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Sizing Of The Brazilian Sugar Manufacturing Sector And Economic Impacts Of Its Exports

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Abstract:
The study aims to measure the production chain of the sugar manufacturing and refining sector and the economic impacts of exports on the Brazilian economy. The methodology is based on the input-output matrix of the year 2018. The sugar production chain in Brazil was divided into three aggregates: Inputs, Sugar manufacturing and refining sector (industry), and Services. The results show that the aggregate Inputs is the aggregate that generates the most jobs, however, the average wage is the lowest of the three aggregates of the sugar production chain. The industry aggregate is the one that generates the most taxes. Sugar exports reached R$16.6 billion in 2018, contributing R$13 billion in income (GDP) and R$1.7 billion in net taxes. The estimated values can support the development of policies for the sugar production chain and improve its performance in the international market.

Key Word*: Input-output; Gross Domestic Product; Remunerations, Taxes; Jobs.*

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I. Introduction

The farming activity, traditionally organized as a family-based operation and guided by farmers, has undergone changes in Brazil and other parts of the world over time. These changes have been motivated by shifts in the market, increased production, and the consequent appreciation of assets associated with these activities. In this context, there is also a reality of professionalization in the management of rural enterprises, with a more intensive exploration of economies of scale and scope. This necessitates capital, which at times exceeds the capabilities of individual investors, requiring the organization of groups to support this dynamic economic activity (Nogueira & Zylbersztajn, 2015).

Since 1990, agribusiness in Brazil has experienced a rapid growth phase in production, leveraging technological advancements to increase productivity. This growth has been driven by external demand, particularly for agricultural commodities, as well as the rehabilitation of previously unusable land and the adoption of intensive production technologies, institutional advancements, and improved access to credit (Bacha et al., 2015). However, in the context of Brazil's economic growth, the secondary sector (manufacturing) has often been seen as synonymous with modernization, with agriculture being viewed as a secondary sector of lesser importance (Barros, 2014).

Sugarcane is the oldest agricultural crop in Brazil, introduced in 1532, marking nearly 500 years of existence. Its agro-industrial activities yield three main products: sugar, essential for food security; ethanol; and cogeneration of electricity using sugarcane bagasse, contributing to national energy security (Szmrecsányi, 1979; Neves, 2014; Shikida & Cattelan, 2020). According to data from the Sugar Cane Industry Union (UNICA, 2022), in the 2020/2021 crop season, sugarcane was cultivated on 8.6 million hectares, with an average productivity of 76 tons per hectare. Brazil produced approximately 657 million tons of sugarcane, leading to the production of 41.5 million tons of sugar (the world's largest producer) and 32.5 billion liters of ethanol (the second-largest producer globally).

The sugar refining and manufacturing sector, due to its historical significance (Rissardi Júnior, 2015), competitive strategies (Vian, 2003; Ferreira et al., 2019), and international competitiveness indicators (Nhesini et al., 2013), requires updated economic analyses. Therefore, this study aims to analyze the sugar refining and manufacturing sector and its economic impact on the Brazilian economy, using the most recent available input-output matrix from 2018 as a basis. The objectives of the study are to: a) demonstrate the size of the sugar refining and manufacturing sector in terms of its three aggregates (inputs, industry, and services), value added to the gross domestic product, employment, income, remuneration, and taxes; b) estimate the sector's contributions to production, employment, incomes, taxes, and the Rasmussen and Hirschman intersectoral

linkage index; c) estimate the national economic impact of the sugar refining and manufacturing sector in the context of exports.

II. Material And Methods

The input-output matrix used for this search presented 68 economic sectors and 128 products for the 2018 year. The matrix was provided by the Regional and Urban Center. This matrix was estimated in 2021 based on the last publication of the national account system made by the National Brazilian Institute of Geography and Statistics (IBGE – in Portuguese) in November 2020, with the base year being 2010. For the construction of this matrix, the methodology of Guilhoto & Sesso Filho (2010; 2005) was used as a theoretical reference.

The estimate of the GDP of the sugar agribusiness was based on the methodology described in the work of Furtuoso, Barros, and Guilhoto (1998), in which the agricultural production chain is analyzed backward and forward. The methodology was applied to data from Brazil in 2018 with the input-output matrix sector x technology sector based on the industry.

Sugar agribusiness is composed of the aggregates (I) Inputs, (II) Manufacture and refining of sugar, and (III) Trade and services. The measurement of aggregate I begins by multiplying the values of the columns of the inputs used by the Sugar manufacturing and refining sector by the respective value-added coefficients (VACi), where i = 68 sectors. The GDP of aggregate I is calculated by:

$$GDP_I = \sum_{i=1}^{n} p_i \times VAC_i \quad (1)$$

GDP is the GDP of aggregate I (inputs),
pi is the total input value of sector i for Sugar manufacturing and refining and
VACi is the value-added coefficient of sector i.

The Value-Added Coefficients (VACi) are obtained by dividing the Value Added at Market Prices of each sector 1 (VA_{PM}) by the respective production (Xi):

$$VAC_i = \frac{VA_{PM_i}}{X_i} \quad (2)$$

The measurement of Aggregate II considers in the calculation the Value Added of the Sugar Manufacturing and Refining sector. It is then necessary to:

$$GDP_{II} = VAFA_{PM} \quad (3)$$

GDP is the GDP of aggregate II (Sugar manufacturing and refining) and

$VAFA_{PM}$ is the Value Added of the Sugar Manufacturing and Refining sector, the other variables are as defined above.

The estimate of Aggregate (III) considers the Value Added of the sectors related to Transportation, Trade and Services segments. The share related to sugar agribusiness of the total Value Added of the trade and services sectors is calculated by the share of the Sugar manufacturing and refining sector in the final demand. The process of calculating the Value Added of the Aggregate (III) begins with the definition of the Domestic Final Demand (DFD):

$$DFD = \text{GFD} - IIL_{FD} - PI_{FD} \quad (4)$$

DFD is the domestic final demand.
GFD is the global final demand.
IIL_{FD} are the net indirect taxes paid for the final demand.
PI_{FD} are the imports for final demand.

[1] Value Added at market prices is obtained by adding the value added at basic prices to indirect taxes net of subsidies on products, resulting in the following expression:
$VA_{PM} = VA_{PB} + IIL$. Where: VA_{PM} = Value Added at Market Prices; VA_{PB} = Value Added at Basic Prices; IIL = Net Indirect Taxes

The trading margin of the trade and services sectors (TM) is calculated by:

$$TM = VAT_{PM} + VAC_{PM} + VAS_{PM} \quad (5)$$

TM is the trading margin.
VAT_{PM} is the value added of the transport sector at market prices.
VAC_{PM} is the value added of the trade sector at market prices.
VAS_{PM} is the value added of the services sector at market prices.

The trading margin (TM) and the Domestic Final Demand (DFD) are used in the calculation of the aggregate of Trade and Services (Distribution of sugar agribusiness products):

$$GDP_{III} = TM \times \frac{DFA}{DFD} \quad (6)$$

GDP_{III} is the GDP of aggregate III.
DFD is the domestic final demand.
DFA is the final demand of the Sugar Manufacturing and Refining sector.

The total GDP of sugar agribusiness is given by the sum of its aggregates, we have that:

$$GDP_{SUGAR} = GDP_I + GDP_{II} + GDP_{III} \quad (7)$$

GDP_{SUGAR}: GDP of sugar agribusiness.

Export impact analysis

From Leontief's basic model, we have:

$$L = (I - A)^{-1}E \quad (8)$$

L is the Leontief impact matrix with a sector-by-sector focus of dimension m x m (m is the number of sectors) and its elements are l_{ij},
A is the matrix of technical coefficients m x m and its elements are a_{ij}.
$A = Z(\hat{X})^{-1}$, where Z_{ij} is the money flow between sectors i and j.
E is the vector of exports by sector.

It is possible to measure the impact that exports have on total production, employment, taxes, remuneration, value added, among others. Thus, it would be necessary to:

$$\Delta X = (I - A)^{-1}\Delta E \quad (9)$$

$$\Delta V = \hat{v}\Delta X \quad (10)$$

Where ΔE and ΔQ are vectors (mx1) that show, respectively, exports and the impacts on the volume of production by sector, while it is a vector ΔV(mx1) that represents the impact on any of the variables discussed above, i.e., employment, imports, taxes, wages, value added, among others. It is also a diagonal matrix $\hat{v}$(mxm) in which the elements of the diagonal are the coefficients of employment, taxes, remuneration, value added, among other factors (fi), which are obtained by dividing the value used of these factors by the total production of the corresponding sector (xi), that is:

$$v_i = \frac{f_i}{x_i} \quad (11)$$

To obtain the impact on the total volume of production, and of each of the variables that are being analyzed, all the elements of the vectors and $\Delta Q \Delta V$.

Multipliers

Based on the direct coefficients and Leontief's inverse matrix, it is possible to estimate for each sector of the economy how much is generated directly and indirectly from employment, imports, taxes, wages, value added or other variable under analysis for each monetary unit produced for the final demand (Miller and Blair, 2009). That is:

$$G_j = \sum_{i=1}^{n} l_{ij} v_i \quad (12)$$

G_j is the total impact, direct and indirect, on the variable.

l_{ij} is the ij-th element of the inverse Leontief matrix and

v_i is the direct coefficient of the variable in question, given where $v_i = \frac{f_i}{x_i}$ is the value of the variable (employment, wages, income, taxes) and xi is the total output of the sector.

The production multiplier that indicates how much is produced for each monetary unit spent on final consumption is defined as:

$$MP_j = \sum_{i=1}^{n} l_{ij} \quad (13)$$

Where MP_j is the production multiplier of the is the jth sector and the other variables are defined as previously stated.

Rasmussen/Hirschman Intersectoral Linkage Indices

From Leontief's basic model and following Rasmussen (1956) and Hirschman (1958), it is possible to determine which sectors have the greatest linking power within the economy. This means we can calculate both the indices of backward linkages, showing what a sector demands from others, and forward linkages, indicating the quantity demanded from other sectors by the sector in question.

Thus, defining it as an element of the inverse Leontief matrix l_{ij}, L* is the mean of all the elements of L. L_{*j}, L_{i*} are respectively the sum of a column and a row of L, backward and forward indexes are calculated:

$$U_j = \left[L_{*j}/n\right]/L^* \quad (14)$$

$$U_i = [L_{i*}/n]L^* \quad (15)$$

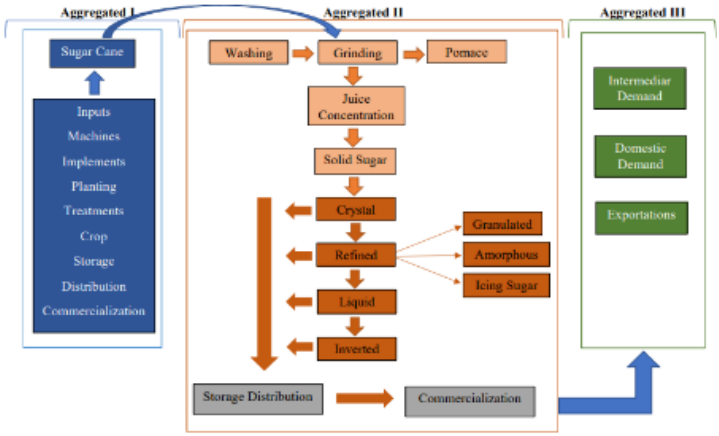
Index values greater than one are considered key sectors in the economy.

The focus of this study will be analyzing the fabricating and refining sugar sector because there is a lack of studies that focus on sizing and dimensioning and the impacts of exports specifically for the fabricating and refining sugar sector. With this, it is possible to explore the productive chain of this sector using as a base the results that will be found using the indicators presented in the next topics (dimensioning the productive chain of sugar, impact analysis of exports, multipliers, intersectoral linkage Rasmussen-Hirschman index).

III. Result

The sugar production chain begins even before the sugarcane is planted, as can be seen in Figure 1. Industries of agricultural inputs, implements, machinery, and equipment, as well as industrialized inputs and packaging industries, benefit from the demand for supplements that help in the production and distribution of sugar. Through these supplements, planting, treatment, and harvesting represent the productive inputs that precede the plant. At the plant, the washing and grinding stages offer the concentration of the juice that leads to the generation of sugarcane products such as alcohol, by-products, and sugar. Figure 1 represents the main sugar chain because it is the focus of the sector analyzed in this research – sugar manufacturing and refining.

Figure 1. Sugar Manufacturing and Refining Industry Production Chain.



Font: Elaborated by authors based on Oliveira (2017); Bianchini & Assumpção (2002) and Alves (1997)

Sugar mills diversify their production by distinguishing sugar, providing greater added value. Solid sugar generates crystal sugar, produced directly in the mill. Its state is in crystalline form and without refining, and its destination is for general use in the food industry. Refined sugar is subdivided into granulated sugar, which is free of dyes and caking and of high purity, intended for the pharmaceutical and food industry; amorphous sugar has fast dissolution, fine granulometry, and great whiteness and is intended for domestic consumption and the food industry; and powdered sugar and used in the food industry (Bianchini & Assumpção, 2002).

Liquid sugar is generated, which is the aqueous solution of sugar, a natural sucrose sweetener with the same sweetening power as solid sugar, used in pharmaceutical industries and in clear beverages (food industry); and invert sugar, also in liquid form, is differentiated by being resistant to microbiological contamination, widely used in the food industry to reduce the risks of glucose crystallization. The storage and distribution of sugar are done according to its specification, customer needs, and distance traveled, facts that impact the quality of the product and consequently the commercialization with the national and international market (Neves et al., 2010).

The industry aims for productivity and efficiency in the production and distribution processes within their input chain, where raw materials are transformed into final products. The added value creates an efficient distribution chain for sugar in both the domestic and external markets. Following Penrose (1959), Porter (1990), and Ballou (2001), a diversified industry can complement its productivity without abandoning old products, improving the variety of final products manufactured and enhancing the integration of the production chain. The results for dimensioning the productive chain of the sugar manufacturing and refining sector and its aggregates, in terms of income generation (GDP), taxes, tax/GDP/revenue ratio, employment, and average annual remuneration are presented in Table 1.

Table 1. Dimensioning of the production chain of the sugar manufacturing and refining sector in Brazil, 2018

Variable	(I) Inputs	(II) Industry	(III) Services	Total
Gross Domestic Product (billion)	R$ 20.6	R$ 8.3	R$ 15.3	R$ 44.2
Taxes (billion)	R$ 3.5	R$ 3.1	R$ 1.3	R$ 7.9
Tax/GDP (%)	17%	37.3%	8.5%	17.9%
Remuneration (billion)	R$ 5.3	R$ 8.6	R$ 8.6	R$ 22.5
Employment (unity)	562,388	154,151	255,201	971,740
Average annual remuneration	R$ 9,424	R$ 55,789	R$ 33,698	R$ 23,154

Following the information shown in Table 1, the total GDP of the productive chain of fabricating and refining the sugar sector was 44.2 billion for the year 2018. It is verified that the highest participation is in inputs (aggregate I), representing 20.6 billion, which is 46.61% of the total value, followed by services (aggregate III) with 15.3 billion, corresponding to 34.62% of GDP, and the industry (aggregate III) with a representativity of 8.3 billion, representing 18.78% of the total. The emphasis on inputs in the GDP participation of the fabricating and refining sugar sector can be explained because it includes a series of other sectors that support the national production of sugar, as seen in Figure 1.

It is possible to see that the fabricating and refining sugar sector represented a tax contribution in this period of approximately 7.9 billion, which is 17.9% of the GDP. With this, the Inputs aggregate represents a contribution of 3.5 billion and the industry 3.1 billion. In other words, the tax burden of primary and secondary activities is close to each other. However, analyzing the production in relation to the GDP of each aggregate, it can be noted that the inputs aggregate is approximately 17%, while the industry is 37.3%.

Despite the reduced workforce in the sugar cane sector offered in the wealthier regions of Brazil due to agricultural mechanization (Oliveira, 2011), this study found that the sector created a total of 22.5 billion in formal salaries and employed 971,740 people with formal direct jobs. This shows that the job and income generation provided by sugar production is crucial for the development of the region, as this money can stimulate other activities (Defante et al., 2018).

Aggregate III (services) is the aggregate with the lowest expenditure in tax generation compared to the other aggregates, at 1.3 billion, representing approximately 8.5% in relation to the GDP generation of the aggregate (15.3 billion). However, this aggregate has good visibility in terms of paid remuneration, reaching approximately 8.6 billion and generating 255,201 formal direct jobs.

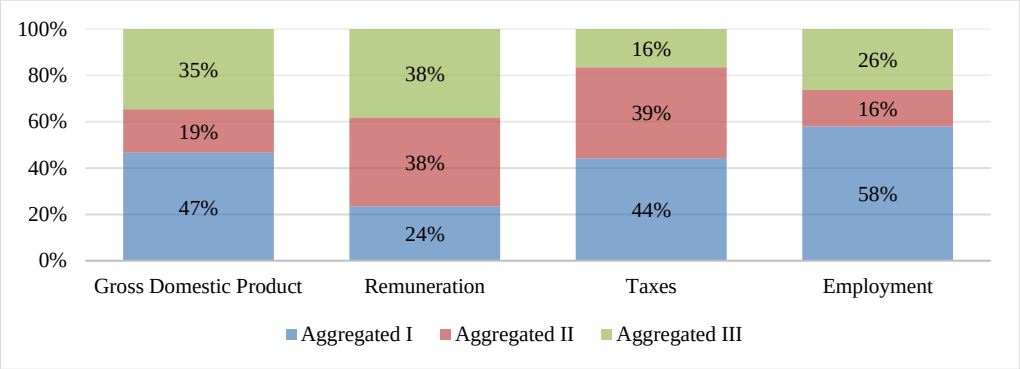
The industry (aggregate II) of the fabricating and refining sugar sector stood out as the least job creator, although it had the highest average annual remuneration of R$ 55,789. Junqueira et al. (2009) mentioned that the increased application of technology in the industry is motivated by the desire to reduce labor costs, as labor is the most expensive component for the aggregate. Despite the industry having the lowest contribution to the GDP generation of the sugar productive chain, it had the highest contribution to tax payments in relation to GDP, corresponding to 37.3% of the total. According to Umbellino et al. (2014), there are many taxes levied on sugar cane production. The industry adds the most value to the product and has the highest tax burden, with strict government oversight and tax substitution and deferral mechanisms.

The Inputs aggregate represents the largest job creator with 562,388 or 57.87% of the total among aggregates, however, it is the aggregate with the lowest income. Out of the total income of 22.5 billion in the sector, aggregate II represents only 5.3 billion, approximately 23.55%, with an annual average corresponding to a monetary value of R$ 9,424.00.

Junqueira et al. (2009) study shows that the expansion of sugar cane agriculture led to a shortage of workforce, which was redistributed from one region to another in Brazil. During this shortage, the average salary was around R$ 750.00 per month, including productivity bonuses. The author observed a trend of low wages in the production of inputs in the sugar productive chain, indicating an opportunity for investments in workforce training to increase work productivity and average remuneration in aggregate I. Additionally, Augusto et al. (2012) noted in their study that industry made significant investments in innovation and technology, particularly in agricultural, industrial, and administrative areas.

In Figure 2, the percentage representativity of the results mentioned in Table 1 is presented, making it evident and illustrative. It is noticeable that the process of generating value in the fabricating and refining sugar sector primarily occurs in the first aggregate, indicating the importance of the inputs sector in the productive chain. Regarding remuneration, aggregates II and III have the same representativity. The industry (aggregate II) is the main contributor to the tax burden in terms of remuneration percentage. As noted in the study by Sesso et al. (2021), this result can be an indicator for generating benefits and strategies using tax reduction or compensation to boost sugar production, which will have impacts on the entire productive chain.

Figure 2. Participation of aggregates in the sugar production chain in the generation of Gross Domestic Product, Remuneration, Taxes and Employment, 2018



The table 2 presents the results for the others economic indicators appointed in the methodology, the values were obtained using a variation of a million of real in the final demand. These results show the impacts of sector about the production, employment and remuneration, being possible analyze this variable with a strategic view.

Table 2. Economic indicators based on the input-output matrix of the sugar manufacturing and refining sector in Brazil, 2018 (R$ millions)

Indicator	Sugar manufacturing and refining sector	Media of economy
Production generation	2.38	1.81
Employment generation	17.13	14.73
Income generation (GDP)	0.78	0.78
Net taxes generation	0.10	0.10
Remuneration generation	0.37	0.40
Backward Indexes	1.32	1.00
Forward Indices	0.67	1.00

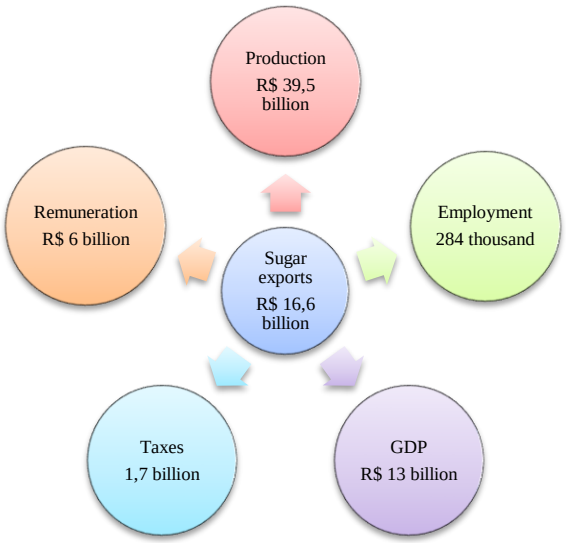
The production multiplier is compatible with the induced production resulting from a monetary increase. In this case, for each million reais generated by the final demand in the fabricating and refining sugar sector, approximately 2.38 million reais are produced in the economy. For the employment and remuneration multiplier, for every million reais variation in the final demand in the fabricating and refining sugar sector, approximately 17 million new jobs are generated with a total remuneration of 370 thousand reais. These results align with the dimensioning presented in Table 1, demonstrating higher employability compared to other Brazilian economic sectors, albeit with lower remuneration, 300 thousand reais lower than the average of other Brazilian sectors.

In 2018, the sector contributed 780 thousand reais to the GDP of the Brazilian economy and approximately 100 thousand reais in net taxes for each variation of one million reais in the final demand, similar to the average of other Brazilian economic sectors. Therefore, there are advantages in increasing sector performance by generating higher-paying jobs (aggregate II) and restructuring tax policies, as both impact the value added in the sugar industry, as also identified in the Sesso et al. (2021) study.

Table 2 presents the results related to the Rasmussen-Hirschman linkage index backward and forward, indicating key sectors as described in Guilhoto (2011). Sectors with a linkage index above 1 in either direction are considered essential for the economy, while sectors with primarily backward linkages have the potential to drive economic growth (McGilvray, 1977). The fabricating and refining sugar sector has a backward linkage index of 1.32, above the average, making it a key sector and an economic stimulator that relies on other productive sectors. Stimulating this sector requires interconnected sectors to increase production to meet demand, as failure to do so could lead to inflation or increased imports. The results support those identified in Table 1, indicating that aggregate I (inputs) is the main value multiplier in the production chain. Figure 1 shows sectors that contribute to aggregate I and are active suppliers to the fabricating and refining sugar sector. Analyzing the results in Table 2 highlights the sector's potential for the national economy. According to the study by Yusuf et al. (2018) on the fabricating and refining sugar sector in São Paulo state in 2011, there was economic leverage for sectors supplying inputs but not as significant for the state's productive structure.

Figure 3 illustrates the sector's export impacts. Total exports amount to 16.6 billion reais, generating 39.5 billion reais in production for the national economy, creating 284 thousand direct and indirect formal jobs with a total remuneration of billion reais. These contributions result in 13 billion reais in remuneration generation (GDP) and 1.7 billion reais in net taxes.

Figure 3. Economic Impacts of Brazil's Sugar Exports, 2018



The findings of the study confirm the competitiveness of Brazilian sugar in the international market. The study by Dias, Gibbert et al. (2006) shows that Brazil was responsible for 40.61% of sugar commercialization in the international market in 2005, indicating that the product has competitive advantages over other products and countries. However, Mazzuchetti & Shikida (2017) identified that Brazil has competitive advantages compared to other countries that export sugar, despite restrictions such as quotas and subsidies that limit commercialization and exportation. On the other hand, studies by Willers et al. (2004) and Mazzuchetti & Shikida (2017) have shown that despite the lower cost of sugar production, its exportation is hindered by protectionist barriers imposed by countries and economic trade blocs, leading to a decrease in the exported amount. As noted by Rissardi Júnior (2015), sugar faces challenges in international markets due to production by almost every country, regulations, government interventions, and preferential agreements.

Throughout Brazilian sugar history, sugar has been a key product that has propelled the country into various regions worldwide and remains one of the principal products in the national export sector. The findings of this study highlight the sugar manufacturing and refining sector as an important creator of jobs and income, contributing to GDP growth and national exports. State collaboration in establishing policies to reduce taxes on industrialization and enhance professional training is essential to stimulate production and support the sector within the Brazilian economy.

IV. Conclusion

The purpose of this article was to analyze the manufacturing and refining sugar sector and its economic impacts on the Brazilian economy using data from the input-output matrix of the 2018 year. The context of the sugar agribusiness within the national productive chain was outlined. The results showed that the manufacturing and refining sugar sector had the highest participation in GDP generation by inputs (aggregate I), representing 46.61% of the total value. This aggregate was also the largest job creator, accounting for 57.87% of the total. However, despite this, aggregate I had the lowest remuneration, with only 22.5 billion reals paid, of which just 5.3 billion was allocated to inputs, equivalent to 9,486 reals on average annually.

Furthermore, the sector showed high job and production generation, contributing to better economic performance. However, the income paid was low, especially in aggregate I, indicating the need to improve the qualifications of the workforce to increase remuneration. This could be achieved by reducing or compensating taxes and enhancing industry productivity through the adoption of new technologies. In terms of economic indicators, the sector had a back ligation index result of 1.32, above the average, making it a key sector in the economy that drives other sectors. However, in terms of the linkage index (demand from other sectors), the manufacturing and refining sugar sector was not considered a key sector.

Sugar exports totaled 16.6 billion, representing a national production of 39.5 billion. This created 284 thousand indirect and direct jobs and remunerated 6 billion to workers in the productive chain. The sector contributed 13 billion reals to GDP and 1.7 billion reals in net taxes. In summary, the data presented underscore the importance of sugar production, distribution, and industrialization within the refining and manufacturing sugar sector of the productive chain. This is crucial both domestically and internationally, given the unique context of sugar exports and the challenges posed by customs barriers.

This study contributes to understanding the productive chain within the agribusiness sector, using the 2018 input-output matrix data for the manufacturing and refining sugar sector. The results confirm the significance of sugar to the Brazilian economy in a contemporary and dynamic manner. However, further targeted research is needed, particularly focusing on workforce specialization in the input sector, fiscal policies targeting aggregate II (industry), and trade agreements to expand sugar exports. Additionally, conducting a similar study on Brazilian ethanol, a key commodity derived from the sugar cane agribusiness, could provide valuable insights.

References

[1]. Alves, M. R. P. Logística Agroindustrial. In: Batalha, M. O. 1997. Gestão Agroindustrial. São Paulo: Editora Atlas, P. 139-212.
[2]. Augusto, C. A.; Takahashi, L. Y.; Sachuk, M. Y. 2012. A Influência Da Inovação Tecnológica Na Competitividade E Nas Relações De Trabalho Em Usinas De Açúcar E Álcool Paranaenses. Organizações Rurais & Agroindustriais, V. 14, N. 1, P. 1-14. Https://Doi.Org/10.22004/Ag.Econ.134188
[3]. Bacha, C. J. C. 2012. Economia E Política Agrícola No Brasil. 2ª Ed. São Paulo: Atlas.
[4]. Ballou, R. H. 2001. Gerenciamento Da Cadeia De Suprimentos: Planejamento, Organização E Logística Empresarial. Porto Alegre: Bookman.
[5]. Barros, G. S. C. De. Agricultura E Indústria No Desenvolvimento Brasileiro. In: Buainain, A. M.; Alves, E.; Silveira, J. M.; Navarro, Z. Eds. 2014. O Mundo Rural No Brasil Do Século 21. A Formação De Um Novo Padrão Agrário E Agrícola. Embrapa/Instituto De Economia Da Unicamp, P. 79-116.
[6]. Bianchini, V. K.; Assumpção, M. R. 2002. A Diferenciação De Produtos Na Cadeia Produtiva Do Açúcar: O Processo De Produção Dos Açúcares Líquido E Líquido Invertido. Abepro, Xxii Encontro Nacional De Engenharia De Produção. Curitiba.
[7]. Dias, L. C.; Gibbert, G. M.; Shikida, P. F. A. 2006. Competitividade Do Açúcar Brasileiro No Mercado Internacional. Revista De Economia E Agronegócio, V. 4, N. 4, P. 457-484. Https://Doi.Org/10.25070/Rea.V4i4.91
[8]. Defante, L. R.; Vilpoux, O.; Sauer, L. 2018. Evolução Da Produção De Cana-De-Açúcar No Estado De Mato Grosso Do Sul. Informe Gepec, V. 22, N. 1, P. 150–169. Https://Doi.Org/10.48075/Igepec.V22i1.17667
[9]. Furtuoso, M.C.O.; Barros, G.S. De C.; Guilhoto, J.J.M. 1998. O Produto Interno Bruto Do Complexo Agroindustrial Brasileiro. Revista Economia E Sociologia Rural, V.36, N. 3, P. 9-32.
[10]. Guilhoto, J. J. M.; Sesso Filho, U. A. 2010. Estimação Da Matriz Insumo-Produto Utilizando Dados Preliminares Das Contas Nacionais: Aplicação E Análise De Indicadores Econômicos Para O Brasil Em 2005. Revista Economia & Tecnologia, [S.L.], V. 6, N. 4. Http://Dx.Doi.Org/10.5380/Ret.V6i4.26912
[11]. Guilhoto, J.J.M, Sonis, M., Hewings, G.J.D. Martins, E.B. 1996. Linkages And Multipliers In A Multiregional Framework: Integration Of Alternative Approaches. Regional Economics Applications Laboratory. Discussion Paper 96-T-8. University Of Illinois.
[12]. Guilhoto, J.J.M. 2011. Análise De Insumo-Produto: Teoria E Fundamentos. Fea-Usp. São Paulo.
[13]. Guilhoto, J.J.M.; Sesso Filho, U. 2005. Estimação Da Matriz Insumo-Produto A Partir De Dados Preliminares Das Contas Nacionais. Economia Aplicada. V. 9. N. 2. P. 277-299.
[14]. Hirschman, A.O. 1958. The Strategy Of Economic Development. New Haven: Yale University Press.
[15]. Isard, W. 1951. Interregional And Regional Input-Output Analysis: A Model Of A Space-Economy. Review Of Economics And Statistics, N.33, P.319-328.
[16]. Junqueira, C. P.; Sterchile, S. P. W.; Shikida, P. F. A. 2009. Mudança Institucional E O Impacto No Padrão Tecnológico: O Caso Da Mecanização Da Colheita De Cana – De – Açúcar No Paraná. Organizações Rurais & Agroindustriais, Lavras Mg, V. 11, N. 1.
[17]. Leontief, W. 1988. A Economia Do Insumo-Produto. 3. Ed. Nova Cultural: São Paulo.
[18]. Leontief, W. 1987. Input-Output Analysis. Eatwell, J., M. Milgate, E P. Newman Eds.. The New Palgrave. A Dictionary Of Economics, V. 2, P.860-64.
[19]. Mazzuchetti, R. N.; Shikida, P. F. A. 2017. O Comércio Internacional Do Açúcar Sob A Perspectiva Do Modelo Gravitacional. Revista De Ciências Agrárias Lisboa, V.40, N.2, P. 471-482.
[20]. Mcgilvray, J. W. 1977. Linkages, Key Sector And Development Strategy. In: Leontief, W. Ed.. Structure, System And Economy Policy. Cambridge: Cambridge University Press. Cap. 4, P.49-56.
[21]. Miller, R.E.; Blair, P.D. 2009. Input-Output Analysis: Foundations And Extensions. Englewood Cliffs: Prentice-Hall.
[22]. Nereus. Núcleo De Economia Regional E Urbana Da Usp. Disponível Em: <Http://Www.Usp.Br/Nereus> Acesso Em: 9 Jan. 2022.
[23]. Neves, M. F.; Trombin, V. G.; Consoli, M. O Mapa Sucroenergético Do Brasil. In: Souza, E. L. De; Macedo, I. De C. Coords.. 2010. Etanol E Bioeletricidade: A Cana-De-Açúcar No Futuro Da Matriz Energética. São Paulo: Luc Projetos De Comunicação, P.14-43.
[24]. Neves, M. F. 2014. Caminhos Da Cana. Sertãozinho: Canaoeste.
[25]. Nogueira, A. C. L.; Zylbersztajn, D. Corporação Agrícola: Uma Análise Do Modelo De Negócios No Brasil. In: Zylbersztajn, D.; Neves, M. F.; Caleman, S. M. Q. 2015. Gestão De Sistemas De Agronegócios. Atlas, São Paulo, P.281-295.
[26]. Oliveira, E. C. 2017. Investimentos No Setor Sucroenergético: Análise Do Perfil Das Operações Automáticas De Financiamento Contratadas Com O Sistema Bndes No Período De 2000 A 2015. Revista De Administração Da Universidade Federal De Santa Maria, V. 10, P. 44-62. Https://Doi.Org/10.5902/19834659%2025222
[27]. Oliveira, R. A. D. 2011. Mobilidade Espacial Dos Cortadores De Cana: Alguns Suportes Teóricos. Informe Gepec, Toledo, V.15, Número Especial, P.241-253. Https://Doi.Org/10.33026/Peg.V16i1.3419
[28]. Penrose, E. 1959. Theory Of The Growth Of The Firm. Brasil Black Well Oxford, England.
[29]. Porter, M. E. 1990. Vantagem Competitiva: Criando E Sustentando Um Desempenho Superior. Rio De Janeiro: Campus.
[30]. Rasmussen, P.N. 1956. Studies In Intersectoral Relations. Amsterdam: North Holland.
[31]. Rissardi Júnior, D. J. 2015. Três Ensaios Sobre A Agroindústria Canavieira No Brasil. 2015. 116 F. Tese Doutorado Em Desenvolvimento Regional E Agronegócio – Universidade Estadual Do Oeste Do Paraná, Toledo.
[32]. Sesso, P. P.; Sesso Filho, U. A.; Pereira, L. F. P. 2021. Dimensionamento Do Agronegócio Do Café No Brasil. Cadernos De Ciência & Tecnologia, Brasília, V. 38, N. 2. Http://Dx.Doi.Org/10.35977/0104-1096.Cct2021.V38.26901
[33]. Shikida, P. F. A.; Cattelan, R. 2020. Evolução E Dinâmica No Setor Sucroenergético Brasileiro. In: Vieira Filho, J. E. R.; Gasques, J. G. Org. Uma Jornada Pelos Contrastes Do Brasil: Cem Anos Do Censo Agropecuário. Brasília: Ipea, Ibge, P.361-374. Http://Dx.Doi.Org/10.38116/978-65-5635-011-0
[34]. Szmrecsányi, T. 1979. O Planejamento Da Agroindústria Canavieira Do Brasil 1930-1975. São Paulo: Hucitec/Unicamp.

[35]. Umbellino, A. A. M.; Tonin, J. M.; Tonin, J. R. 2014. A Tributação Do Setor Sucroenergético No Estado Do Paraná 2003-2011. 11º Ecopar, Apucarana – Pr.
[36]. União Da Indústria De Cana-De-Açúcar Unica. Observatório Da Cana. Disponível Em: Https://Observatoriodacana.Com.Br/. Acesso Em: 23 Mar. 2022.
[37]. Vian, C. E. F. 2003. Agroindústria Canavieira: Estratégias Competitivas E Modernização. Campinas: Editora Átomo.
[38]. Willers, E. M.; Birck, L. G.; Shikida, P. F. A. 2004. O Açúcar Paranaense E As Barreiras Protecionistas Do Mercado Internacional. Tempo Da Ciência - Revista De Ciências Sociais E Humanas, Toledo, V. 11, N. 21, P. 37-52.
[39]. Yusuf, K. A.; Tanahashi, A. A. N.; Caldarelli, C. E.; Sesso Filho, U. A. 2018. Agroindústria Canavieira E Seus Impactos Econômicos No Estado De São Paulo: Uma Aplicação Insumo-Produto. Revista De Desenvolvimento Econômico – Rde, Ano Xx, V. 3, N. 41, P. 145-166, Salvador – Ba.
[40]. Zylbersztajn, D.; Neves M. F.; Caleman, S. M. Q. O Futuro Do Agro. In: Zylbersztajn, D.; Neves, M. F.; Caleman, S. M. 2015. Q. Gestão De Sistemas De Agronegócios. Atlas, São Paulo, P.297-301.