How does the financial performance of sugar-using firms compare to other agribusinesses? An accounting and economic profit rates analysis

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Carlos J.O. Trejo-Pech and Karen L. DeLong
Department of Agricultural and Resource Economics, The University of Tennessee at Knoxville, Knoxville, Tennessee, USA, and
Robert Johansson
American Sugar Alliance, New Alexandria, Virginia, USA

Abstract

Purpose – The United States (US) sugar program protects domestic sugar farmers from unrestricted imports of heavily-subsidized global sugar. Sugar-using firms (SUFs) criticize that program for causing US sugar prices to be higher than world sugar prices. This study examines the financial performance of publicly traded SUFs to determine if they are performing at an economic disadvantage in terms of accounting profitability, risk and economic profitability compared to other industries.

Design/methodology/approach – Firm-level financial accounting and market data from 2010 to 2019 were utilized to construct financial metrics for publicly traded SUFs, agribusinesses and general US firms. These financial metrics were analyzed to determine how SUFs compare to their agribusiness peer group and general US companies. The comprehensive financial analysis in this study covers: (1) accounting profit rates, (2) drivers of profitability, (3) economic profit rates, (4) trend analysis and (5) peer comparisons. Quantile regression analysis and Wilcoxon–Mann–Whitney statistics are employed for statistical comparisons.

Findings – Regarding various profitability and risk measures, SUFs outperform their agribusiness peers and the general benchmark of all US firms in terms of accounting profit rates, risk levels and economic profit rates. Furthermore, compared to other US industries using the 17 French and Fama classifications, SUFs have the highest return on investment and economic profit rate–measured by the Economic Value Added® margin–and the second-lowest opportunity cost of capital, measured by the weighted average cost of capital.

Originality/value – This study finds nothing to suggest that the US sugar program hinders the financial success of SUFs, contrary to recent claims by sugar-using firms. Notably in this analysis is the evaluation of economic profit rates and a series of robustness techniques.

Keywords Financial analysis, Sugar-using firms, US sugar program, Accounting and economic profits, Economic value Added®

Paper type Research paper

1. Introduction

Sugar-containing products (SCPs) are consumable goods made with sucrose. United States (US) SCP manufacturers (hereafter referred to as sugar-using firms (SUFs)) generate billions of dollars of revenue annually and produce products ranging from ice cream to candy bars [1]. Current sugar policies in the US (referred to as the US sugar program hereafter) protect

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American sugar farmers from unrestricted imports of heavily-subsidized global sugar, which typically trade below the costs of production (LMC International, 2021). According to the Sweetener Users Association (SUA) (SUA, 2022), the US sugar program is a "bad deal for American food and beverage manufacturers" because it "restricts imports to keep domestic prices high."

However, previous research has not found any evidence that the sugar program significantly harms the profitability of SUFs (Trejo-Pech *et al.*, 2020). This may be partially explained by the fact that the price of sugar represents a small share of SUFs cost of production. A recent study supports that assertion. DeLong and Trejo-Pech (2022) found US sugar prices and relative US-to-world sugar prices were not relevant factors in the pricing of selected SCPs, arguing that is in part due to the surveyed SCPs having sugar costs representing, on average, 2.5% of the SCP's retail price despite sugar representing a significant portion of the SCPs' weight. Similarly, Triantis (2016) reported that the cost of sugar constitutes, on average, only 4% of the cost of producing highly-sweetened SCPs, and less-sweetened SCPs contained an even lower sugar-cost share. Therefore, it is possible that the US sugar program does not significantly affect SUFs' profitability in part because sugar represents such a small share of their costs.

Despite the *partial* explanation provided in the abovementioned studies, the question remains as whether SUFs profitability is or is not negatively affected, and why. Without the US sugar program, SUFs would buy more heavily-subsidized sugar for their SCPs in the world market at artificially low prices, increasing their gross profits ceteris paribus. But at the same time, SUFs would be exposed to much greater risk around their sugar supply chain and potential costs of building storage facilities to manage that risk. The explanations in Trejo-Pech *et al.* (2020) and DeLong and Trejo-Pech (2022) imply that the US sugar program may represent a cost to SUFs but that this cost is insignificant in light of other factors impacting production (i.e. profitability is not impacted *statistically*).

To complement the partial explanation provided so far by previous research, it is argued in this article that the US sugar program provides economic benefits to SUFs that offset the potential reduction in profitability due to higher domestic sugar prices. The argument is that due to the US sugar program, SUFs invest less capital in their balance sheets, have lower expenses and therefore have higher profits than they otherwise would have without the US sugar program. (A more elaborated discussion on these benefits is provided in sections 2.3. and 2.4.) This increased profit recompenses for the fact that SUFs are restricted from buying heavily-subsidized sugar at lower costs in a highly distorted world sugar market. A discussion regarding how the US program benefits SUFs is generally neglected in the sugar policy literature. Hence, this is one of the contributions of this article.

Therefore, against the SUA's claim that the US sugar program affects SUFs because it keeps domestic sugar prices high, we counter in this article that the sugar program actually provides economic benefits accruing to SUFs that have offset the statistically insignificant sugar price effect on profitability. One approach to investigate our proposition would be to attempt to *estimate* the US program's cost and benefits accruing to SUFs and respond to whether the program decreases, increases or has no economic effect on SUFs' profitability. However, due to the lack of a counterfactual and data to disentangle the effects of the US sugar program on SUFs profitability, this study indirectly investigates this problem by conducting a comprehensive analysis of SUFs profitability and risk vis-à-vis other agribusinesses and other non-agriculture firms. The analysis includes both accounting and economic profit rates, the latter defined as the return on capital invested minus the cost of capital invested, hence embedding a risk component.

This study differs from previous research. Trejo-Pech *et al.* (2020) modeled the impact of domestic and domestic-to-world sugar market price changes on SUFs' accounting profitability (and firm market value), controlling for factors explaining firm profitability. DeLong and Trejo-Pech (2022) modeled the impact of domestic and domestic-to-world sugar market price changes on SCPs retail prices–rather than in accounting profitability–controlling for factors explaining SCPs retail prices. Both studies used panel regression analysis. The approach of our research, based on the framework of industry financial analysis, follows Triantis (2016), with differences explained in the literature section. Results from our study shed light on the likelihood of the US sugar program hindering, or not, this group of firms, which contributes to the literature investigating this research question.

This study aims to analyze the financial performance, in terms of accounting and economic profit rates, of publicly traded SUFs to investigate how it compares to its peer group of other publicly traded agribusinesses and the overall performance of all US publicly traded companies. Ultimately, this study is concerned with the indirect effect of the US sugar program on the economic performance of US SUFs, which are enterprises processing and commercializing SCPs. For example, suppose the US sugar program causes harm to SUFs, as is claimed by the SUA. In that case, it is likely that (1) SUFs' financial performance will be worse than other agribusinesses and US companies or (2) SUFs' economic profit rates will be negative. However, if the overall economic performance of SUFs is similar to or better than other industries, then it is likely that the US sugar program is not causing financial distress to SUFs, consistent with findings in previous research. Furthermore, if SUFs' economic performance is far superior to their peers and SUFs' economic profit rates are high, then the SUA's long-held accusation that the US sugar program is "a bad deal for American food and beverage manufacturers," is likely false since they are experiencing economic success while also operating within the context of the US sugar program which ensures a reliable just-in-time supply of sugar to SUFs.

2. Background and motivation

2.1 The world sugar market and the US sugar program

The world sugar market is one of the most distorted commodity markets due to a wide variety of government interventions, including import tariffs and quotas, domestic price supports, inputs subsidies, export subsidies and other mandates distorting trade (Elobeid and Beghin, 2006; Hudson, 2019; Mitchell, 2004). Analysis of the world sugar market at the beginning of the 2000s (Mitchell, 2004) and recent analysis (Hudson, 2019) concluded that at least 80% of global sugar production is at subsidized or protected prices. Due to such interventions, world sugar prices are depressed and artificially lower than they would be relative to an undistorted world price. As a result, most sugar-producing countries have in place programs to protect their producers from artificially low world sugar prices that, in many instances, are lower than production costs (LMC International, 2021).

Elobeid and Beghin (2006) documented that domestic sugar prices in OECD-affiliated countries—the US included—and the European Union were two to three times higher than world sugar prices. In the US, domestic sugar prices were, on average, 89% higher than world sugar prices from 2000 to 2022 (USDA ERS, 2023). The US is the world's fifth largest producer and third largest importer of sugar [2]. While meeting its trade commitments, US farm policy still provides up to 85% of the domestic market to US sugarcane and sugarbeet processors through the US sugar program, encompassing policies that include price supports, marketing allotments, tariff-rate quotas and re-exports, among other mechanisms (USDA ERS, 2021). The US sugar program has been operated, to the maximum extent possible, at no cost to the Federal Government by avoiding loan forfeitures to USDA's Commodity Credit Corporation (Uri and Boyd, 1994; USDA ERS, 2021) for the past 15 years and is projected by USDA to do so for the next 10 years (USDA Office of the Chief Economist, 2023).

However, SUFs, represented by the SUA, claim that the US sugar program hinders their business because they cannot easily access the discounted, subsidized world sugar price (SUA, 2022; Sweetener Users Association, 2020). This claim is not unexpected because welfare research based on partial or general equilibrium models predicts that the removal of

US trade interventions in sugar would positively benefit sweetener users (e.g. SUFs and sugar final consumers mainly), positively benefit exporting countries that predominantly subsidize their sugar industries and negatively affect American producers (e.g. sugarcane and sugarbeet growers and processors mainly) (Beghin *et al.*, 2001; Beghin and Elobeid, 2015; Uri and Boyd, 1994).

Despite the insights provided by sugar welfare-based models, their results depend mainly on domestic and world price differences and assumptions regarding quantity allocations under different regimes. Still, those models do not consider other relevant elements due to a lack of data or model design, such as coupled supports and export subsidies (see for example WTO case considering the subsidies for the Indian sugar industry [3]). Welfare-based models also neglect to include benefits provided by the US sugar program, such as: (1) contributions to sugar supply stability, which reduces SUFs' business risk and (2) obviating SUFs investment and expenditures related to the sugar supply chain infrastructure. Those benefits, typically ignored in the literature, are discussed below after discussing the cost of the US sugar program accruing to SUFs.

2.2 SUFs do not have full access to the world sugar market, paying higher input prices

As mentioned, world prices reflect heavily-subsidies (for example WTO India finding) and due to the mechanisms preventing unrestricted imports of that heavily-subsidized sugar from the global market, domestic sugar prices are higher than the artificially low world sugar prices. Therefore, SUFs in the US pay a higher price for the sugar in their SCPs, which decreases their gross profits relative to an unobserved counterfactual–open supplies from the world sugar market. However, this counterfactual profit reduction is expected to be *negligible or* most likely *negative* for three reasons. First, because the share of sugar price in the cost of sales is low, as previously discussed. Second, without the US sugar program, the world sugar price would increase due to additional world sugar demand, and SUFs would not be able to pay the current artificially low price for sugar (Beghin *et al.*, 2001; Elobeid and Beghin, 2006). Third, without the US sugar program it is likely that SUFs would have to invest in costly sugar storage and other risk management strategies to maintain a steady, reliable supply of sugar in the absence of domestic sugar producers.

2.3 Sugar supply stability and risk reduction

It has been argued that the US sugar program creates conditions for domestic sugar users to operate in a more stable market regarding quantity and price volatility (American Sugar Alliance, 2021). This is because the US sugar program ensures that the country has the needed infrastructure and policies to supply a relevant portion of domestic users' needs–delivered quantities of sugar have ranged between 65 and 76% in recent years–with high-quality standards, responsibly produced, and reasonably priced [4]. That partially insulates SUFs from a more volatile world sugar market on which countries with sugar surplus sell (dump) to prevent an oversupply in their own market to clear storage for the next crop season, regardless of the world price (American Sugar Alliance, 2021).

Measured in terms of the coefficient of variation, sugar world prices volatility has been higher than US sugar prices volatility (0.39 vs 0.25) during 1980–2020 [5]. Furthermore, Lewis and Manfredo (2012) found the United States Department of Agriculture (USDA) sugar production and consumption forecasts to be efficient and unbiased most years, which indicates domestic sugar supply can be successfully forecasted. The USDA performs those forecasts as a mandate related to the sugar program according to the Food, Agriculture, Conservation, and Trade Act of 1990. Efficient USDA forecasts help the Secretary of Agriculture to implement the US sugar program at no cost to the government. It is expected that those forecasts, which are readily available to the public in the monthly *World Agricultural Supply and Demand Estimates* (*WASDE*) publication, are used by SUFs to plan their operations better and reduce business risk. To recap, the argument is that due in part to the US sugar program, SUFs operate in a reliable and more stable domestic supply market that supplies a relevant portion of SUFs' needs. That is important for SUFs because a firm's stability relates to realized economic benefits (Allayannis and Weston, 2003; Jancenelle *et al.*, 2016).

Allayannis and Weston (2003) document that a firm's profit volatility is substantially penalized by investors; or equivalently, that stability is highly valued. Specifically, they found that firms operating in more stable environments–proxied primarily by profits' stability and, to a lesser extent, by cash flow's stability–have higher firm value, on average. The smooth profitability and higher firm value relationship is expected, given that certainty decreases the firm's opportunity cost of debt and equity capital according to financial theories. For instance, the Capital Asset Pricing Model (CAPM) (Sharpe, 1964) predicts that higher uncertainty increases a firm's systematic risk (i.e. the firm's beta), which, ceteris paribus, increases the cost of equity capital and reduces firm value. (The CAPM is presented in the Methods section of this paper.) Also, stable profitability reduces a firm's perceived likelihood of default and its cost of debt capital (Trueman and Titman, 1988). Profit volatility and profits prediction are also correlated (i.e. volatile earnings increase the likelihood of prediction errors) and matter to investors who value accurate earnings predictions and penalize negative earnings surprises–defined as actual earnings deviating from predicted earnings. Jancenelle *et al.* (2016) recently confirmed that earnings surprises negatively affect firm value.

Therefore, it is likely that the US sugar program benefits SUFs economically. That is, by operating in a highly predictable sector (e.g. with readily available USDA efficient production and consumption forecasts and with a reliable domestic supply market) and with relatively low input price volatility, SUFs' opportunity cost of capital is likely lower and firm value is likely higher than in the absence of the US sugar program.

2.4 Savings on infrastructure investment in the sugar supply chain

The American Sugar Alliance (2021) also argues that SUFs would need to increase their investments without the US sugar program to maintain a reliable and efficient supply chain. Specifically, the nonrecourse loans provided to sugar producers facilitate financing the steady flow of sugar supplies throughout the year and out of the harvesting season–sugar is stored by farmers and processors–without requiring wholesale intermediaries and SUFs to invest in and maintain storage facilities.

In addition, sugar warehousing and distribution terminals are strategically located to meet consumer needs on a *just-in-time* basis, saving SUFs expenses related to working capital investments. Without the US sugar program, the current supply infrastructure would be impaired, causing sugar processors to go out of business because sugar processing is not a very attractive enterprise. For instance, in the last 35 years, 59 wholesale refined sugar processors went out of business with closures related to decreasing US sugar prices adjusted for inflation and without third-party investors–outside of sugar farmers/cooperatives–investing in this sector (American Sugar Alliance, 2021).

Thus, the absence of the US sugar program will likely depress this sector, jeopardize just-in-time deliveries and require SUFs to invest in and maintain their own costly storage facilities. This will increase SUFs' invested capital–fixed assets and working capital–in their balance sheets, raise expenses (e.g. higher depreciation expenses, higher cost of operations and higher interest expenses) and reduce profits.

2.5 The financial analysis framework

It is argued in the previous sections that the US sugar program economically benefits SUFs by reducing firm and industry stability and lowering SUFs' fixed assets and operating working capital investments, therefore saving these firms operating and financial expenses that increase their profits. It is also claimed that these benefits will likely offset the cost of these firms paying relatively high sugar input prices used in their SCPs. However, due to a lack of data to estimate the US sugar program's cost and benefits, we approach this research problem indirectly by conducting a comprehensive financial analysis of SUFs in terms of profitability and risk. Investigating SUFs' profitability and risk is crucial to understanding the net impact of the US sugar program on SUFs. Our financial analysis is comprehensive because it covers: (1) accounting profit rates, (2) drivers of profitability, (3) economic profit rates, (4) trend analysis and (5) peer comparisons based on statistical tests between groups of firms.

Accounting profit rates–the return on assets, equity and investment–are included because these metrics are closely followed by financial analysts and investors (Trejo-Pech *et al.*, 2015). Next, the DuPont model decomposes profitability to understand SUFs' drivers of profitability. Most notably, in terms of economic theory, the analysis covers economic profit rates–particularly, the Economic Value Added® margin–which considers profitability and risk. Analyzing economic profits is appropriate to evaluate whether an industry generates abnormal or excess profits. In particular, Qualls (1974) first proposed the analysis of economic profits to identify industries with high seller concentration and market power because long-term abnormal profits or high positive economic profits tend to persist in these industries. Most of the analyses conducted in this paper are *complemented* by trend analysis and peer comparisons to gain a perspective over time and about other industries not directly exposed to the US sugar program.

3. Previous literature on agribusiness financial analysis

Trejo-Pech *et al.* (2008) evaluated the relationships between accounting profits, cash flows and working capital items of publicly traded agribusinesses and all US firms from 1970 to 2004. They documented that while the profitability of agribusinesses is slightly lower than the profitability of the US market, the cash flow of agribusinesses is somewhat higher than that of all US firms. Overall, their findings suggested that the financial performance of agribusinesses was similar to that of the entire US market during this period. Katchova and Enlow (2013) also compared the financial performance of publicly traded agribusinesses and all firms from 1961 to 2011, examining a large variety of financial ratios compared to the previous study. They concluded that agribusinesses outperformed the median sample of all firms in terms of accounting profitability and market ratios but had slightly lower liquidity and debt ratios. No known research has systematically compared the financial performance of agribusinesses and all US firms since their study.

Triantis (2016) and Trejo-Pech *et al.* (2020) have analyzed financial aspects of SUFs, a subset of the agribusiness industry. Using panel regression analysis, Trejo-Pech *et al.* (2020) modeled SUFs' profitability from 2000 to 2017 as a function of sugar prices, firm expenses, firm efficiency, firm size, growth rate and firm risk. They found that as the US-to-world sugar price ratio increased, SUF profitability was either unchanged or, counterintuitively, tended to increase. Their overall results suggested that the US sugar program–specifically, US sugar prices–does not hurt the profitability of publicly traded SUFs. However, they did not evaluate SUFs' profitability over time or compared to peers; neither did they evaluate economic profitability. Our study fills this gap as well.

More related to our study, Triantis (2016) examined whether the US sugar program has damaged the financial performance of SUFs. Triantis's (2016) financial section included an analysis of the net margin, return on equity, stock price, beta risk factor and price-to-earnings ratio of SUFs compared to the food processing industry and the US market (for selected metrics) during 2001–2015. Triantis (2016) concluded that SUFs outperformed food processors and the US economy during this period. One limitation of Triantis (2016) is that the study analyzed only the largest nine publicly-traded firms in confectionery, breakfast cereal and bread and bakery product sectors. In addition, Triantis (2016) calculated the abovementioned financial ratios for SUFs and compared them with corresponding ratios of the food processing industry and the US market computed by other authors. While nothing is wrong with this approach, it is unclear if the financial ratios for SUFs, food processors and the US market are calculated following the same methods (e.g. data curation, treatment of variables, etc.). Our study addresses these limitations by analyzing not only the largest SUFs but all publicly traded SUFs and calculating all metrics with the same methodology for SUFs and other industries, thus allowing for a consistent comparison of SUFs and peers. The financial metrics calculated in this study also differ from Triantis (2016) in several aspects. This study estimates alternative proxies of profitability rather than only one proxy, identifies drivers of profitability, compare SUFs with other industries and, most notably, analyzes economic profits. The latter is one contribution of our study to the literature.

4. Data and methods

4.1 Financial data

Financial and market data at the firm level were obtained from databases maintained by Wharton Research Data Services (WRDS, 2022). Specifically, financial data included items from the income statement and balance sheet from COMPUSTAT-Capital IQ/North America/ Fundamental Annual (COMPUSTAT). Financial market data had firm market capitalization or market value (obtained from COMPUSTAT as well) and the firm's risk factors or betas from the WRDS's Beta Suite module (Beta Suite). The study is performed with annual data of nonfinancial American-based publicly traded firms from 2010 to 2019 [6]. Foreign firms trading in American stock exchanges were removed from the databases given that a relevant objective of this study is to evaluate the financial performance of SUFs purchasing sugar in the US [7].

4.2 Agribusiness, sugar-using firms and other industries

We assigned each firm in the database an industry designation according to Fama and French's (F&F) 17 industries classification (Fama and French, 2021). F&F industry classifications are based on Standard Industry Classification (SIC) codes and are mainly used to create investment portfolios of similar firms. Fama and French classify firms according to 5, 10, 12, 17, 30, 38, 48 and 49 industries. We chose the 17 industries classification for this study because the sub-industries included in the "food" sector accurately portray agribusinesses. Industries in the F&F's 17 industries classification are (1) agribusiness (referred to as Food in the F&F classification), (2) automobiles, (3) banks, insurance companies and other financials, (4) chemicals, (5) construction and construction materials, (6) consumer durables, (7) drugs, soap, perfumes, tobacco, (8) fabricated products, (9) machinery and business equipment, (10) mines mining and minerals, (11) oil and petroleum products, (12) other retail stores, (13) steel works, (14) textiles, apparel and footwear, (15) transportation, (16) utilities and (17) other [8].

Following standard practice in corporate finance research, we removed firms in the financial industry (i.e. banks, insurance companies and other financials) from the database because the financial statements and financial ratios of nonfinancial and financial firms are not comparable. The agribusiness industry is composed of 31 subindustries, including agricultural producers, food and beverage manufacturers, food and beverage wholesales and agricultural service providers (Table A1 in the Appendix provides a list of sub-industries with their respective SIC codes).

We further divided agribusiness firms into two groups, which we refer to as different industries in this study: SUFs and agribusinesses other than SUFs (AGB). Table 1 provides the number of observations in the database, separating agribusinesses (accruing the F&F

Portfolios	N
Sugar-using firms (SUFs)	235
Agribusinesses other than SUFs (AGB)	980
The US market (ALL)	33,619

Note(s): Portfolio SUFs contains firm/observations of agribusiness identified as sugar-using firms in this study. AGB has agribusinesses other than SUFs. Firms/observations in SUFs plus firms/observations in AGB comprise the agribusiness industry, according to Fama and French's 17 industries classification (Fama and French, 2021). Portfolio ALL contains firm/observations across all industries with non-missing data for the relevant variables in this study
Source(s): Author's own creation/work

Table 1.
Portfolios analyzed, 2010 to 2019

classification) into SUFs and AGB. SUFs and AGB are considered peers because both groups contain agribusinesses.

Table 1 also shows the US market (ALL), the group formed by aggregating all firms/industries in the database. The US market group serves as the analysis' reference or broad benchmark. We refer to the groups in Table 1 as portfolios. The number of observations shown in Table 1 refers to the total firm/annual observations in the database (the number of observations for specific variables with non-missing data to calculate the financial ratios in the analysis is included in subsequent tables). Below we explain how firms in the SUFs' portfolio were identified.

4.3 SUFs portfolio

The SUFs portfolio was created with firms identified in prior research as agribusinesses for which sugar is a relevant input of production (DeLong and Trejo-Pech, 2022; Trejo-Pech *et al.*, 2020; Triantis, 2016). Triantis (2016) evaluated the performance of selected financial ratios of the nine largest publicly traded firms in the confectionery, breakfast cereal and bread and bakery industries. Trejo-Pech *et al.* (2020) modeled sugar-using firms' profitability as a function of sugar prices and other control variables of all sugar-using firms (not only the largest) in the industries referred to above and in the beverages industry. Trejo-Pech *et al.* (2020) identified sugar-using firms according to sugar industry reports by IBISWorld and by inspecting firms' annual reports (10K reports) filed with the US Securities and Exchange Commission (SEC). DeLong and Trejo-Pech (2022) modeled retail prices of selected sugar-using firms as a function of sugar prices and control variables. This study's sample contains all SUFs identified in these previous studies. Table 2 lists the names of firms in our SUFs portfolio, indicating the number of observations in the database.

Further, to ensure that sugar is currently a raw ingredient in the production process of firms in the SUFs portfolio, we inspected the 2015 to 2020 10K reports of SUFs in the sample, finding that, indeed, sugar was mentioned in the 10K reports of these firms. 10K reports were gathered from the Electronic Data Gathering, Analysis and Retrieval System by the SEC [9]. Mentions of sugar in 10Ks were related to sugar as a relevant raw material purchased by these firms, sugar price as a source of commodity risk and sugar consumption taxes as a potential source of revenue volatility, among others. Table A2 in the Appendix provides selected extracts with mentions of sugar. This inspection confirms that firms in the sample were not only SUFs during the periods analyzed by previous studies, but they still consumed sugar as an important input in recent years.

This study uses historical financial files from Compustat, meaning that SUFs not currently listed in an exchange market but listed in any year between 2010 and early 2020 are

Company name	Ticker	N
B&G Foods Inc	BGS	10
Campbell Soup Co	CPB	10
Coca Cola Consolidated Inc[1]	COKE	10
Coca-Cola Co[2]	KO	10
Conagra Brands Inc	CAG	9
Dean Foods Co[3]	DFODQ	8
Dr Pepper Snapple Group Inc[4]	DPS	8
Flowers Foods Inc	FLO	10
General Mills Inc	GIS	9
Hain Celestial Group Inc	HAIN	10
Hershey Co	HSY	10
J & J Snack Foods Corp	JJSF	10
Kellogg Co	K	10
Keurig Dr Pepper Inc	KDP	10
Kraft Foods Group Inc[5]	KRFT	4
Kraft Heinz Co	KHC	9
Mondelez International Inc	MDLZ	10
Monster Beverage Corp	MNST	10
Pepsico Inc	PEP	10
Pinnacle Foods Inc[6]	PF	8
Post Holdings Inc	POST	10
Ralcorp Holdings Inc[7]	RAH	3
Rocky Mountain Choc Fact Inc	RMCF	10
Smucker (JM) Co	SJM	9
Snyders-Lance Inc[8]	LNCE	8
Tootsie Roll Industries Inc	TR	10
Total		235

Note(s): [1] This firm was called Coca-Cola Bottling Company Consolidated until 2019
[2] Coca-Cola Company is the parent company of Coca Cola Consolidated Inc. (COKE)
[3] On November 12, 2019, Dean Foods Company filed a voluntary petition for reorganization under Chapter 11 (missing data for 2011)
[4] As of 2018, Dr Pepper Snapple Group, Inc was acquired by Keurig Dr Pepper Inc
[5] Kraft Foods Group, Inc was acquired in 2015 by The Kraft Heinz Company (missing data for 2011)
[6] Pinnacle Foods was privately held until it went public in 2013. In 2017, it was acquired by Conagra
[7] Ralcorp was acquired by Conagra in 2013
[8] Snyder's-Lance, Inc. has operated as a subsidiary of Campbell Soup Company since 2018
Source(s): Author's own creation/work, based on the databases referred to in the Methods section

Table 2.
List of sugar-using firms, 2010 to 2019

included in the sample. For instance, Pinnacle Foods Inc. and Ralcorp Holdings Inc. traded as individual companies from 2008 to 2017 and 2000 to 2012, respectively, until both were acquired by Conagra Brands Inc., another SUF listed in Table A2.

4.4 Methods for financial analysis

To evaluate financial performance, we conduct the following analyses: (1) compute and compare alternative proxies of accounting profit rates across SUFs, AGB and ALL portfolios, (2) compute and compare key drivers of accounting profitability across SUFs, AGB and ALL portfolios, (3) compute and compare risk metrics and economic profit rates across SUFs, AGB and ALL portfolios, (4) rank accounting and economic profit rates of SUFs, AGB and ALL portfolios relative to 18 US portfolios [10] and (5) conduct trend analysis. As it is elaborated below, this study uses median values as the main basis for the analysis.

The most important metrics for the purpose of our research question are those related to economic profit rates–the return on invested capital, the firm's beta and the opportunity cost of capital and its components–because, as explained below, economic profits evaluates whether an industry generates abnormal or excess earnings in the long-term. We use the Economic Value Added® margin as the proxy for economic profit rate. Therefore, an analysis of economic profit rates or EVA%, and its related components, may suffice to respond to our research question of whether SUFs profitability is likely affected or not by the US sugar program. But analyzing multiple proxies of accounting profitability, comparing SUFs with peers and conducting trend analysis complement the study and make our findings more robust if the results are consistent.

4.4.1 Proxies of accounting profit rates. Widely used profitability ratios include the return on assets (*ROA*), return on equity (*ROE*) and return on investment (*ROI*). In this study, we calculate these financial ratios as follows:

$$ROA = \frac{Net\,income}{Assets} \tag{1}$$

$$ROE = \frac{Net\,income}{Equity} \tag{2}$$

$$ROI = \frac{NOPAT}{Invested\ Capital} = \frac{EBIT \times (1 - tax)}{D + E}, \tag{3}$$

The financial metrics in this study are calculated for the i firm in year t. Most variables to estimate the financial metrics, but not all, are also calculated for firm i every t. For simplicity, unless noted (e.g. equation (6)), we do not include subscripts in the formulas.

Unlike *ROA* and *ROE, ROI* relates profitability to capital investment components: equity (E) and debt (D). Net operating profits after taxes (*NOPAT*) captures firm profits after taxes—but before interest expenses—that are available to pay the financing cost of debt (*D*) and equity (*E*) capital. *NOPAT* is calculated by multiplying earnings before interest and taxes (*EBIT*) times *1-tax* to account for the tax-deductibility of interest expenses (Schill, 2017). Variable *tax* is the effective tax rate, calculated by dividing COMPUSTAT items annual taxes accrued by pretax income. Variable *D* in equation (3) is total debt including long-term and current debt, and variable *E* is stockholder equity. Other variables in equations (1) through (3) are named similarly in COMPUSTAT.

Since ROE and ROI are the most preferred profitability ratios by equity analysts covering publicly traded firms (Trejo-Pech *et al.*, 2015), we expand further on these two profitability metrics. Specifically, we decompose ROE according to the DuPont model and compare ROI with the firm's opportunity cost of capital.

4.4.2 Drivers of profitability. According to the DuPont decomposition, *ROE* can be expressed in terms of drives of profitability as follows:

$$ROE = ROA \times \frac{Assets}{Equity} = \frac{Net\,income}{Assets} \times \frac{Assets}{Equity} = \frac{Net\,income}{Revenue} \times \frac{Revenue}{Assets} \times \frac{Assets}{Equity}. \tag{4}$$

The DuPont decomposition, equation (4), shows that *ROE* equals *ROA* multiplied by a leverage-related financial ratio (i.e. *ROA* is already contained into *ROE*) and is the product of net income margin (net income to revenue), asset turnover (revenue to assets) and leverage (assets to equity). More generally, profitability is decomposed into a margin, asset efficiency and leverage ratio. We decompose *ROE* according to equation (4) to compare drivers of profitability of sugar-using firms with peers because this decomposition provides a parsimonious representation of drivers of firm profitability (i.e. decomposing one equation instead of calculating many financial ratios, yet providing an insightful decomposing of profits into margin, asset efficiency and leverage).

4.4.3 Risk-adjusted profitability and risk metrics. ROI provides a profitability rate of return that is a benchmark for the firm's opportunity cost of capital. This is because ROI relates risk-adjusted profit (*NOPAT*) to debt plus equity (equation 3), the same components used to estimate a firm's opportunity cost of capital (equation 5). Previous studies indicate that most financial managers in the US use the weighted average cost of capital (*WACC)* as the proxy for the firm's opportunity cost of capital (Graham and Harvey, 2001; Jacobs and Shivdasani, 2012). As shown in equation (5), *WACC* considers the weights of debt and equity in the firm's capital structure and the tax-deductibility of interest expenses.

$$WACC = \left\{\frac{D}{D+E} \times d \times (1 - tax)\right\} + \left\{\frac{E}{D+E} \times e\right\}. \tag{5}$$

The first *WACC* component in equation (5) measures the cost of debt net of interest-related tax savings, with d capturing the cost of debt. The second term shows the cost of equity adjusted by the weight of equity in the capital structure. Upper-case D and E represent dollar values, whereas lower-case d and e represent the cost of debt and equity in annual rates. Variable d is calculated by dividing COMPUSTAT item interest and related expenses by D and e is estimated with the capital asset pricing model (CAPM) (Sharpe, 1964). Variable e is unobservable. Surveyed managers in the US indicate they commonly apply CAPM to have an *estimate* of equity investors' expected rate of return or cost of equity (Graham and Harvey, 2001). CAPM estimates the cost of equity by:

$$e_{i,t} = risk\,free\,rate_t + \beta_{i,t} \times US\,market\,premium. \tag{6}$$

For the risk-free rate variable, we calculated every year the average of the daily annualized rates for the long-term composite bond—US governmental bond maturing in ten or more years—available in the US Department of Treasury website [11]. The US market risk premium is typically proxied by historical rate premiums between the rate of return of a US well-diversified portfolio and the risk-free rate. Brotherson *et al.* (2013) report managers and financial analysts using a market risk premium between 5 and 8% annually. We selected the mid-point, 6.5% as market risk premium in this study.

The beta factor, β, which is specific for each firm i and year t, is estimated using the software Beta Suite by WRDS following the specifications in Trejo-Pech *et al.* (2021). The beta parameters are obtained by regressing the firm's monthly historical stock returns on the corresponding market risk premia. Stock returns are calculated by dividing the firm's stock price in month t by stock price in month t-1 and then subtracting 1. Beta Suite uses Fama and French's monthly excess return on the market as market premia (Fama and French, 1993), defined as the difference between the value-weighted return of a diversified portfolio of all firms with available data trading on the NYSE, AMEX or NASDAQ stock exchanges minus the corresponding US Treasury bill rate proxying the risk-free rate. After estimating the beta parameters for all firms in our sample, we merged the COMPUSTAT and the Beta Suite files, using the beta values calculated for the month/year firms filed their financial statements with the SEC according to COMPUSTAT.

Equation (5) resembles equation (3) because both use the same investment base and consider the tax effect of interest expenses on profits. Subtracting the opportunity cost of capital, equation (5), from profitability, equation (3), gives the economic profit rate, also known as the Economic Value Added® margin (EVA%):

$$EVA\% = ROI - WACC \tag{7}$$

EVA margin can be rearranged and represented as

$$EVA\% = \frac{(EBIT - D \times d) \times (1 - t) - E \times e}{Invested\ Capital}, \tag{7a}$$

or, by defining earnings after interest and taxes $EAT = (EBIT - D \times d) \times (1 - t)$, as

$$EVA\% = \frac{EAT - E \times e}{Invested\ Capital}. \tag{7b}$$

The numerator of equation (7b) shows that when earnings (net of interest and tax payments), EAT, is equal to expected payments to equity investors (e.g. the second term), the EVA margin will be zero. At zero EVA margin, the firm generates just enough profits to pay both debt holders and equity holders the returns they expect for their investment according to the risk level they undertake. In other words, a firm generating zero EVA margin or zero economic profits will satisfy the expectation of debt and equity holders. Microeconomic theory predicts that in the long-term, firms yield zero economic profits or zero EVA margin—according to this specific proxy—as they enter steady-state equilibrium. Positive and negative EVA margins are temporary deviations that tend to disappear as firms enter or exit industries due to competitive market adjustments.

4.4.4 Statistical tests. Portfolios SUFs and AGB–SUFs' closest benchmark in this study–are compared statistically. Specifically, for each financial metric, we conduct two comparisons. First, the null hypothesis of median equalities between two groups (Conroy, 2012), SUFs and AGB, was tested using quantile regression [12].

$$Ho : SUFs_{Median\ financial\ metric\ X} = AGB_{Median\ financial\ metric\ X}. \tag{8}$$

The AGB portfolio is used as the reference for the test. Thus, a positive (negative) quantile regression coefficient that is statistically significant signifies that the median of the financial metric (e.g. ROA, EVA%, etc.) in portfolio SUFs is statistically higher (lower) than the median in portfolio AGB. For those tests, the STATA procedure *qreg* with the option *vce(robust)* was employed for robust standard errors.

In addition, we calculate the Wilcoxon-Mann-Whitney (WMW) statistic (i.e. STATA procedure *ranksum* with option *porder*), which estimates the probability of an observation (i.e. financial metric) in portfolio SUFs is higher than an observation in portfolio AGB. This probability is calculated based on the percentage of cases in which a random observation in one group is higher than a random observation in a second group, plus half the probability that the values are tied (Conroy, 2012; Divine *et al.*, 2018),

$$p'' = \widehat{Pr}(X_1 > X_2) + \widehat{Pr}(X_1 = X_2) \Big/ 2. \tag{9}$$

Conroy (2012) claims that the WMW parameter, which forms the basis of the WMW U test, is a useful measure of *effect size* when comparing two groups because it tells the likelihood that a member of one group will score higher than a member of the other group (e.g. the likelihood that the rate of a financial metric will be higher for a sugar-using firm compared to an agribusiness).

4.4.5 Rankings of financial metrics. ROI, WACC and *EVA%* for SUFs and AGB are also evaluated in relation to their ranking position across all US industries (i.e. the F&F 17 industries— excluding the finance industry— SUF, AGB and ALL).

4.4.6 Trends. All the analysis above was conducted by comparing the median of financial metrics across portfolios during the decade of the study. To evaluate whether the profitability and risk of the SUF portfolio are clustered around a few years, we calculate and inspect metrics over time for the decade of study.

4.4.7 Data curation. Following recommendations in WRDS industry financial ratio module and others (WRDS Research Team, 2016; Cocco and Volpin, 2013), we remove observations for financial ratios with zero or negative denominator values (e.g. observations with zero or negative assets, equity, invested capital or revenue are removed from the database) and winsorize the data. The calculated financial metrics are winsorized at 1% every year using STATA code *winsor2* to remove outliers.

5. Results and discussion

The financial metrics analyzed in this study are normalized to make these metrics comparable across firms regardless of firm size. This is because the financial ratios and the weighted average cost of capital are expressed in terms of proxies of firm size (e.g. total assets, market value, etc.) or because the beta risk factor is a normalized metric expressed in relation to the risk of a market portfolio. While we cured the data from outlier observations, as is common in corporate finance research, the distributions of most financial metrics are skewed rather than symmetrical (Figure A1 in Appendix shows the distributions of the financial metrics for the portfolio of SUFs.). Except for beta and ROA, all financial metrics have a skewness absolute value higher than 1.0, suggesting highly skewed financial metrics. Because of this, we discuss median instead of mean values since using median values is more appropriate when financial ratios are aggregated at the industry level (WRDS Research Team, 2016).

5.1 Profitability

Table 3 provides selected statistics of three proxies of firm accounting profitability: return on assets, return on equity and return on investment (*ROA*, *ROE* and *ROI*). The correlation coefficients amongst the three metrics are high, ranging from 0.65 to 0.84, which was expected given all three financial ratios are proxies of profitability. Profitability median returns are presented for the portfolio of SUFs, agribusinesses other than SUFs (AGB) and all firms in the US market (ALL). The accounting profitability of SUFs is the highest across the three portfolios regardless of the financial ratio chosen to proxy profitability. During the 2010–2019 period (excluding the COVID pandemic period), the median *ROA* for SUFs was 6.3%, compared to 3.9% for AGB and 3.0% for the pool of all US publicly traded firms. Median *ROE* was 16.0% for SUFs, 8.1% for AGB and 7.3% for ALL. Median *ROI* for SUFs, AGB and ALL were 11.3%, 6.6% and 6.1%, respectively. Table 3 shows that the median values across accounting profit rates are statistically higher—at a 1% significance level—for SUFs compared to AGB, according to quantile regressions. Table 3 also shows that the likelihood of higher accounting profit rates for SUFs varies between 63 and 69%, according to the WMW statistic.

5.2 Drivers of profitability: the DuPont decomposition

To evaluate the drivers of firm profitability, *ROE* is decomposed according to the DuPont model (equation (4)) into net income margin (net profits to revenue), assets turnover (revenue to assets) and the equity multiplier (assets to equity). Table 4 shows the *ROE* decomposition for the three portfolios of firms.

Results suggest that SUFs' net income margin is the primary driver of accounting profits for SUFs compared to its peers because SUFs' net income margin, at 8.0% median, is by far higher than the net income margins of AGB (2.6%) and ALL (3.4%). SUFs' equity multiplier is also higher than AGB and ALL, suggesting that the median leverage for SUFs is higher than the leverage of its peers. However, the gap between leverage of SUFs, AGB and ALL is not as large as the differences across net income margins. SUFs' median assets represent 2.8 times its equity, compared to around two times for AGB and ALL. Regarding asset efficiency, while SUFs' median asset turnover is slightly higher than ALL (0.83 vs 0.80), SUFs' asset efficiency

	SUFs	SUFs vs AGB	AGB	ALL
ROA	0.063		0.039	0.030
n	229		889	30,485
quantile reg		0.024***		
WMW p"		0.627		
ROE	0.160		0.081	0.073
n	229		889	30,485
quantile reg		0.079***		
WMW p"		0.687		
ROI	0.113		0.066	0.061
n	229		921	29,377
quantile reg		0.047***		
WMW p"		0.690		

Note(s): *ROA* is the return on assets, *ROE* is the return on equity, and *ROI* is the return on investment (equations (1), (2), and (3)). SUFs is a portfolio of SUFs, AGB contains agribusinesses other than SUFs, and ALL is the portfolio with all firms in the US market

Quantile regressions test the null hypothesis of median equalities between two groups (Conroy, 2012), SUFs and AGB, according to equation (8). The AGB portfolio is the reference for the test. Thus, a positive (negative) quantile regression coefficient that is statistically significant signifies that the median of the financial metric in portfolio SUFs is statistically higher (lower) than the median in portfolio AGB. *** denotes a 1% significance level

p" is the WMW statistic, equation (9), which estimates the probability of a financial metric in portfolio SUFs is higher than one in portfolio AGB

Source(s): Author's own creation/work; estimations based on the databases referred to in the Methods section

Table 3.
Profitability financial ratios, median values from 2010 to 2019

	SUFs	SUFs vs AGB	AGB	ALL
Net income margin	0.080		0.026	0.034
n	229		889	30,485
quantile reg		0.054***		
WMW p"		0.710		
Asset turnover	0.833		1.447	0.800
n	229		889	30,485
quantile reg		−0.614***		
WMW p"		0.323		
Equity multiplier	2.766		1.998	2.075
n	229		889	30,485
quantile reg		0.765***		
WMW p"		0.642		

Note(s): *ROE* decomposition according to equation (4). Net income margin is calculated by dividing net profits by revenue, assets turnover is the ratio of revenue to total assets, and the equity multiplier is calculated by dividing total assets by equity

SUFs is a portfolio of sugar-using firms, AGB contains agribusinesses other than SUFs, and ALL is the portfolio with all firms in the US market

Quantile regressions test the null hypothesis of median equalities between two groups (Conroy, 2012), SUFs and AGB, according to equation (8). The AGB portfolio is the reference for the test. Thus, a positive (negative) quantile regression coefficient that is statistically significant signifies that the median of the financial metric in portfolio SUFs is statistically higher (lower) than the median in portfolio AGB. *** denotes a 1% significance level

p" is the WMW statistic, equation (9), which estimates the probability of a financial metric in portfolio SUFs is higher than one in portfolio AGB

Source(s): Author's own creation/work; estimations based on the databases referred to in the Methods section

Table 4.
ROE DuPont decomposition, median values from 2010 to 2019

is lower than AGB (0.83 vs 1.45), indicating that SUFs are less asset-efficient than other agribusinesses.

Overall, results in Table 4 suggest that net income margin and leverage are the two main drives of the SUFs' industry accounting profitability. Still, net income margin is by far the main driver. The quantile regressions confirmed that the median values of SUFs and AGB are statistically different. To further look the profit structure, we calculated the gross margin, defined as revenue minus cost of goods sold divided by revenue, finding that SUFs' gross margin at 39.6% was higher than AGB's gross margin at 27.2%. SUFs' gross margin was relatively stable, varying no more than two percent points around the median over the 2010–2019 period of study.

5.3 Risk and economic profit rates: beta, WACC and EVA

As discussed, unlike *ROA* and *ROE*, *ROI* is a profitability ratio providing a rate of return that can be used as a benchmark against the firm's opportunity cost of capital. The opportunity cost of capital is measured by the weighted average cost of capital (*WACC*, equation (5)). The economic profit rate, measured by the Economic Value Added® margin (*EVA%*), equation (7), represents the difference between *ROI* and *WACC*. Table 5 provides the statistics for *EVA%* and related financial metrics across portfolios. As expected, the median of beta, the firm systematic risk measure (equation (6)), is around 1.0 for our US market portfolio. According to asset pricing theory, beta = 1.0 represents the market's average or baseline risk level, and betas below and above 1.0 are related to lower or higher than average risk levels. Theory prescribes that the risk of a well-diversified portfolio—containing firms from different industries—represents the baseline or average risk against the risk of specific firms or groups of firms that should be compared. Results in Table 5 indicate that the SUFs and AGB industries are at low-risk levels compared to the US market.

	SUFs	SUFs vs AGB	AGB	ALL
Beta	0.455		0.649	1.075
n	166		425	14,434
quantile reg		−0.194***		
WMW p"		0.272		
WACC	0.053		0.064	0.087
n	156		386	12,820
quantile reg		−0.011***		
WMW p"		0.295		
EVA%	0.061		0.014	−0.002
n	156		386	12,820
quantile reg		0.048***		
WMW p"		0.708		

Note(s): Beta is the firm's systematic market risk estimated according to equation (6), *WACC* is the firm weighted average cost of capital, estimated by equation (5), and *EVA%* is the economic profit rate, measured by the Economic Value Added® margin, calculated with equation (7)
SUFs is a portfolio of sugar-using firms, AGB contains agribusinesses other than SUFs, and ALL is the portfolio with all firms in the US market
Quantile regressions test the null hypothesis of median equalities between two groups (Conroy, 2012), SUFs and AGB, according to equation (8). The AGB portfolio is the reference for the test. Thus, a positive (negative) quantile regression coefficient that is statistically significant signifies that the median of the financial metric in portfolio SUFs is statistically higher (lower) than the median in portfolio AGB. *** denotes a 1% significance level
p" is the WMW statistic, equation (9), which estimates the probability of a financial metric in portfolio SUFs is higher than one in portfolio AGB
Source(s): Author's own creation/work; estimations based on the databases referred to in the Methods section

Table 5. Risk and economic profit rate (economic value added® margin), median values from 2010 to 2019

A firm's beta is only one factor affecting, through the cost of equity, the firm's *WACC*. *WACC* is a more comprehensive risk measure because, as shown in equation (5), a firm's *WACC* is a function of the cost of equity, cost of debt, a mix of debt and equity and tax rates. Our estimations show that SUFs' risk proxied by *WACC* is also lower than the risk of its peers. Median *WACC* for SUF is 5.3%, compared to *WACC* = 6.4% for AGB and *WACC* = 8.7% for ALL (Table 5). Quantile regression confirmed that the WACC (i.e. risk) of SUFs is statistically significant lower than AGB's WACC at a 1% significance level. The WMW statistic in Table 5 suggests that there is only a 29.5% probability that a firm randomly chosen from the SUFs portfolio has a higher WACC than another firm randomly chosen in AGB.

Since *WACC* represents the firm's opportunity cost of capital, the *WACC* rate indicates the profit rate of return the firm should generate to satisfy debt and equity holders' expectations—according to the risk they undertake when investing in the specific firm. *ROI* is one measure that, when compared to *WACC,* indicates whether a firm can satisfy the expectations of capital providers. The *EVA%* shows the difference between *ROI* and *WACC* (equation (7)). A firm with *EVA%* = 0 (or, more generally, with zero economic profits) can satisfy the expectations of capital providers.

Our results, in Table 5, show that the combination of a low *WACC* and high *ROI* generates a relatively high *EVA%* median value equal to 6.1% for SUFs, in contrast with *EVA%* = 1.4% for AGB. The 4.8 percentual points difference between medians is statistically significant at 1%, with a 70.8% probability that a randomly chosen sugar-using firm would have a higher EVA% than another AGB firm. *EVA%* is 0.0% for the US market. This latter result is consistent with microeconomic theory predicting that in the long-term, firms in the market generate zero economic profit since abnormal (different from zero) economic profits will tend to disappear as firms enter and exit industries in the presence of positive or negative abnormal income. Overall, results indicate not only accounting profitability (e.g. *ROA*, *ROE* and *ROI*) but economic profitability (*EVA%*) of SUFs is higher than their peers. These results are consistent with previous research documenting that publicly traded agribusinesses are less risky than the US market (Katchova and Enlow, 2013). One possible explanation of these results is that the price elasticity of demand for food products, and more specifically, SCPs, could be characterized as mostly inelastic. However, a review of literature on the price elasticity of demand for food categories, and specifically SCPs, shows mixed results with the price elasticity of demand for several food and SCP categories ranging from inelastic to elastic (Lakkakula *et al.*, 2016; Okrent and Alston, 2012; Valizadeh and Ng, 2021). Future research could update these results and investigate this possibility more specifically within SCP categories. Overall, our results suggest that SUFs represent an agribusiness subsector most likely driving results in previous research that did not disaggregate the agribusiness industry.

5.4 Ranking positions of profitability and risk across industries

The analyses above evaluated the profitability and risk metrics of SUFs relative to AGB and ALL. In this section, we further assessed selected profitability and risk metrics of the three portfolios in relation to their position relative to all US industries or portfolios (i.e. the F&F 17 industries—excluding the finance industry, SUFs, AGB and ALL). 2010–2019 median *ROI* and *EVA%* values of portfolios were separately ranked from highest to lowest. In contrast, 2010–2019 median *WACC* industry values were ranked from lowest to highest since *WACC* represents risk. Table 6 provides the results.

SUFs ranked first in terms of accounting profit rate *ROI* and economic profit *EVA%*, indicating that SUFs had the highest accounting and economic profit rates across the 18 portfolios. Regarding risk, SUFs' *WACC* was the second-lowest, only above the utilities industry, across all industries as defined in this study. *ROI* and *EVA%* for agribusinesses other than SUFs ranked in the 13th and 10th positions, slightly above the middle of the 18 portfolios, and ranked as the 3rd lowest risk industry. Finally, the aggregate US market ranked between 12 and 14 across all industries. Thus, SUFs is a group of highly attractive firms for US investors, yielding high accounting and economic profitability compared to the rest of the industries. Agribusinesses other than SUFs represent an 'average-profitability' industry but a 'low-risk' industry.

5.5 Trends

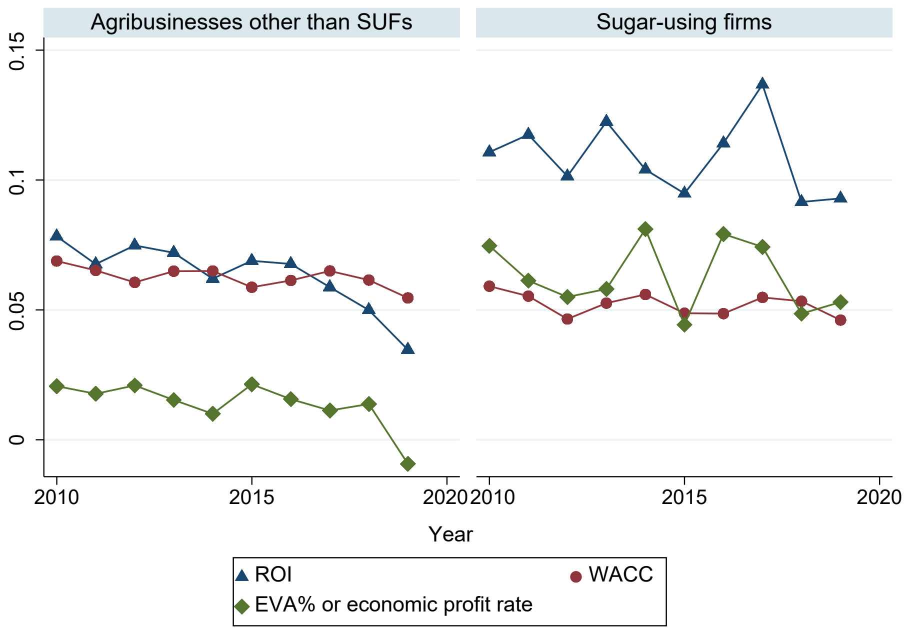
All the analysis above was conducted by comparing the median of financial metrics across portfolios during the decade of study. In this section, we asked whether the SUFs portfolio's high profitability and low risk are affected by high profits, particularly clustered around a few years. We calculated the median of accounting profit ROI, risk proxy WACC and economic profit proxy EVA% each year and plotted these metrics.

Figure 1 shows that, in general, profitability (*ROI*) for SUFs is above 10%, except for three years when ROI is slightly below 10%. This contrasts with median *ROI*s in AGB, which are

	SUFs	AGB	ALL
ROI	1	13	14
WACC	2	3	13
EVA%	1	10	12

Note(s): ROI and EVA% were ranked separately across 18 industries or portfolios from highest to lowest. WACC was ranked from lowest to highest
Source(s): Author's own creation/work

Table 6. Ranking positions of profitability and risk metrics across portfolios, 2000–2019



Source(s): Author's own creation/work

Figure 1. Profitability and risk metrics for SUF and AGB, 2000–2019

between 5 and 10%, with one exception. *WACC* is relatively stable during the decade and similar for both SUFs and AGB. In addition, the *ROI* of SUFs is far above *WACC* every year (generating relatively high *EVA%*). In contrast, the *ROI* of AGB is some years similar or even slightly below *WACC* (generating EVA% around zero some years). Figure 1 confirms the previous results and shows that SUFs' financial performance has been solid and stable over the last decade.

5.6 Robustness tests

While soft drink firms use real sugar (sucrose) for some of their products, they also use high fructose corn syrup (HFCS) as a sweetener in many beverages. To test the robustness of our results and eliminate any possibility of HFCS being utilized primarily by companies rather than sugar, we removed soft drink companies from the SUFs portfolio and instead added them to the AGB portfolio and recomputed all financial metrics. Results are provided upon request to the authors.

While the results changed slightly, the quality of the overall conclusion remains the same for every financial metric. Specifically, profitability decreases a little for SUFs and increases for AGB. However, SUFs' profitability is still statistically higher (e.g. SUFs' ROI moves from 11.1% to 10.3% and from 6.6% to 6.8% for AGB). Similarly, the net margin for SUFs decreases from 8.0% to 7.6% for SUFs and moves from 2.6% to 2.7% for AGB (similar minor changes are observed for other drivers of profitability). EVA% margin goes down from 6.1% to 5.9% for SUFs and increases from 1.4% to 1.8% for AGB. Regarding rankings of financial performance across industries, SUFs' positions do not change. Still, the AGB portfolio improves a little when soft drink firms are included, moving from position 13 to 9 in terms of ROI, and from 10 to 8 in terms of EVA margin, remaining in position 3 in terms of cost of capital. Finally, no changes in trend over time are distinguishable.

6. Conclusions

American sugar farmers rely on a strong US sugar program to limit unrestricted amounts of heavily-subsidized global sugar into the United States. Such global sugar generally trades below the cost of production, indicating the degree of subsidization. The SUA, which represents American food and beverage manufacturers who produce SCPs, contend that current sugar policies in the US hinder their business. However, this study shows that SUFs represent a portfolio of highly profitable–profitability measured by accounting and economic profits–and low-risk firms relative to peers and the whole US market. Specifically, over the 2010–2019 period, sugar-using firms had the highest accounting profit rate (ROI) and economic profit rate (EVA%) and the second lowest risk level (WACC) among all F&F industries, a robust result that has spanned across the decade.

While due to a lack of data, this study did not measure the US sugar program's costs and benefits accruing to SUFs, the results of our research that indirectly address the cost/benefits concern suggest that sugar program benefits (e.g. firm's risk reduction, increased profits predictability, conditions for a reliable supply of sugar at less volatile prices, and help to finance distribution that contributes to just-in-time deliveries of sugar [13]) offset the cost (e.g. the inability of SUFs to have access to sugar in the world sugar market at artificially low prices) of the program on those firms. Furthermore, given that SUFs' overall economic performance is far superior to their peers and SUFs' economic profit rates are positive and relatively high, we do not find support for the SUA's long-held accusation that the US sugar program is "a bad deal for American food and beverage manufacturers." On the contrary, our results suggest that current sugar policies in the United States are not likely to hinder the economic performance of SUFs, but may be facilitating improved performance.

The more direct implication of this study is that it supports and provides complementary explanations to previous research findings that there is no evidence that the US sugar program negatively affects SUFs' economic profitability. Also, this study opens the question as to what factors other than a reliable supply of a key ingredient–sugar–may help explain why SUFs perform far better economically than other US industries. Finally, but not less importantly, the study offers a financial analysis framework that is parsimonious yet comprehensive, covering accounting and economic profits, peer comparisons and trend analysis. Such a framework could be employed to analyze the impacts of policies or other economic shocks on a group of firms within agribusiness or other industries.

Notes

1. Sales of chocolate and candy hit an all-time high in 2021, reaching $36.9bn, which doesn't count the sales of other sugar-containing food products (refer to: https://www.prnewswire.com/news-releases/sales-of-chocolate-and-candy-hit-all-time-high-301501800.html).
2. The USDA forecasts that for the 2022/2023 crop year, the US sugar production will represent 4.5% of the world sugar production, US sugar consumption will be 6.4% relative to total consumption, and as a net importer, US imports will be 5.4% of total world imports (USDA FAS, 2022).
3. https://docs.wto.org/dol2fe/Pages/FE_Search/FE_S_S006.aspx?Query=(@Symbol=%20wt/ds580/*)&Language=ENGLISH&Context=FomerScriptedSearch&languageUIChanged=true#. Accessed on 03/10/23.
4. The importance of a reliable and resilient sugar supply chain was proven during the COVID pandemic because without such supply SUFs would have had their operations affected, resulting in lost jobs and shortages of staple goods at grocery stores (American Sugar Alliance, 2021).
5. Estimated by authors using price series available on the USDA ERS website (USDA ERS, 2023).
6. Data from early 2020 (January and February) were included. We excluded data from financial reports filed beginning March 2020, when COVID-19 was declared a pandemic.
7. The sample has only firms/observations with ISO Country Code "USA" in COMPUSTAT.
8. Details of all F&F classifications are provided at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
9. Available at: https://www.sec.gov/edgar.shtml
10. The 18 portfolios include 16 F&F industries (the F&F industries excluding the financial sector), SUF and ALL.
11. Rates available at: https://home.treasury.gov/resource-center/data-chart-center/interest-rates/TextView?type=daily_treasury_long_term_rate&field_tdr_date_value=2000
12. The dependent variable is a financial metric and the explanatory variable is a group variable taking values of 0 for the AGB portfolio (the reference) and 1 for the SUFs portfolio.
13. In financial terms, these benefits imply less fixed asset and working capital investments in SUFs balance sheets, SUFs incurring lower operating and financing expenses, and therefore obtaining higher profits that they would have in the absence of the US sugar program.

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Appendix

Table A1. The agribusiness industry by sub-industries according to Fama and French's 17 industries classification

SIC codes	Sub-industries
0100–0199	Agricultural production - crops
0200–0299	Agricultural production - livestock
0700–0799	Agricultural services
0900–0999	Fishing, hunting and trapping
2000–2009	Food and kindred products
2010–2019	Meat products
2020–2029	Dairy products
2030–2039	Canned and preserved fruits and vegetables
2040–2046	Flour and other grain mill products
2047–2047	Dog and cat food
2048–2048	Prepared feeds for animals
2050–2059	Bakery products
2060–2063	Sugar and confectionery products
2064–2068	Candy and other confectionery
2070–2079	Fats and oils
2080–2080	Beverages
2082–2082	Malt beverages
2083–2083	Malt
2084–2084	Wine
2085–2085	Distilled and blended liquors
2086–2086	Bottled-canned soft drinks
2087–2087	Flavoring syrup
2090–2092	Misc. food preparations and kindred products
2095–2095	Roasted coffee
2096–2096	Potato chips
2097–2097	Manufactured ice
2098–2099	Misc. food preparations
5140–5149	Wholesale - groceries and related products
5150–5159	Wholesale - farm product raw materials
5180–5182	Wholesale - beer, wine and distilled alcoholic beverages
5191–5191	Wholesale - farm supplies

Source(s): Author's own creation/work, based on NAICS (https://www.census.gov/naics/) and Fama and French's 17 industries classification
Fama and French's 17 industries classification. Available in: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_17_ind_port.html

Table A2. Extracts of 10K selected reports and firms in this study on which SCP firms mention sugar as relevant for their business

Name of company	Extract from 10K report
B&G Foods Inc	"The principal raw materials for our products include corn, peas, broccoli, oils, beans, pepper, garlic and other spices, maple syrup, wheat, corn, nuts, cheese, fruits, beans, tomatoes, peppers, meat, sugar, concentrates, molasses and corn sweeteners."
Coca Cola Consolidated Inc	"Certain jurisdictions in which our products are sold have imposed, or are considering imposing, taxes, labeling requirements or other limitations on, or regulations pertaining to, the sale of certain of our products, ingredients or substances contained in, or attributes of, our products or commodities used in the manufacture of our products, including certain of our products that contain added sugars or sodium, exceed a specified caloric count or include specified ingredients such as caffeine."
Conagra Brands Inc	"We purchase commodity inputs such as wheat, corn, oats, soybean meal, soybean oil, meat, dairy products, nuts, sugar, natural gas, electricity and packaging materials to be used in our operations. These commodities are subject to price fluctuations that may create price risk."
Flowers Foods Inc	"Our primary baking ingredients are flour, sweeteners, shortening, yeast and water."
General Mills Inc	"The principal raw materials that we use are grains (wheat, oats and corn), dairy products, sugar, fruits, vegetable oils, meats, nuts, vegetables and other agricultural products."
Hershey Co	"We also use substantial quantities of sugar, corn products, Class II and IV dairy products, wheat products, peanuts, almonds and energy in our production process."
J & J Snack Foods Corp	"Our most significant raw material requirements include flour, packaging, shortening, corn syrup, sugar, juice, cheese, chocolate and a variety of nuts."
Kellogg Co	"Agricultural commodities, including corn, wheat, rice, potato flakes, vegetable oils, sugar and cocoa, are the principal raw materials used in our products."
Kraft Heinz Co	"We purchase and use large quantities of commodities, including dairy products, meat products, coffee beans, soybean and vegetable oils, sugar and other sweeteners, tomatoes, potatoes, corn products, wheat products, nuts and cocoa products, to manufacture our products."
Mondelez International Inc	"We purchase and use large quantities of commodities, including cocoa, dairy, wheat, palm and other vegetable oils, sugar and other sweeteners, flavoring agents and nuts."
Monster Beverage Corp	"The principal raw materials used in the manufacturing of our products are aluminum cans, aluminum cap cans, sleek aluminum cans, aluminum cans with re-sealable ends, PET plastic bottles, caps, as well as flavors, juice concentrates, glucose, sugar, sucralose, milk, cream, protein, coffee, tea, supplement ingredients and other packaging materials, the costs of which are subject to fluctuations."
Post Holdings Inc	"The principal ingredients for most of our businesses are agricultural commodities, including wheat, oats, rice, corn, other grain products, vegetable oils, dairy- and vegetable-based proteins, sugar and other sweeteners, fruit and nuts."
Rocky Mountain Choc Fact Inc	"The principal ingredients used in our products are chocolate, nuts, sugar, corn syrup, cream and butter."

Source(s): Author's own creation/work, based on the firms' 10K reports

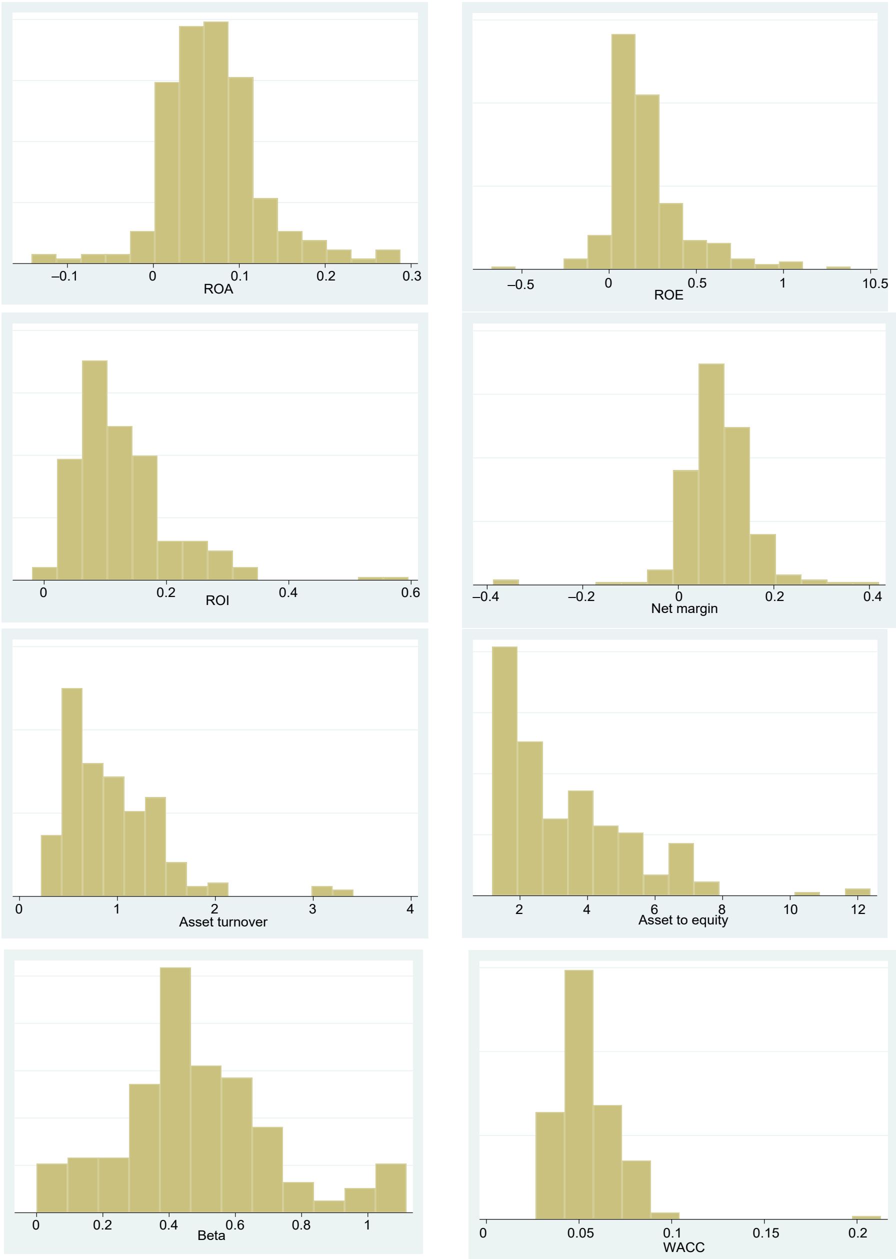

Figure A1.
Distributions of the financial metrics of SUFs

(*continued*)

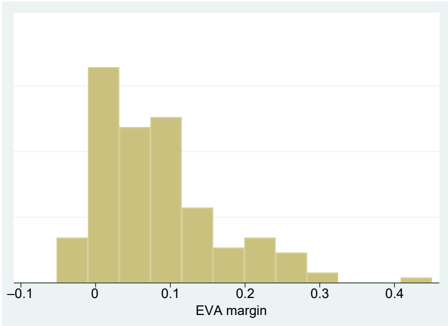

Figure A1.

About the authors

Dr. Carlos J.O. Trejo-Pech is an Associate Professor of Agribusiness Finance at the University of Tennessee at Knoxville. He received his PhD in Food and Resource Economics with a minor in finance from the University of Florida. He holds an M.S. in Business Finance and a MABM in Agribusiness from Mississippi State University. Trejo-Pech's research work has been published in Agribusiness: An International Journal, American Journal of Agricultural Economics, Agricultural Finance Review, Journal of Economics and Finance, among others. Dr. Trejo-Pech is currently a managing editor for the International Food and Agribusiness Management Review and co-editor of the Journal of Food Distribution Research. Carlos J.O. Trejo-Pech is the corresponding author and can be contacted at: ctrejope@utk.edu

Dr. Karen L. DeLong is an associate professor at the University of Tennessee in the Department of Agricultural and Resource Economics. She earned her Ph.D. in Business Administration (Agribusiness) from the W. P. Carey School of Business at the Arizona State University in 2014, her M.S. in Agricultural, Food and Resource Economics at the Michigan State University in 2010, and a B.S. in Mathematics and Economics at the Western Michigan University in 2008. She researches livestock economics, experimental economics, international trade and food policy.

Dr. Robert Johansson serves as the Associate Director of Economics and Policy Analysis for the American Sugar Alliance, the national coalition of sugarbeet and sugarcane growers, processors and refiners. Previously, Dr. Robert Johansson was the Chief Economist for the U.S. Department of Agriculture. Dr. Johansson served in that role from January 2015 to January 2021. He has also served as an economist with several government agencies, including USDA's Economic Research Service, the Office of Management and Budget, the Congressional Budget Office and the White House Council of Economic Advisers. Dr. Johansson received his Ph.D. in Agricultural and Applied Economics from the University of Minnesota in 2000. His research has spanned a wide range of issues, including biofuels policy, water quality and quantity policies, regulatory economics, food security and regional modeling of agricultural systems.