**	0.0056	2.1800	0.0430
LCADA	0.0186	0.0131	1.4200	0.1740
CM	-0.8417***	0.0930	-9.0500	0.0000
LCM	0.1086	0.1147	0.9500	0.3570
Constant	1.7896***	0.2533	7.0700	0.0000
σ_u	0.3923			
σ_e	0.0695			
ρ	0.9696			
F-test for fixed effects	F (17, 135) = 15.85***			
Hausman test	X^2 (7) = 77.02***			
R^2 (within)	0.8382			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-28. Results Applying FEE for the Alternative Model Using U.S. Raw Sugar Prices

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.4187***	0.0910	-4.6000	0.0000
ASSET	0.1098	0.1177	0.9300	0.3640
IS	-1.4780	1.2916	-1.1400	0.2680
CADA	0.0072	0.0133	0.5400	0.5960
LCADA	0.0168	0.0245	0.6900	0.5020
RAW	0.0031	0.0030	1.0600	0.3050
Constant	1.2995***	0.2166	6.0000	0.0000
σ_u	0.6151			
σ_e	0.1026			
ρ	0.9729			
F-test for fixed effects	F (17, 136) = 28.01***			
Hausman test	X^2 (6) = 44.86***			
R^2 (within)	0.6445			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-29. Results Applying FEE for the Alternative Model Using U.S. Wholesale Refined Cane Sugar Prices

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.4201***	0.0909	-4.6200	0.0000
ASSET	0.1036	0.1191	0.8700	0.3960
IS	-1.5920	1.2708	-1.2500	0.2270
CADA	0.0070	0.0128	0.5500	0.5890
LCADA	0.0168	0.0249	0.6700	0.5090
CANE	0.0014	0.0017	0.8400	0.4100
Constant	1.3424***	0.2235	6.0100	0.0000
σ_u	0.6145			
σ_e	0.1031			
ρ	0.9726			
F-test for fixed effects	F (17, 136) = 27.64***			
Hausman test	X^2 (6) =47.07***			
R^2 (within)	0.6412			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-30. Results Applying FEE for the Alternative Model Using U.S. Wholesale Refined Beet Sugar Prices

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.4191***	0.0901	-4.6500	0.0000
ASSET	0.1045	0.1195	0.8700	0.3940
IS	-1.5814	1.2856	-1.2300	0.2350
CADA	0.0070	0.0128	0.5500	0.5900
LCADA	0.0170	0.0248	0.6900	0.5020
BEET	0.0013	0.0015	0.8200	0.4240
Constant	1.3440***	0.2235	6.0100	0.0000
σ_u	0.6135			
σ_e	0.1031			
ρ	0.9725			
F-test for fixed effects	F (17, 136) = 27.61***			
Hausman test	X^2 (6) = 44.67***			
R^2 (within)	0.6408			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-31. Results Applying the FDL Model Using U.S. Raw Sugar Prices

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.4214***	0.0918	-4.5900	0.0000
ASSET	0.1088	0.1187	0.9200	0.3720
IS	-1.4136	1.3248	-1.0700	0.3010
CADA	0.0080	0.0138	0.5800	0.5700
LCADA	0.0172	0.0246	0.7000	0.4930
RAW	0.0020	0.0019	1.0200	0.3210
LRAW	0.0019	0.0024	0.7800	0.4440
Constant	1.2902***	0.2152	5.9900	0.0000
σ_u	0.6165			
σ_e	0.1027			
ρ	0.9730			
F-test for fixed effects	F (17, 135) = 27.84***			
Hausman test	X^2 (7) = 55.38***			
R^2 (within)	0.6464			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-32. Results Applying the FDL Model Using U.S. Wholesale Refined Cane Sugar Prices

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.4246***	0.0894	-4.7500	0.0000
ASSET	0.1041	0.1200	0.8700	0.3980
IS	-1.4956	1.3028	-1.1500	0.2670
CADA	0.0082	0.0135	0.6100	0.5530
LCADA	0.0173	0.0247	0.7000	0.4940
CANE	0.0004	0.0010	0.4300	0.6710
LCANE	0.0015	0.0014	1.1000	0.2880
Constant	1.3345***	0.2169	6.1500	0.0000
σ_u	0.6183			
σ_e	0.1030			
ρ	0.9730			
F-test for fixed effects	F (17, 135) = 27.76***			
Hausman test	X^2 (7) = 60.12***			
R^2 (within)	0.6446			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-33. Results Applying the FDL Model Using U.S. Wholesale Refined Beet Sugar Prices

Variable	Coefficient	Standard Error	t-value	P-value
SIZE	-0.4235***	0.0877	-4.8300	0.0000
ASSET	0.1055	0.1204	0.8800	0.3930
IS	-1.4756	1.3152	-1.1200	0.2770
CADA	0.0080	0.0136	0.5900	0.5640
LCADA	0.0174	0.0247	0.7000	0.4900
BEET	0.0003	0.0009	0.3100	0.7600
LBEET	0.0015	0.0013	1.1000	0.2870
Constant	1.3372***	0.2150	6.2200	0.0000
σ_u	0.6173			
σ_e	0.1030			
ρ	0.9729			
F-test for fixed effects	F (17, 135) = 27.75***			
Hausman test	X^2 (7) = 56.12***			
R^2 (within)	0.6444			

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level. The standard errors are robust for heteroskedasticity. The number of observations used is 160.

Table A-34. Two-Sample Variance-Comparison Test Results

Year	Gross Profit Margin	EBIT to Total Assets	Interest Margin	CAPEX to D&A	Total Asset Turnover
2000	0.6921	0.7404	0.2127	0.0551	0.3375
2001	0.0020*	0.9860	0.1422	0.9195	0.5651
2002	0.0965	0.7395	0.0873	0.0002*	0.4187
2003	0.0112*	0.0094*	0.0755	0.6731	0.0265*
2004	0.0001*	0.0003*	0.2137	0.0138*	0.0351*
2005	0.1084	0.1423	0.0628	0.0000*	0.1001
2006	0.0568	0.0441*	0.0964	0.9356	0.1060
2007	0.0760	0.0105*	0.5318	0.0312*	0.0488*
2008	0.0456*	0.0000*	0.5953	0.4137	0.7809
2009	0.0121*	0.0046*	0.5297	0.0377*	0.3500
2010	0.0232*	0.0005*	0.4948	0.0074*	0.4764
2011	0.0198*	0.0021*	0.8417	0.2683	0.5411
2012	0.0134*	0.0142*	0.8896	0.6051	0.9036
2013	0.0287*	0.0073*	0.3390	0.4775	0.3132
2014	0.0944	0.0246*	0.9884	0.5147	0.6144
2015	0.1356	0.0000*	0.5212	0.8045	0.5400
2016	0.2619	0.0655	0.7528	0.1517	0.5540

Note: All columns refer to the difference between the financial ratios related to sugar corporations with the respective business segments' ratios. Each column presents the p-values of the two-sample variance comparison test. Under the null hypothesis the standard deviations of both samples are the same. * indicates significance at 5%.

Table A-35. Two-Sample t Test Results

Year	Gross Profit Margin	EBIT to Total Assets	Interest Margin	CAPEX to D&A	Total Asset Turnover
2000	0.0473*	0.7925	0.6289	0.4195	0.9413
2001	0.0368*	0.2221	0.5990	0.9095	0.6471
2002	0.3642	0.5507	0.2866	0.3458	0.5067
2003	0.7074	0.6359	0.2830	0.0811	0.2409
2004	0.7613	0.6155	0.3824	0.1294	0.3646
2005	0.0713	0.2837	0.3877	0.4067	0.6119
2006	0.1994	0.4217	0.2600	0.2493	0.7406
2007	0.1141	0.4577	0.8362	0.6454	0.3247
2008	0.4577	0.5657	0.9746	0.8043	0.7800
2009	0.4487	0.5456	0.7904	0.4759	0.6390
2010	0.3525	0.5251	0.8557	0.4313	0.9973
2011	0.1747	0.3623	0.6342	0.5207	0.8408
2012	0.2205	0.8137	0.9823	0.6742	0.8810
2013	0.2677	0.5645	0.5584	0.8014	0.4986
2014	0.3640	0.4898	0.9492	0.8102	0.8086
2015	0.3784	0.3236	0.7874	0.3239	0.6812
2016	0.3065	0.2711	0.9671	0.9062	0.7221

Note: All columns refer to the difference between the financial ratios related to sugar corporations with the respective business segments' ratios. Each column presents the p-values of the two-sample t test of equality of the means. Under the null hypothesis the means of both samples are equal. * indicates significance at 5%.

CHAPTER IV
CONCLUSIONS

In this thesis it was examined whether changes in the U.S. sugar prices affects the financial performance of the U.S. publicly-traded food processing and beverage agribusinesses that utilize sugar as input for the period 2000-2016. The second part of the analysis focused on the financial performance of the sugar related business segments and the comparison with the respective sugar related corporations.

Regarding the first topic, addressed in Chapter II, the results indicate that U.S. sugar prices do not have any significant impact in the financial performance of the selected U.S. sugar-using manufacturers for the period 2000-2016. U.S. sugar prices cannot be considered as a substitute of the cost of goods sold almost in every profitability model. Only the wholesale refined beet and cane sugar prices seemed to have an impact on profitability, however the impact is minor. Firm's prospect, size, leverage consistently have a significant impact on profitability. However, only firm's prospect has a positive impact on return-on-assets. Sales growth found to have no impact on firms' profitability in every model. U.S. sugar prices seem to be a small part of cost of sales for the selected sample of sugar-using agribusinesses.

Regarding the second topic, addressed in Chapter III, the results are consistent with the findings of Chapter II. More specifically, sugar prices in every model cannot be considered as a substitute of cost of goods sold, thus they have no impact on sugar related business segments profitability. In the alternative profitability models only, firm size found to be negative and have a significant impact on firms' profitability, a result consistent with the related literature. The financial ratio analysis along with the mean equality tests, shed more light on the business segments analysis. More specifically, the average financial metrics of the sugar related business segments found to have no statistically significant difference than the average ratios of the respective sugar related corporations. This indicates that the performance of the sugar related segments is similar to the complete corporation. The results of the business segments analysis are consistent with those from Chapter II and support the claim that the U.S. sugar prices have no significant impact on the financial performance of the sugar related corporations as the latter mainly argue.

VITA

Vasileios Siokos was born in Athens, Greece, on April 11th, 1992. He comes from Rachoula and Kallithiron (Sekliza), Karditsa, Greece. He has a BSc from the Department of Agricultural Economics and Rural Development of the Agricultural University of Athens. He was ranked third graduate among the students that were admitted to the Department the same year with him and first among one hundred and five students that graduated the same year with him, regardless their admission year. In August 2016, he was admitted as graduate research assistant in the Department of Agricultural and Resource Economics in the University of Tennessee, Knoxville. He fulfilled his class requirements with A's in all the classes and he is expected to graduate on May 2018.