Relative Comparative Advantage of the United States, Brazil, and Argentina in Exporting Crop Products to Key South Asian and ASEAN Markets

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Relative Comparative Advantage of the United States, Brazil, and Argentina in Exporting Crop Products to Key South Asian and ASEAN Markets

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ABSTRACT

We employed the Lafay Index to assess the relative comparative advantage of the United States, Brazil, and Argentina in exporting five selected crops to Bangladesh, India, Thailand and Vietnam. The U.S. showed higher relative comparative advantage in cotton exports to Bangladesh and India, and soybean exports to Bangladesh. Brazil demonstrated higher relative comparative advantage in exporting corn to Bangladesh, and cotton and soybeans to Thailand and Vietnam. Argentina excelled in corn and wheat exports to India, Thailand, and Vietnam. All three countries faced comparative disadvantages in rice exports. Overall, Brazil and Argentina represent significant competitions for the U.S. exports in these regions.

KEYWORDS: Lafay Index, comparative advantage, U.S., Brazil, Argentina, South Asia, ASEAN, agricultural exports

JEL Codes: F14

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1 | INTRODUCTION

South Asian and Association of Southeast Asian Nations (ASEAN) countries are important markets for the U.S. to expand its agricultural exports due to their large populations, rising incomes, and increasing urbanization. Considering macroeconomic factors such as GDP per capita, real GDP growth, population growth, and changes in the real exchange rate, Regmi (2021) emphasized that these regions offer significant opportunities for the U.S. to boost its agricultural export market. In South Asia, Bangladesh and India stand out as key markets, while in ASEAN, Vietnam, the Philippines, Thailand, and Indonesia exhibit significant potential for growth in the real export value of U.S. agricultural products (Regmi, 2021). Specifically, among the ASEAN nations, Vietnam and Thailand are noteworthy for their rapidly expanding populations, growing middle class, flourishing retail and food processing sectors, and increasing consumer demand for health and wellness products, as well as safe, high-quality food (USDA-FAS, 2024b).

Historically, the U.S. has maintained its position as one of the leading agricultural exporters in the world, exporting a diverse range of commodities such as soybeans, corn, cotton, beef, pork, poultry, dairy, nuts, fruits, vegetables, rice, and wheat. With U.S. agricultural output growing faster than domestic demand for many products, the U.S. farmers and agricultural firms have relied on export markets to sustain prices and revenues. As a result, U.S. agricultural exports have grown steadily over the past 25 years—from around $62.8 billion in 1997 to $196 billion in 2022, and this growth has been significantly driven by crop products (USDA-ERS, 2024a). Between 2000 to 2021, five crops—soybeans, corn, cotton, wheat, and rice—collectively accounted for an average of approximately 34% of the total value of U.S. agricultural exports (USDA-ERS, 2024b). However, over the past two decades, the United States' position as a leading exporter of crop products in the international market has changed considerably. The market share of the five U.S.

crop products—corn, cotton, soybeans, wheat, and rice—has significantly declined, with the exception of cotton, which experienced a strong resurgence in 2022 (Figure 1). In recent years, the U.S. has faced increasing competition from countries such as Argentina and Brazil, jeopardizing its dominant position in the agricultural export market. For instance, Brazil has recently surpassed the United States to become the most dominant player in the global soybean export market, holding a market share of 51% in 2021 (Padilla et al., 2023; Baryshpolets et al., 2022). Meanwhile, U.S. cotton exports decreased by 4% in 2021 compared to the previous year due to increased competition from Brazil (Padilla et al., 2023).

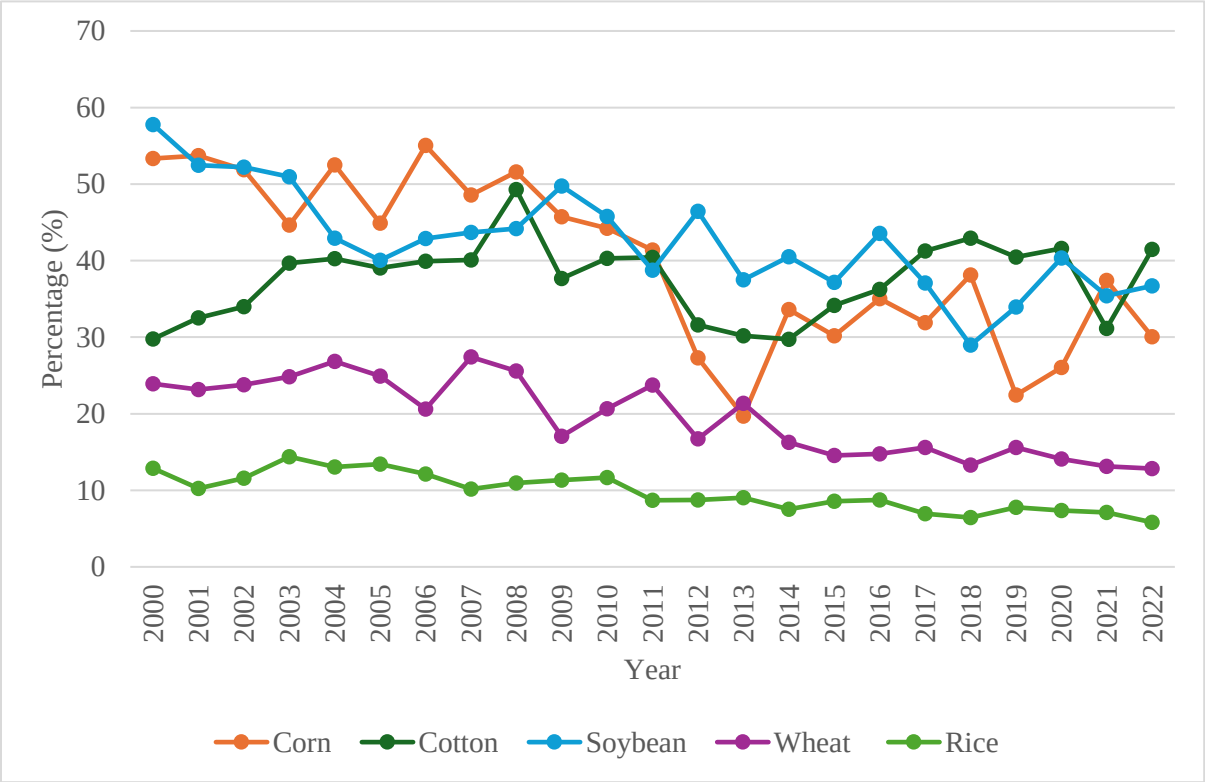

Figure 1. Export Share of U.S. Crop Products in the World Export Market from 2000 to 2022. (Authors' construction based on the data derived from FAO Statistics)

Additionally, U.S.'s inability to capture new emerging markets resulted in a decrease in its wheat export market share from its level in the early 2000s. However, the decline in the overall U.S. crop export market share in the international agricultural landscape is influenced by several other

critical factors. Prominently, the absence of new free trade agreements (FTAs) with potential developing and emerging countries from 2012 to 2020 has significantly hindered U.S. market expansion, while many of the U.S.'s competitors have capitalized on the opportunity by securing multiple Free Trade Agreements (FTA) during the same timeframe (Padilla et al., 2023). Meanwhile, one of the most notable reasons that has caused the U.S. to lose its market share between 2018 to 2021, is its overreliance on a few countries for exporting agricultural crop items. China imposed retaliatory tariffs on U.S. agricultural products in 2018, and as a result, the U.S. incurred substantial losses in its agricultural export sector with 71% ($9.35 billion) annualized losses for soybean, around 3% ($366 million) for cotton and over 2% ($309 million) for wheat respectively (Morgan et al., 2022). During the retaliatory tariff actions, China specifically targeted U.S. soybeans, exploiting the fact that from 2007 to 2017, before the tariffs, the U.S. exported around 56% of its total soybeans to China (USDA-FAS, 2024a). This reliance made the U.S. vulnerable to China's trade actions, and this set of trade disputes demonstrates the susceptibility of agricultural commodities that are dependent on a limited number of export destinations. Therefore, it is necessary to diversify and expand export markets to mitigate the risks stemming from heavy reliance on limited markets and increased competition from other countries (Regmi et al., 2021). In response to the U.S.-China trade dispute, U.S. government officials have also emphasized the importance of diversifying markets for U.S. agricultural exports to prevent a recurrence of large trade deficits caused by the loss of a solitary market (Lee and Jones, 2023). In this regard, the four key markets of South Asia and ASEAN region— Bangladesh, India, Vietnam and Thailand— can be the most promising markets for the U.S. to diversify its agricultural export markets.

Despite having immense export potential in Bangladesh, India, Vietnam and Thailand, it remains unclear for which products the U.S. has higher comparative advantage compared to its major

counterparts, Brazil and Argentina. Hence, it is necessary for the U.S. to ascertain about the relative comparative advantages its major counterparts in exporting these selected crop items to hose markets. The comparative advantage of a country in exporting agricultural products is not only related to its capacity to export and production but also to the sustainability of its long-term agricultural export sector growth. Therefore, this study aims to determine the export competitiveness of five major U.S. crop products relative to its major counterparts, Brazil and Argentina, to the most potential South Asian (Bangladesh and India) and ASEAN countries (Vietnam and Thailand) using Lafay (LFI) index. Lafay (LFI) index has been widely utilized to assess the competitiveness of Czech agricultural products (Burianova and Belova, 2012), Russian agricultural products (Ishchukova and Smutka, 2013), ASEAN countries' agricultural products (Reyes, 2014), Western Balkans, Turkish, and Namibian agri-food sectors (Matkovski et al., 2021; Karaman et al., 2022), and India's handloom industry (Singh and Gautam, 2020) compared to other nations. However, there has been a notable absence of studies evaluating comparative advantages of the U.S. in exporting its major crop products in the key South Asian and ASEAN markets and conducting competitors' analyses to provide a comprehensive view of competitiveness dynamics in international trade. To the best of the authors' knowledge, this study represents the first attempt to employ the Lafay Index to assess the comparative advantage of five U.S. crop products in leading South Asian and ASEAN countries, while also comparing them with Brazil and Argentina.

2 | DATA AND METHOD

2.1 | DATA DESCRIPTION

To derive the LFI values for the United States, Brazil, and Argentina, we considered the export and import values of corn, cotton, soybeans, wheat and rice products in relation to their partner

countries: Bangladesh, India, Vietnam and Thailand. Specifically, we assessed how much these three nations export to and import from these partner countries for the selected crops. Additionally, we examined the total trade values for all commodities between the reporting countries (the United States, Brazil, and Argentina) and the partner countries (Bangladesh, India, Vietnam, and Thailand). To ensure accuracy and appropriateness of our LFI index, we utilized a single, comprehensive data source. We used the World Integrated Trade Solution (WITS) platform to access UN Comtrade data and derived the necessary datasets including exports and imports values based on the Harmonized System (HS) 1996 classification: product code 1005 for corn, 5201 for cotton, 1001 for wheat, 1006 for rice, 1201 for soybeans (whether or not broken), and the total trade value for all commodities by selecting the total trade option from the product tree panel for the years 2000 to 2022.

2.2 | METHOD

The concept of revealed comparative advantage (RCA) is based on Ricardian trade theory, which holds that relative productivity differences between nations drive trade patterns. Although it is difficult to detect productivity differences directly, the RCA measure may be used to quickly compute these disparities using trade data. RCA can give a broad overview and preliminary assessment of a country's competitive export capabilities. The most common and widely used index for analyzing comparative advantage is Balassa's index (1965)[1]. Gnidchenko and Salnikov

[1] $RCA_{ij} = \frac{\frac{X_{ijt}}{X_{it}}}{\frac{X_{wjt}}{X_{wt}}}$; where $\mathrm{RCA_{ij}}$ = Revealed Comparative Advantage of county *'i'* in commodity *'j'*, X_{ijt}= Export of country *'i'* for product *'j'* in year *'t'*, X_{it} = Export of country *'i'* for all

(2021) reviewed 131 studies conducted between 2013 and 2019 and they found that Balassa's Revealed Comparative Index (RCA) is the most common method used for analyzing comparative advantages of particular products and sectors. However, Boffa et al. (2010) pointed out that the Balassa index's concentration only on exports may overlook imports and other critical components of trade analysis, such as tariffs and other protective measures. Meanwhile, it is not possible to assess a country's export comparative advantage by exporting a particular product to a specific region or country using Balassa's index. Addressing these issues, Lafay (1992) developed the Lafay Index (LFI), the evaluation of trade specialization by providing a greater explanatory capability at the dynamics of production specialization (Bugamelli, 2001) and addressing oscillations within intra-industry trade and economic cycles (Burianova & Belova, 2012). Additionally, the LFI index mitigates the impact of short-term cyclical and macroeconomic fluctuations on trade flow intensity while stressing bilateral trade links between nations and regions by comparing the normalized trade balance of specific goods to the total normalized trade balance (Zaghini, 2003; Amable 2000; Caselli & Zaghini, 2005). Thus, the LFI index is utilized for comprehensive analyses of the position of particular products within the foreign trade structure of individual nations or groups of nations examining the balance of supply and demand in trade relations between nations and regions (Zaghini, 2003). The Lafay index (LFI) equation can be express as:

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products in year *"t"*, X_{wjt} = Export of the world for product *'j'* in year *'t'*, X_{wt} = Export of the world's all products in year *'t'*

$$LFI_{ij}^{k} = 100\left[\frac{X_{ij}^{k} - M_{ij}^{k}}{X_{ij}^{k} + M_{ij}^{k}} - \frac{\sum_{k=1}^{k}\left(X_{ij}^{k} - M_{ij}^{k}\right)}{\sum_{k=1}^{K}\left(X_{ij}^{k} + M_{ij}^{k}\right)}\right]\frac{X_{ij}^{k} + M_{ij}^{k}}{\sum_{k=1}^{k}\left(X_{ij}^{k} + M_{ij}^{k}\right)}$$

where, X_{ij}^{k} = export of country *i* for product *k* to the particular country or region *j*, M_{j}^{i} = import of country *i* for product *k* from the particular country or region j, *k* = number of items analyzed. The main *LFI* index equation can be divided into three parts LFI_1, LFI_2, LFI_3 (Zaghini, 2003; Burianova and Belova, 2012;). The $LFI_1 = \frac{X_{ij}^{k} - M_{ij}^{k}}{X_{ij}^{k} + M_{ij}^{k}}$ measures net export ratio of country *i* in product *k* to its partner country *j*, showing how much more or less the country exports the product compared to how much it imports to and from its partner country. This is similar to the Balassa RCA index, which measures the relative export performance of a product. The $LFI_2 = \frac{\sum_{k=1}^{k}\left(X_{ij}^{k} - M_{ij}^{k}\right)}{\sum_{k=1}^{K}\left(X_{ij}^{k} + M_{ij}^{k}\right)}$ measures the ratio of total net exports to total trade measuring whether the country *i* is a net exporter or importer considering all traded goods. Finally, $LFI_3 = \frac{X_{ij}^{k} + M_{ij}^{k}}{\sum_{k=1}^{k}\left(X_{ij}^{k} + M_{ij}^{k}\right)}$ measures a specific product *k's* share in the total trade of county *i* representing the significance of that commodity in the country's total trade structure. One of the advantages of using *LFI* index is that it also incorporates the trade competitiveness (TC) index, a method to measure the level of the export competitiveness of particular products. Long (2021) used this TC index express as: $TC_{ij} = \frac{(X_{ij} - M_{ij})}{(X_{ij} + M_{ij})}$ where X_{ij} is country i's export of a particular product to country 'j' and M_{ij} is country i's import of that product from country j in a particular period of time. This TC index is incorporated in the Lafay index as well in the form of LFI_1. A greater positive value of the *LFI* index signifies a greater level of comparative advantage or specialization in the respective item. Conversely, negative values of the

LFI index indicate a lack of specialization, implying a comparative disadvantage (Zaghini, 2005). In this study, we have considered exporting countries—such as the United States, Brazil, and Argentina—and importing countries—including Bangladesh, India, Thailand, and Vietnam. The positive LFI values of an exporting country (*i*) for exporting a specific product (*k*) to a particular importing country (*j*) and indicate that the exporting country has a comparative advantage in the export of the product compared to the importing country. For example, if the United States has a higher positive LFI value for exporting cotton to Bangladesh, it means that the U.S. has a greater comparative advantage in exporting cotton to Bangladesh compared to Bangladesh itself. Similarly, if Brazil has a higher comparative advantage in exporting cotton to Bangladesh, we will compare the LFI values of the U.S. and Brazil for the same market (Bangladesh) to determine which country has a higher relative comparative advantage in exporting cotton to Bangladesh.

3 | RESULTS AND DISCUSSION

The calculated Lafay (LFI) index values (averaged over the years in each period) are used to assess the comparative advantage of the U.S., Brazil, and Argentina in exporting corn, cotton, soybeans, wheat, and rice to Bangladesh, India, Thailand and Vietnam during the periods of 2000-2007, 2008-2015, and 2016-2022, are detailed in Tables A.1 to A.5 (see appendices).[2] To facilitate a clearer comprehension of the competitive landscape, we have discussed the results section using graphical representations.

[2] According to the Lafay index equation, when both the export (X_{ij}^{k}) and import (X_{ij}^{k}) values between country *i* and country *j* for specific crop products in a given year t (where t = 2000, 2001, ..., 2022) are zero, the Lafay Index will result in an undefined outcome. We encountered numerous instances of such cases, which we preliminarily denoted as 'x'. When calculating the mean LFI values for the three periods 2000-2007, 2008-2015, and 2016-2022, we treated these 'x' values as 0, indicating neither a comparative advantage nor disadvantage in export or import.

Figure 2 shows the relative comparative advantages of the U.S., Brazil, and Argentina in exporting corn to Bangladesh, India, Thailand and Vietnam in three different time periods. During the first two periods, none of these exporting countries possessed a relative comparative advantage in the Bangladeshi corn market. However, in the most recent period (2016-2022), Brazil achieved a notable comparative advantage with an LFI value of 1.882, many times higher than Argentina (0.248) and the U.S. (0.246). The demand for corn in Bangladesh is fueled by the growth of the cattle and poultry feed industries, where corn makes up 60% of feed ingredients. Bangladesh imports 80% of its corn from India, with the bulk of the remaining from Brazil (AgFlow, 2022). The preference for Indian corn is due to factors like geographic proximity resulting in lower transportation and logistics costs and shorter shipment times. Consequently, countries like the U.S., Brazil, and Argentina have limited opportunities to export corn to Bangladesh (AgFlow, 2022). On the other hand, India itself is the 6th largest corn producer in the world and major exporter of corn to the South Asian and ASEAN countries, such as Bangladesh, Nepal and Vietnam (USDA-FAS, 2024a). Therefore, there has been a very limited opportunity for other countries to expand their corn exports to date. However, India has to import corn because of low output and increased demand due to the country's expanding poultry and corn starch manufacturing industries (Reuters, 2019). In India, Argentina consistently held the highest relative comparative advantage throughout all three periods, followed by Brazil and the U.S., although the degree of export specialization was very low, peaking at an LFI of only 0.282. In Thailand, Argentina initially held a slight numerical relative comparativeness from 2000 to 2007 (LFI of 0.083), but this declined over time. From 2016 to 2022, none of the countries held a relatively comparative advantage and all ended the study period with low LFI measuring a very little comparative advantage. Vietnam is by far the largest corn importer in Southeast Asia, and it mainly imports corn as a feed ingredient

to support the level of meat and fish production, which increased nearly 30 percent in the last decade because of huge animal-based protein demand. In the Vietnamese market, Brazil was the largest source of corn exports from 2008 to 2015 with an LFI of 7.489. The period of 2016-2022 saw a dramatic shift, with Argentina's LFI soaring to 13.289, surpassing Brazil's 11.706 underscoring a substantial relative competitiveness for both countries. Both Argentina and Brazil have high competitiveness in exporting corn to Vietnam because of their lower price relative to U.S. corn (USDA-FAS, 2021). Notably, Vietnam emerged as the most favorable market for corn exports, with Brazil and Argentina showing relative comparative advantages in the most recent period, indicated by LFI values of 13.289 and 11.706, respectively. Conversely, the LFI values for exports to India and Thailand remained low, ranging from 0.000 to 0.030, reflecting minimal export specialization.

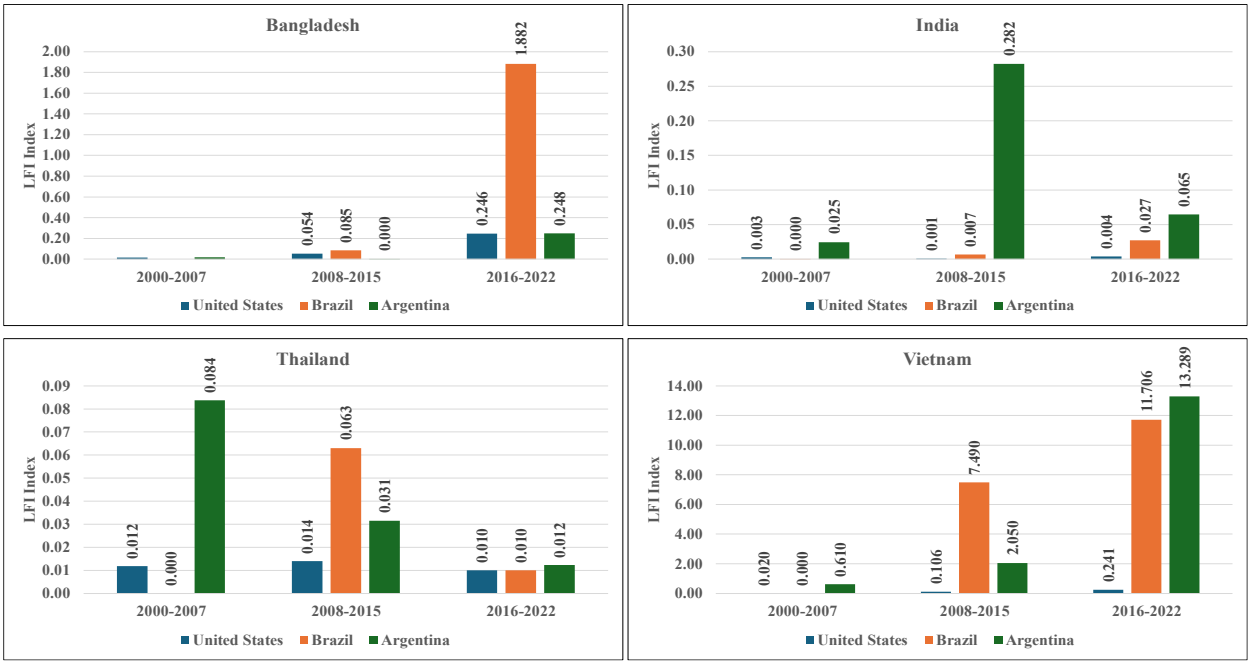

Figure 2. Lafay Index Values (Mean) of United States, Brazil and Argentina for Exporting Corn to Bangladesh, India, Vietnam and Thailand in Three Different Time Periods

As the world's second-largest textile exporter, Bangladesh faces a limited local cotton supply and must rely heavily on imports. The United States is the primary market for Bangladesh's textile exports, with around 18% ($10.2 billion) of its total textile products exported to the U.S. in 2022 (OEC, 2022). This strong bilateral trade relationship gives the U.S. a competitive advantage in exporting cotton to Bangladesh over Brazil and Argentina as reflected in the higher LFI values of U.S. (Figure 3). Despite being one of the world's largest cotton growers and exporters, India imports substantial amounts of U.S. cotton, particularly high-quality and specialized types such as extra-long staple Pima cotton, which is less prevalent in India (USDA-FAS, 2024). However, both Brazil and the U.S. experienced a downward trend in relative comparative advantage for cotton export in Indian market as India has expanded its domestic cotton production. Brazil initially had a higher comparative advantage from 2000 to 2007, but the U.S. passed Brazil in the most recent period (2016-2022), securing the top position with an LFI value of 0.575 compared to Brazil's 0.309. Brazil maintained a unilateral competitive advantage in exporting cotton to the Thai and Vietnamese markets, achieving significantly higher LFI values than the U.S. and Argentina. This high relative comparative advantage in export of Brazil in the Thai and Vietnamese markets may have been achieved through its strategic business efforts. The Cotton Brazil program, developed by Abrapa in collaboration with Apex-Brasil and Anea, focuses on building trade relations and conducting promotional and market development activities, with its headquarters located in Singapore, within the ASEAN region (Cotton Brazil, 2022). By strategically targeting ten countries, including Bangladesh, India, Vietnam, and Thailand, Brazil's global initiatives have successfully expanded its cotton market and boosted its export competitiveness in these regions (Cotton Brazil, 2024).

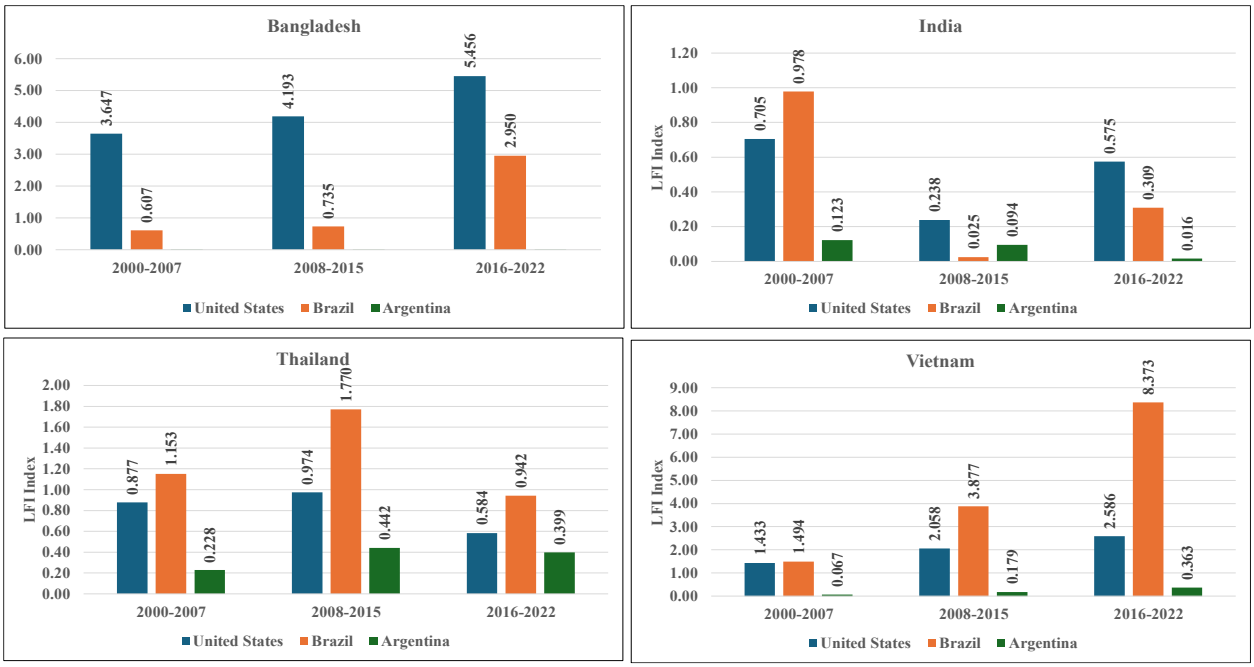

Figure 3. Lafay Index Values (Mean) of United States, Brazil and Argentina for Exporting Cotton to Bangladesh, India, Vietnam and Thailand in Three Different Time Period

The United States exhibited a higher degree of specialization in exporting soybeans to Bangladesh, followed by Brazil (Figure 4). The U.S.'s export competitiveness increased during the period of 2016-2022, with an LFI value rising to 6.928 from 1.681 in the previous period (2008-2015). Due to the increasing demand from the aquaculture and livestock sectors, Bangladesh produces approximately 6.57 million metric tons of commercial feed annually and soybean meal is used as a key feed ingredient for its high protein content. While U.S. soybeans are preferred by Bangladeshi importers because of their color, processing characteristics, moisture, low heat damage and other intrinsic qualities, Brazilian soybeans take shorter shipping time to Bangladesh (USSEC, 2023). India, by contrast, is the fifth largest soybean producer in the world. India's 57% import duty on whole soybeans and ban on genetically modified (GM) soybeans severely limit export opportunities for other countries, such as the U.S. (USDA-ERS, 2020). Nevertheless, India is the world's top importer of soybean oil, surpassing the European Union and China, with domestic

consumption growing by double digits over the past decade. But in terms of exports of soybean oil to India, the United States does not possess a market share because India prefers to purchase soybean oil from Argentina and Brazil, which offer comparatively lower prices (USDA-ERS, 2020). Therefore, none of these three countries demonstrated a significant comparative advantage in exporting soybean to India, and the U.S. even experienced a competitive disadvantage while Brazil and Argentina showed weak relative comparative advantage with LFI values of 0.008 and 0.002 respectively in the period of 2008-2015. Similar to Bangladesh, the demand for soybean meal in Thailand and Vietnam is growing because of their demand for protein feed ingredients (USDA-FAS, 2017). In Thailand, Brazil's competitive advantage in exporting soybeans grew substantially, with LFI values increasing from 6.465 to 19.146 over time. Meanwhile, Argentina's relative comparative advantage fell from 14.742 to 0.143 between 2000-2007 and 2008-2015. The U.S. experienced a very slow growth over time and its relative competitive advantage was lower than Argentina and Brazil in the Thai soybeans market. Brazil consistently maintained the highest relative comparative advantage in exporting soybeans to Vietnam, with LFI values of 7.495 in 2008-2015 and 6.306 in 2016-2022, significantly outperforming the U.S., which had LFI values of 1.159 and 0.862, respectively, during these periods. Production costs per acre for soybeans in Brazil are 22.5% lower than the U.S. costs, and due to investments in the overland transportation infrastructure, Brazil has experienced reduce marketing cost, and inland transportation cost, for exporting soybeans over time compared to the U.S. (Michigan Farm Bureau, 2024).

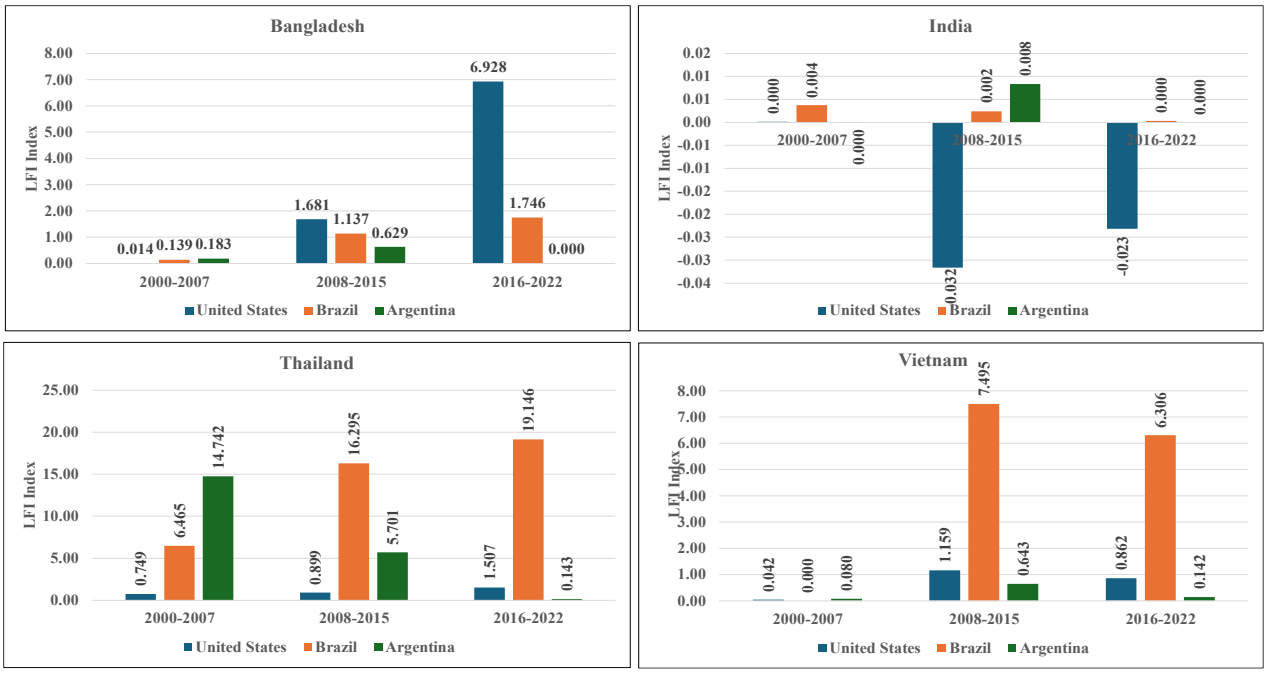

Figure 4. Lafay Index Values (Mean) of United States, Brazil and Argentina for Exporting Soybeans to Bangladesh, India, Vietnam and Thailand in Three Different Time Periods

The U.S. holds the highest degree of relative comparative advantage in exporting wheat to Bangladesh, followed by Argentina and Brazil (Figure 5). The reason for the U.S.'s competitive advantage in exporting wheat to Bangladesh is a high demand for high-quality red wheat for making high-quality flour for human consumption local supplies cannot provide. (USDA-FAS, 2024c). Being the third largest wheat producer in the world, India is capable enough of meeting its domestic demand for wheat. Thus, none of the countries showed substantial competitive advantage in exporting wheat to India, as indicated by all their LFI index values being less than 1.00. Argentina recently emerged as a strong competitor in Thailand's wheat market, previously dominated by Australia. This shift is driven by Argentina's ability to provide competitively priced wheat, including shipping costs, which appeals to Thailand seeking economic alternatives amid Australia's supply fluctuations and higher premiums due to climate issues (Datamar, 2019). In

Vietnam, Brazil leads in relative comparative advantage for wheat exports, but only by a slight numerical margin over Argentina.

Across Bangladesh, India, Vietnam, and Thailand, the United States, Brazil, and Argentina generally exhibit comparative disadvantages in exporting rice (Figure 6). India, Thailand and Vietnam consistently hold the first, second and third positions in the world as a rice exporting country. Meanwhile, Bangladesh is the third largest rice producer in the world and self-sufficient meeting its domestic demand. Therefore, there remains a very limited opportunity for other countries, such as the U.S., Brazil, and Argentina to export rice in these markets (USDA-FAS, 2023)

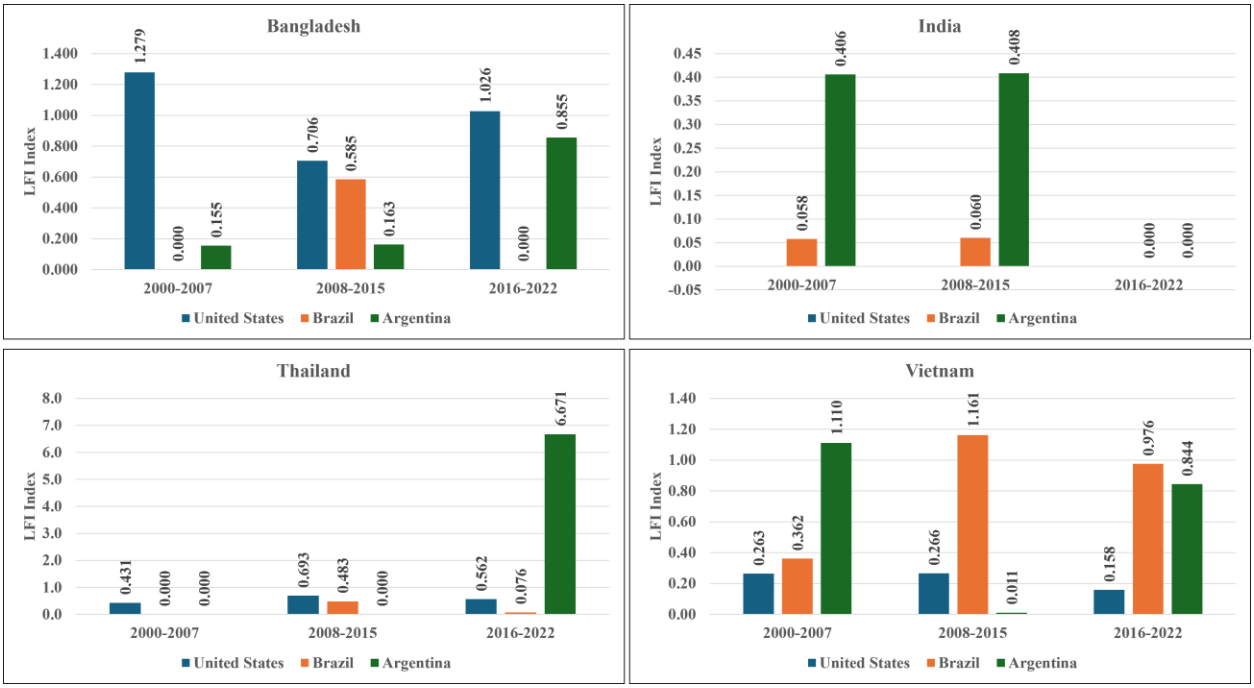

Figure 5. Lafay Index Values (Mean) of United States, Brazil and Argentina for Exporting Wheat to Bangladesh, India, Vietnam and Thailand in Three Different Time Periods

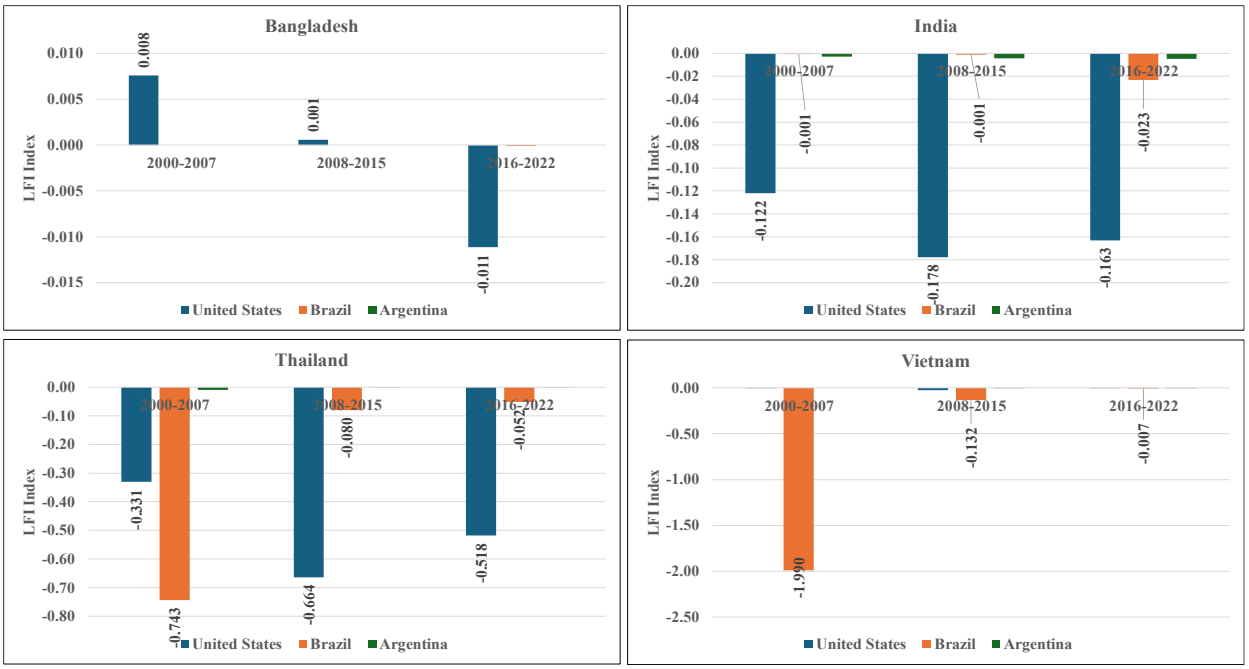

Figure 6. Lafay Index Values (Mean) of United States, Brazil and Argentina for Exporting Rice to Bangladesh, India, Vietnam and Thailand in Three Different Time Periods

4| LIMITAIONS AND FUTURE RESEARCH

The LFI index provides an insight into the comparative advantage of a country in exporting goods compared to other countries. On the basis of intuitive reasoning, we presented facts, provided explanations, and tried to reconcile them with arguments about the countries under this study showed greater comparative advantage or disadvantage in exporting a particular crop product to a specific importing country. While this interpretation is based on intuition, a more robust approach would include examining the factors affecting comparative advantage using relevant independent variables and using causal models, such as structural equations, to analyze their relationship to comparative advantage. In addition, the LFI index can be used to assess the performance of the United States in different sectors and compare it with that of other countries in various commodities and provide a quick overview of current trends.

5 | CONCLUSION AND POLICY RECOMMENDATION

Brazil stands out as an agricultural juggernaut, demonstrating the highest competitive advantage in corn exports to Bangladesh, cotton and soybeans to Vietnam and Thailand, and wheat to Vietnam. Brazil exhibited significant increases in higher comparative advantage relative to the U.S. and Argentina in exporting these crop products in the key South Asian and ASEAN markets. The ability to deliver products at a lower net price as well as recent domestic policies to produce non-GMO crop products have shaped Brazil's competitive positions over time. Nevertheless, the overall strength of Brazil is export markets continues to grow.

On the other hand, strong upstream and downstream trade relations, such as cotton and textiles between the U.S. and Bangladesh, play an important role in providing the U.S. with a comparative advantage in the Bangladeshi cotton market compared to Brazil and Argentina. Therefore, the U.S. should focus on a number of strategic initiatives to increase agricultural exports to South Asia and ASEAN countries by improving bilateral trade relations. First, it is essential to negotiate free trade agreements with key importers such as India and Vietnam to reduce barriers and tariffs for agricultural products such as corn and soybeans. Currently, the U.S. does not have free-trade agreements with any of the countries of South Asia and ASEAN. Second, increased investment in trade promotion activities, including trade missions and international agricultural fairs, will highlight the quality and reliability of U.S. agricultural products and focus on developing trade relations that strengthen exports. Thirdly, support for agricultural technology and innovation through R&D can increase productivity and reduce costs, as can investment in transport infrastructure, which can reduce the cost of transfer. Finally, initiatives such as trade facilitation projects carried out by USDA and U.S. Agency for International Development (USAID) are also

essential. These projects provide technical assistance, capacity building and infrastructure development, ensuring that international standards are met and that access to markets is improved. Implementation of these recommendations can strengthen the U.S. position. Implementing these recommendations can strengthen the U.S.'s position in agricultural exports by increasing and maintaining comparative advantage with other major agricultural exports.

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APPENDICES

Table A.1. Lafay Index Values (Mean) of United States, Brazil and Argentina for exporting corn to Bangladesh, India, Vietnam and Thailand in different time periods

Partner Country	Period	2000-2007	2008-2015	2016-2022
Bangladesh	United States	0.01629	0.05380	0.24624
	Brazil	0.00000	0.08469	1.88185
	Argentina	0.01787	0.00010	0.24840
India	United States	0.00257	0.00073	0.00383
	Brazil	0.00000	0.00676	0.02712
	Argentina	0.02462	0.28234	0.06454
Vietnam	United States	0.01952	0.10567	0.24086
	Brazil	0.00000	7.48990	11.7063
	Argentina	0.60993	2.05026	13.2894
Thailand	United States	0.01184	0.01394	0.00996
	Brazil	0.00000	0.06303	0.00998
	Argentina	0.08376	0.03145	0.01231

Table A.2. Lafay Index Values (Mean) of United States, Brazil and Argentina for exporting cotton to Bangladesh, India, Vietnam and Thailand in different time periods

Partner Country	Period	2000-2007	2008-2015	2016-2022
Bangladesh	United States	3.64719	4.19274	5.45575
	Brazil	0.60672	0.73467	2.94982
	Argentina	0.00570	0.00952	0.00671
India	United States	0.70527	0.23783	0.57451
	Brazil	0.97786	0.02457	0.30926
	Argentina	0.12282	0.09420	0.01603
Vietnam	United States	1.43282	2.05821	2.58570
	Brazil	1.49368	3.87699	8.37344
	Argentina	0.06662	0.17865	0.36305
Thailand	United States	0.87731	0.97352	0.58390
	Brazil	1.15304	1.77007	0.94206
	Argentina	0.22799	0.44188	0.39855

Table A.3. Lafay Index Values (Mean) of United States, Brazil and Argentina for exporting soybean to Bangladesh, India, Vietnam and Thailand in different time periods

Partner Country	Period	2000-2007	2008-2015	2016-2022
Bangladesh	United States	0.01369	1.68079	6.92760
	Brazil	0.13894	1.13652	1.74636
	Argentina	0.18252	0.62866	0.00000
India	United States	0.00015	-0.03164	-0.02315
	Brazil	0.00371	0.00240	0.00033
	Argentina	0.00000	0.00836	0.00000
Vietnam	United States	0.04173	1.15851	0.86228
	Brazil	0.00000	7.49498	6.30644
	Argentina	0.08008	0.64272	0.14185
Thailand	United States	0.74897	0.89863	1.50664
	Brazil	6.46541	16.29529	19.14581
	Argentina	14.74238	5.70069	0.14316

Table A.4. Lafay Index Values (Mean) of United States, Brazil and Argentina for exporting wheat to Bangladesh, India, Vietnam and Thailand in different time periods

Partner Country	Period	2000-2007	2008-2015	2016-2022
Bangladesh	United States	1.27911	0.70554	1.02602
	Brazil	0.00000	0.58533	0.00000
	Argentina	0.15487	0.16313	0.85516
India	United States	0.00025	0.00008	-0.00003
	Brazil	0.05766	0.06009	0.00000
	Argentina	0.40576	0.40850	0.00000
Vietnam	United States	0.26342	0.26583	0.15839
	Brazil	0.36175	1.16134	0.97556
	Argentina	1.11028	0.01134	0.84406
Thailand	United States	0.43083	0.69330	0.56236
	Brazil	0.00000	0.48289	0.07562
	Argentina	0.00000	0.00000	6.67082

Table A.5. Lafay Index Values (Mean) of United States, Brazil and Argentina for exporting rice to Bangladesh, India, Vietnam and Thailand in different time periods

Partner Country	Period	2000-2007	2008-2015	2016-2022
Bangladesh	United States	0.00761	0.00056	-0.01113
	Brazil	0.00000	0.00000	0.00000
	Argentina	0.00000	0.00000	0.00000
India	United States	-0.12192	-0.17793	-0.16307
	Brazil	-0.00057	-0.00120	-0.02313
	Argentina	-0.00293	-0.00442	-0.00468
Vietnam	United States	-0.00021	-0.02555	-0.00156
	Brazil	-1.98989	-0.13248	-0.00738
	Argentina	0.00000	0.00000	-0.00020
Thailand	United States	-0.33051	-0.66379	-0.51797
	Brazil	-0.74311	-0.07983	-0.05216
	Argentina	-0.00929	-0.00120	-0.00101