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BIMSTEC'S INCIPIENT COMPETITIVE ADVANTAGE AND TRADE SPECIALISATION IN RAW SUGAR

ABSTRACT: *Currently, there is a significant global focus on the growing impact of Asian nations within the realm of international trade. In the framework of 48 Asian nations, the raw sugar sector of BIMSTEC underwent a notable reorganisation, leading to enhanced revenue and employment opportunities. This study sought to explore the competitive advantage and trade specialisation of the member nations of BIMSTEC in the raw sugar commodities sector. Effective marketing strategies have significantly contributed to the enhancement of visibility and demand for these commodities in global markets, thereby further driving competitiveness. The data was obtained from the Observatory of Economic Complexity (OEC) database, and the analysis was conducted using "R" software. Furthermore, pertinent data sources were consulted in the literature review to guarantee the precision of the analysis concerning the theoretical framework. Utilising theoretical frameworks, the RSCA and Lafay indexes were applied to evaluate the competitive advantage and trade specialisation of raw sugar among the BIMSTEC member nations during the period 2005-2022. The study demonstrated that India and Thailand exhibited the greatest comparative advantage within the region, focusing their expertise on the trade of raw sugar products. The study further articulated the domains of potential collaboration or competition and proposed several overarching recommendations for each nation. Policymakers may draw upon the insights derived from this research to evaluate the respective nation's competitive standing.*

KEY WORDS: *Raw Sugar, Balassa Index, Lafay Index, BIMSTEC, RSCA, Marketing*

JEL CLASSIFICATION: B17, C13, F14, F19, N55, Q17

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1. INTRODUCTION

Due to its versatile applications, sugar is widely consumed in many sectors and households. Its versatility extends beyond the culinary realm, as it is utilised in producing ethanol, pharmaceuticals, and even cosmetic items. The sugar industry has a substantial impact on the Gross Domestic Product of countries that cultivate it and it generates jobs in the manufacturing and agricultural sectors (Hassan, 2008). Sugar is a fundamental need that is crucial for human survival. Moreover, it plays a vital role in the worldwide food industry, serving an essential function. The global sugar market and its associated goods are subject to constant fluctuations. Sugarcane, which accounts for over 80% of global sugar production, is the primary raw material utilised. Approximately 30% of sugar is traded globally, while 70% is consumed within local communities (Taylor, 2017). Raw sugar is a widely traded commodity internationally and within specific geographic regions (Bouët et al., 2021). To account for the distinct characteristics of sugar production from cane and beets, sugar has been divided into separate categories for cane and beet sugars. In general, the production of sugar beet faces higher competition than that of cane sugar. In regions where sugar beet is cultivated, cane sugar's production and processing capacity is supplemented with sugar beet production, increasing the output. Although the methods and production systems may be quite different, beet sugar, which is produced in specialty sugar beet processing plants and cane sugar, which is manufactured in large refineries often work quite well as substitutes for each other in most cooking applications. A distinct separation is maintained between the production, transportation, processing, and distribution of sugar beet and sugarcane. Imported raw sugar undergoes a refining process at domestic sugar refineries before being distributed for use. This process significantly impacts the farming and trade of sugar crops, greatly influencing the economics of sugar production and trade. Significant, transformative changes are occurring in the sugar market, fundamentally altering the dynamics and intensifying competitiveness. Europe and the United States, which are substantial participants in the worldwide food and agricultural markets, experienced a decline in their market influence due to the opening up and integration of markets that started in the 1990s with the Uruguay Round of GATT. Conversely, this enhanced Latin American nations' economic and commercial status, as it did with a number of Southeast Asian and Pacific island nations. Nevertheless, protectionist policies implemented by the European Union (EU), the Commonwealth of Independent

States (CIS), and China have a substantial impact on the sugar market, as evidenced by studies conducted by Dillen et al. (2008), Smutka et al. (2013), and Janda et al. (2012). Anticipated alterations in the global sugar market will impact exports, imports, and production capacity levels. In recent years, there has been significant and rapid growth in the development of sugar crops, mainly sugar cane, and an expansion of the global sugar market. As previously stated, growing use is made of sugar crops in producing biofuels, and this is the main driver behind this expansion (Janda et al., 2012; Smutka et al., 2013). Asian sugar-producing nations play a substantial role in the global sugar industry. Together, these countries contribute to almost 40% of the total sugar production worldwide. The primary contributors in this region are India, China, Sri Lanka, Bangladesh, Pakistan, and the Southeast Asian nations, specifically Thailand, Indonesia, Vietnam, The Philippines, and Myanmar, along with several minor producers (Solomon & Li, 2016).

However, in the context of South Asian nations, experts believed that integration was essential to stimulate prosperity in the southern part of the world (Khan & Larik, 2007). The South Asian Association for Regional Cooperation (SAARC) has not succeeded due to numerous political conflicts, leading producers to develop a misconception about the erosion of political and economic autonomy. The consolidation and progress of emerging Asian nations are pressing concerns after acknowledging the SAARC's failure. India's emergence as a growing power and a significant Asian trading partner prompted the Indian government to implement the Look East Policy in the 1990s. This policy strengthened India's relationship with Southeast Asia, East Asia, and the Asian-Pacific by opening up its economy. In addition, amidst several agreements, a notable organisation called BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) is steadily gaining prominence. BIMSTEC was officially launched as a regional entity in June of 1997 following the adoption of the Bangkok Declaration. This document merged seven countries forming the central core of BIMSTEC, consisting of India, Thailand, Bangladesh, Sri Lanka, Nepal, Myanmar, and Bhutan. In the last few years, the group has participated in ministerial meetings annually. This process has been highly instrumental in enhancing and strengthening both the qualitative and quantitative aspects between the member countries. Recent studies have indicated that BIMSTEC members contribute substantially to commerce despite a delayed start.

Furthermore, most countries in the region exhibit comparable cultural practices, languages, and per-capita income levels, which will facilitate regional trade. BIMSTEC is a growing movement that combines Southeast and South Asia. It aims to promote trade and economic integration, bringing new development opportunities. As mentioned, it comprises seven member countries, representing around 22% of the global population, with a total GDP of over 2.7 trillion US dollars (Krishnankutty, 2021). Although established in 1997, the organisation did not initially significantly impact trade among member countries. However, interest in trade increased among members in 2020. India's 'Look East' Policy was changed to the 'Act East' policy in 2015 (Dutta, 2019). The prevalence of desired traits among the nations of BIMSTEC suggests a strong potential for a successful Free Trade Agreement (Banik, 2007). BIMSTEC member countries have seen an increase in raw sugar production, with many emerging as significant contributors to the global sugar market. The region's tropical and sub-tropical climate and abundant arable land provide an ideal environment for cultivating raw sugar. Several member nations, such as, India and Thailand are actively involved in exporting sugar, aiming to take advantage of the growing global demand for this vital commodity. Sugarcane production strongly correlates with the trade in raw sugar, mainly the export trade. Nations that cultivate larger quantities of sugarcane typically experience higher export volumes. As significant sugar cane growers, the Americas, and Asia are ranked in the top spots of international exporter regions (Mabeta & Smutka, 2023). Although BIMSTEC's share of global sugarcane production has averaged approximately 27.3%, its contribution to global sugar exports remains substantial, according to the Observatory of Economic Complexity (OEC, 2024).Thailand and India, member nations of BIMSTEC, account for significant levels of raw sugar production and exports worldwide. India and Thailand were the world's largest raw sugar producers in the period 2021–2022, surpassing Brazil and the European Union, and are essential exporters of sugar (OEC, 2024). The balance between trends in production and consumption shows that India is self-sufficient (Milovanovic & Smutka, 2016). However, for over seven decades, India's sugar business has been subject to tight oversight of the regulatory authorities. Despite these limitations, the Indian government does not provide direct cash benefits to sugarcane producers or producers in general; it only allows export subsidies of surplus raw sugar and imposes import duties on sugar (Sukhtankar, 2012; Vikas & Babu, 2017).

The global focus on Asia's economic influence, particularly on the raw sugar trade, has grown exponentially. This study addresses a pivotal need to analyse the competitive dynamics of BIMSTEC nations, which play a crucial role in global sugar production and trade. Unlike previous studies, the paper integrates advanced comparative indices to uncover trade patterns and the structured and policy-level implications of the raw sugar trade within BIMSTEC. It is the first to utilise multiple indices, offering a unique lens on intra-regional trade dynamics.

In this study, we have attempted to identify the structural features of BIMSTEC member nations' raw sugar trade pattern, considering the significance of openness and trade for the economic development of BISMTEC. The primary objective of this study is to examine the comparative advantage and trade specialisation of the raw sugar trade of BIMSTEC member countries from 2005 to 2022. By highlighting the BIMSTEC member nations' comparative advantage in trade, we aim to highlight the structural changes and features of the raw sugar trade.

After the introduction, the study is organised as follows: The next section presents a literature overview of the production, consumption, and trade of raw sugar in BIMSTEC nations, as well as empirical studies on the comparative advantage of trading raw sugar. Subsequently, the research elucidates the techniques and information employed, followed by an exposition and discourse on the findings. The last portion comprises concluding remarks with policy implications.

2. LITERATURE REVIEW

It is essential to undertake additional research to carry out an in-depth analysis of the raw sugar trade among the countries that are members of BIMSTEC. This is the case even though many empirical studies have been conducted on the growth and progression of regional economic integration. The concept of comparative advantage is an essential component of contemporary economic theory. In the context of international trade, comparative advantage is a concept that has been around for more than two hundred years and has remained unchanged to this day. It is believed to be a determinant of specialisation. Liesner (1958) was the pioneer in developing the measurement of revealed comparative advantage and later Balassa developed it further. Balassa published disclosed comparative advantage measures for manufacturing and other industries in 1965,

1977, and 1989. Shaped by various supply and demand factors, comparative advantage measures determine trade patterns, ultimately leading to international trade specialisation. The use of finite resources and well-being are improved through comparative advantage. Several new models in international commerce have so far failed to disprove the performance appeal of the comparative advantage metric. According to the law of comparative advantage, a nation is said to have a comparative advantage if it possesses specialised items that cannot be produced as effectively by another nation. The exporting competitiveness of any industry can be identified in the relative advantages that the different product categories have accumulated through engaging in international trade (Huo, 2014). This highlights that a country can import products with the greatest absolute disadvantage and export services with the smallest absolute disadvantage. In addition to this, it emphasises the fact that a nation that possesses all of the absolute cost advantages in its products would import goods that are associated with the smallest absolute benefits, not to mention that it will specialise and export the products that have the greatest absolute advantage (Krugman & Obstfield, 2000). The revealed comparative advantage measure is considered the most reliable and comparable method for determining comparative advantage. The basis of international trade lies in the differences in factor intensities between countries, where countries export goods in which they have a comparative advantage and import those in which they suffer a comparative disadvantage (Costinot & Donaldson, 2012). It considers factors such as trade specialization patterns and international trade advantage. Various researchers have extensively studied and validated this measure (Hilman, 1980; Yeats, 1985; Vollrath, 1991; Laursen, 2015; Dalum et al., 1996; Bojnec, 2001; Widodo, 2009). The Heckscher-Ohlin Theory states that a nation's comparative advantage is determined by its relative factor endowment. Trade influences the relative price of factors within and between nations (Salvatore, 2007). Comparative advantage factors include trade specialisation, demand bias, and national preferences. According to Lundbäck and Torstensson (1998), these factors influence net exports and trade specialisation. Bojnec (2001) suggests that supply and demand factors determine trade patterns. Furthermore, Bastos and Cabral (2007) argue that trade liberalisation increases specialisation in industries for larger economies. These findings represent the consensus of economists who have conducted the analysis. Conversely, Helpman and Krugman (1987) argue that developed nations seek to export non-standardised items and industries that

demand a large scale, whereas developing countries focus on producing standardised products (Bojnec, 2001). Numerous studies have been undertaken on the trade specialisation trend. Oberoi's (2018) study reveal that a country's production and trade in goods and commodities are directly linked to its level of specialisation, which in turn affects monetary growth. Török et al. (2020) address the issue of asymmetric value in the Balassa index by using the revealed symmetric comparative advantage index as a linear transformation. They combine this approach with other methodologies one of which is the panel data linear regression model, to assess export competitiveness. Moreover, Latruffe (2010) argues that it is crucial to prioritise the non-price factors of competitiveness and consider the impact of government intervention on competitiveness. Similarly, Vollrath (1991) found that agricultural exporters with minimal government intervention tend to exhibit the highest degree of competitiveness. In contrast, Mizik (2021) argues that a favorable legal and policy framework is key to enhancing domestic producers' competitiveness. Subsequently, there is a progression towards products with greater value-added and complexity and the implementation of highly efficient and profitable production methods. Their study concludes that, this situation requires a modification in the approach taken by decision-makers. To analyse the trade performance of specific countries in relation to specific goods, one can look at the performance within major group classifications (Balassa, 1965). Disdier et al. (2015) found in their study on this subject that Australia and New Zealand possess notable comparative advantages in the Asian and Pacific regions' marketplaces for fruit and vegetables, beverages, and dairy products. In their study on the comparative advantages and specialisation of agri-food sectors worldwide, Jambor and Babu (2016) found that the Netherlands, Spain, and Denmark were the most competitive nations. Wu (2010) analysed China's export structure and the competitiveness of peanuts and peanut products in terms of their comparative trade advantages. He found that there are significant opportunities for competitiveness in global marketplaces. However, Zhang and Liu (2008) discovered that the Chinese peanut trade was encountering a decrease in its competitive advantages, albeit within a period. The South Asian Free Trade Area (SAFTA) has had a beneficial effect on the export competitiveness of sugar, while also highlighting that India possesses a comparative advantage in commodities for which it has plentiful natural resources (Narayan & Bhattacharya, 2019). In addition, Chaudhary and Kumar (2016) conducted a

study in which it is found that sugar exports from India a member of SAFTA, have high levels of specialisation in all regions. Similarly, Narayan and Bhattacharya (2019) concluded that this competitiveness of exported sugar has improved over the years but the country still lags behind all others in terms of exports. Nagy and Jámbor (2019) identified that a substantial competitive advantage could be attributed to two main factors: manufacturing highly processed products and specialising in producing a limited number of commodities that directly compete with the products from other companies. Pawlak (2017) emphasises that countries gain significant competitive advantages in trade by focusing on trading specific product groups that align with their highest shares in global exports. This strategy allows them to consistently achieve a favourable trade balance and promote trade expansion. Consequently, their comparative advantages were the primary reason for their advantageous export specialisation profile. This is consistent with the classical theory of comparable costs, sometimes called the theory of comparative advantage. The hypothesis was originally formulated by David Ricardo and subsequently enhanced by Bojnec and Fertő (2014). (2014). Bojnec and Fertő (2014) highlight the importance of diversifying the range of products exported to acquire a competitive advantage in global marketplaces. According to Nowak (2016), the level of competitiveness is greatly influenced by the historical trajectory and natural conditions, along with their determining factors. Additionally, the length of time a country has been a member of the European Union plays a role in determining the amount of support the agri-food sector receives from EU funds. In addition, Pishgar-Komleh et al. (2021) introduced concepts similar to those discussed in this context but expanded them by incorporating ecological factors. The current literature needs to provide information showing the competitiveness level in the global raw sugar trade. Although there have been recent attempts to increase food production and exports, it is possible that there needs to be a more comprehensive policy focus on all food products traded with BIMSTEC and the global market. By analysing raw sugar trade dynamics in BIMSTEC, this study seeks to fill this gap in the literature and provide insights into respective nation's comparative advantage, fostering opportunities for trade expansion and economic cooperation.

3. MATERIALS & METHODS

The data used for this study were extracted from the OEC database (2024) for the years from 2005 to 2022. In particular, secondary data specifically focusing on the commodity raw sugar across the BIMSTEC countries were used. It is classified under HS (Harmonised System) Code: 1701 (OEC, 2024). One of the main reasons raw sugar is chosen is its role as a staple food. The research also draws on various scholarly articles and other relevant works from across the world. It is possible to evaluate a country's sectors using several different approaches. Statistical index comparisons, mathematical computations, a literature review, and scientific analysis are all part of the scientific research methodology used in this work.

Since the formation of comparative trade advantages is fundamentally a slow process, there must be a temporal dimension to the evolution of trade specialisation, a sign of structural changes in a country's economic system. International trade and national specialisation in products in which countries excel are evaluated using comparative advantage, a basic premise of classical trade theory that is widely utilised in modern economics. There are several ways to assess comparative benefits (Balassa, 1986). The most common of them is the index of revealed comparative advantage (RCA), which has been the most popular in empirical research since Balassa (1965) and all of his subsequent revisions. In 1965, Balassa first introduced the RCA index. Part of the process is examining how a country's exports compare to the global total for a specific sector. According to Balassa (1965), this comparison helps determine the country's competitive edge in that particular industry. A country's potential comparative advantage can be evaluated by categorizing its industries according to the Balassa Index (RCA). If the percentage of a particular good that a country exports exceeds the percentage of that good exported globally (i.e. relative to the country's total exports), we say that the country has achieved a RCA in that good. RCA is used to measure specialisation. This study used the RCA indices, the Balassa index and the Lafay index, to evaluate the competitiveness of BIMSTEC nations, including India, in sugar trade, according to several studies (Aksoy & Kaymak, 2021; Cicek & Bashimov, 2016; Kanaka & Chinadurai, 2012; Pilinkiene, 2014; Terin et al., 2018; Torok & Jambor, 2016). These indicators are regarded as reliable ways to assess specialization in international trade.

Due to a lack of comprehensive data on factor costs, Balassa stressed that measuring competitiveness is challenging. Therefore, the most widely accepted indirect method is the RCA index, which uses a country's trading history to calculate its comparative advantage. A country's comparative advantage might be inferred from its export performance without complete factor cost data. The export pattern of commodities reflects changes in non-price factors and relative costs, which impact the export structure:

$$B = \frac{x_{ij} / x_{it}}{x_{mj} / x_{mt}}$$

where

x_{ij} = exports of a specific product *i* (e.g. rice) by a specific country in a particular year

x_{it} = total exports of a specific country in a particular year

x_{mj} = world exports of a specific product in a particular year

x_{mt} = world's total exports in a particular year

According to Balassa, an RCA index> 1 indicates a country has a competitive advantage in a specific item or industry. An RCA less than 1 indicates a comparative disadvantage, on the other hand. Asymmetrical values and the fact that the Balassa index often ignores the various impacts of agricultural policies are two of its main points of criticism. State interventions and trade restrictions distort trade structures, and the asymmetric Balassa index value shows that it goes all the way to infinity for countries with a comparative advantage but ranges from zero to one for those with a comparative disadvantage, which overestimates the relative weight of a sector.

In response to criticisms of the Balassa index (B), Dalum et al. (1996) used the revealed symmetric comparative advantage (RCSA) index. The following format is used to express the converted index:

$$RSCA = \frac{B-1}{B+1}$$

The RSCA index ranges from -1 to 1, where values from 0 to 1 represent a relative export advantage and values from -1 to 0 represent a relative export disadvantage. The index portrays the median point of comparative advantage and neutral comparative advantage when its value equals 0.

To overcome the practical constraints of the Balassa index, Lafay (1992) devised an index that incorporates both trade and production characteristics. The Lafay index quantifies a nation's degree of trade specialisation with respect to a particular product. Positive values of the index suggest a higher level of comparative advantage, whereas negative values indicate a decrease in specialisation. The magnitude of the absolute values' indicates the levels of specialisation or despecialisation (Vollrath, 1991).This figure results from evaluating the country's standardised trade balance for a particular good, *j*. The trade balance for a given product is divided by the total value of trade to get the normalized trade balance, i.e.:

$$LFI_j = 100\left\{\frac{x_j - m_j}{x_j + m_j} - \frac{\sum_{j=1}^{N}(x_j - m_j)}{\sum_{j=1}^{N}(x_j + m_j)}\right\}\frac{x_j + m_j}{\sum_{j=1}^{N}(x_j + m_j)}$$

where,

x_j = exports of a specific product

m_j = imports of a particular product

A country with a positive product *j* index exhibits a comparative advantage and a high degree of specialisation. On the other hand, a negative value signifies a relative disadvantage and limited product specialisation. The Lafay index (LFI) is defined as a symmetrical measure across all products inside a country, guaranteeing that the total of all sector indices is equal to zero. Unlike RCA, the LFI is unaffected by the total global exports or imports of all countries. Instead, it depends exclusively on the individual values of a specific country. This metric can evaluate the degree of autonomy of a nation. It is essential to approach the evaluation of RCA indicators with caution and a clear understanding of their limitations. However, the RCA analysis of the industrial sector can provide valuable insights into the study of structural changes in export specialisation. As

far as the authors know, the LFI has yet to be used to assess the comparative and trade advantages of BIMSTEC nations in the raw sugar industry.

4. EMPIRICAL ESTIMATION

4.1. Trends in the raw sugar trade at the world level

India, a South Asian nation, has emerged as a significant player in global raw sugar exports. While it did not rank among the top exporters in 2005, it is projected to secure second position by 2022, consolidating its status as a major industry player. These findings indicate significant growth in India's raw sugar export business. Thailand's export performance has also demonstrated consistent growth throughout the years. In 2005, it secured fourth position with a total export value of USD758,396,357. However, in 2022, it further advanced to third position, with a remarkable increase in export value to a total of USD3,224,226,771. This achievement solidifies Thailand's standing as one of the leading exporters in the world. Thailand's consistent performance demonstrates its enduring position in the global raw sugar industry. Most unrefined sugar exported from South Asia originates from India and Thailand. South Asian countries have shown fascinating trends as the world's leading importers of raw sugar from 2005 to 2022. Pakistan, as the sole South Asian country in the table 2, imported 397,683,220 units (USD) worth of raw sugar in 2005, placing it in ninth position. Throughout 2022, Bangladesh progressively emerged as the fourth largest importer, displacing Pakistan from its prominent position. This upheaval significantly strengthened Bangladesh’s position as one of the largest purchasers of sugar in the global market. This indicates a substantial increase in the country's need for raw sugar. Significantly, all these states, except Pakistan, are part of the burgeoning multilateral regional alliance, BIMSTEC.

Table 1: Top exporters of raw Sugar Worldwide (figures in USD)

Country	2005	Country	2022
Brazil	4,698,526,865	Brazil	11,506,671,903
France	1,427,717,244	India	6,034,263,140
Germany	767,658,729	Thailand	3,224,226,771
Thailand	758,396,357	Australia	1,223,339,283
Belgium	584,619,405	France	1,161,854,819
Australia	554,690,602	Germany	885,249,746
United Kingdom	384,449,490	Mexico	846,085,051
United Arab Emirates	372,935,804	Guatemala	815,549,010
Mauritius	355,979,231	United Arab Emirates	573,595,582
South Africa	317,420,889	Morocco	436,250,134

Source: Compiled by the authors from the OEC database, 2024

Table 2: Top importers of raw sugar worldwide (figures in USD)

Country	2005	Country	2022
Russia	1,207,765,706	Indonesia	2,367,900,157
United Kingdom	1,125,065,768	China	2,254,009,753
United States	888,547,566	United States	1,937,681,876
Indonesia	591,395,962	Bangladesh	972,026,884
United Arab Emirates	590,981,006	Sudan	956,825,855
Belgium	573,577,433	Italy	944,620,126
Italy	556,670,642	South Korea	865,465,455
Germany	445,141,746	Malaysia	843,854,375
Pakistan	397,683,220	United Arab Emirates	784,477,303
Spain	344,047,083	Algeria	773,560,546

Source: Compiled by the authors from the OEC database, 2024

4.2. Trends in the raw sugar trade at the BIMSTEC level

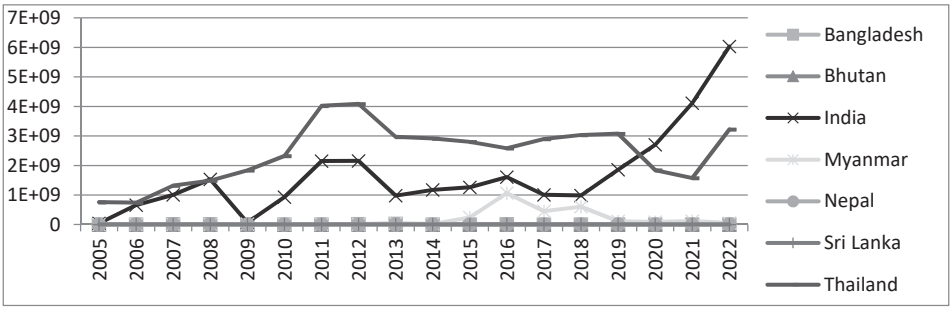
In Figure 1, **Panel A** illustrates the USD value of Raw Sugar exports from the BIMSTEC nations. The data covers the period from 2005 to 2022. It has been noted that, over time, India and Thailand are the only countries that stand out from the rest of the group due to their substantial global exports of raw sugar. Myanmar's growth in the mid-term has been comparatively moderate in contrast to the higher exports from India and Thailand. Conversely, the level of raw sugar

exports from Sri Lanka, Bangladesh, Nepal, and Bhutan places these countries at the bottom of the table of raw sugar exports (Table A1), meaning these countries are of less significance in this respect compared to India and Thailand. Figure 1 accurately illustrates the trajectory of these countries' exports.

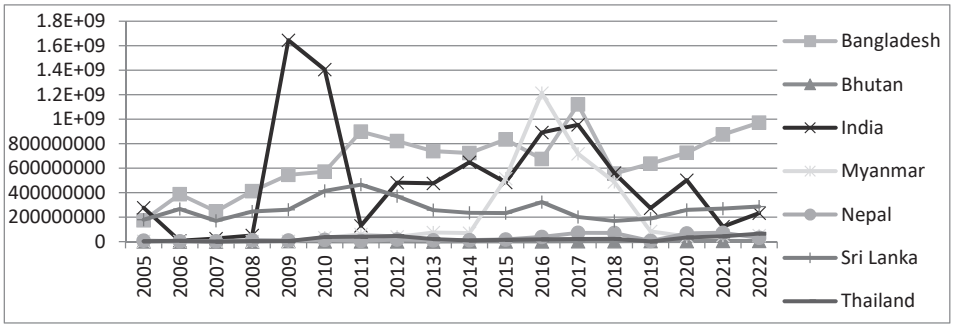
Panel B displays the trends in the value of imports of raw sugar by BIMSTEC nations. India imported substantial amounts of raw sugar in 2009 and 2010 to control domestic sugar prices. This phenomenon is observed in India due to the periodicity of manufacturing. Such a situation occurred in Myanmar in 2016 and 2017. Bangladesh and Sri Lanka also imported significant quantities of raw sugar during the stated timeframe. Nevertheless, Thailand exhibited a unique characteristic that set it apart from all other member nations of BIMSTEC in this specific case. Once again, it is clear that the value of imports in Nepal was more than that of Bhutan, although it was relatively small compared to other BIMSTEC members.

Figure 1: Trends in the raw sugar trade (exports and imports) at BIMSTEC level during the period 2005-2022

Panel A: Trends in raw sugar exports (USD) at the BIMSTEC level



Panel B: Trends in raw sugar import (USD) at the BIMSTEC level



Sources: Prepared by the authors on the basis of data from the OEC database, 2024

4.3. Pattern of trade in raw sugar at the BIMSTEC Level

4.3.1. Analysis of revealed symmetric comparative advantage of BIMSTEC member nations

Table 3 illustrates the progression of the RSCA index of the countries that are members of BIMSTEC throughout the period under study. Theoretically, as mentioned earlier, the RSCA index can range from minus to plus one. A negative result for this index indicates that the relevant countries are not experiencing any significant export disadvantage, whereas a value of one represents a relative advantage in terms of export production.

Thailand is the sole country among all BIMSTEC nations that consistently achieved positive scores throughout the entire period from 2005 to 2022. This indicates that Thailand has a relative export advantage and the highest comparative advantage compared to the other nations. India ranks second, consisting of mixed scores, with slightly more positive values, indicating a relatively better export of raw sugar than that of remaining member countries. Myanmar, Nepal, Bangladesh, Sri Lanka, and Bhutan all have consecutive negative scores, which indicates a relative export disadvantage or comparative disadvantage for the product raw sugar.

Table 3: RSCA index scores for raw sugar for BIMSTEC Level member nations

Year	**Bangladesh**	**Bhutan**	**India**	**Myanmar**	**Nepal**	**Sri Lanka**	**Thailand**
2005	-0.998	-0.993	-0.859	-0.908	0.224	-0.940	0.148
2006	-0.993	-0.997	0.057	-0.975	-0.801	-0.943	0.099
2007	-0.749	-0.997	0.217	-0.993	0.475	-0.943	0.347
2008	-0.754	-1.000	0.356	-0.542	0.348	-0.975	0.372
2009	-0.799	-1.000	-0.818	0.021	-0.880	-0.987	0.510
2010	-0.999	-1.000	-0.002	-0.460	-0.998	-0.966	0.477
2011	-1.000	-1.000	0.280	-0.638	-0.993	-0.990	0.607
2012	-0.758	-1.000	0.320	-0.681	-0.999	-0.988	0.642
2013	-0.693	-1.000	-0.126	0.020	-1.000	-0.904	0.534
2014	-0.918	-1.000	0.019	-0.687	-0.997	-0.972	0.558
2015	-0.986	-1.000	0.127	0.589	-1.000	-0.966	0.554
2016	-0.893	-1.000	0.274	0.904	-0.992	-0.956	0.539
2017	-0.964	-1.000	0.004	0.778	-0.987	-0.939	0.556
2018	-0.982	-1.000	-0.036	0.803	-0.979	-0.957	0.565
2019	-1.000	-1.000	0.291	0.237	-0.998	-0.965	0.604
2020	-1.000	-1.000	0.545	0.207	-0.999	-0.952	0.461
2021	-0.999	-0.978	0.556	0.327	-0.999	-0.875	0.305
2022	-0.999	-1.000	0.654	-0.180	-0.998	-0.957	0.586

Source: Calculated by the authors on the basis of data from the OEC database, 2024

4.3.2 Analysis of the trade specialisation of raw sugar of BIMSTEC member nations

Table 4 shows, the Lafay index scores for BIMSTEC member nations during the period under study. In theory, the Lafay index can take values between -∞ and +∞. A negative value for this index indicates that the countries in question do not make much use of trade specialisation.

Table 4: Lafay index scores for BIMSTEC member nations

Year	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand
2005	-0.619	-0.131	-0.104	-0.024	0.062	-0.860	0.314
2006	-1.175	-0.092	0.236	-0.035	-0.059	-1.097	0.258
2007	-0.649	-0.052	0.283	-0.019	0.361	-0.626	0.392
2008	-0.819	-0.061	0.343	0.040	0.105	-0.730	0.379
2009	-1.138	-0.425	-0.259	0.167	-0.082	-1.166	0.536
2010	-0.920	-0.092	0.009	-0.088	-0.094	-1.293	0.542
2011	-1.107	-0.083	0.325	-0.157	-0.026	-0.979	0.805
2012	-1.089	-0.081	0.291	-0.079	-0.063	-0.871	0.835
2013	-0.906	-0.048	0.093	0.017	-0.030	-0.585	0.619
2014	-0.895	-0.221	0.105	-0.109	-0.026	-0.457	0.605
2015	-0.810	-0.092	0.160	-0.363	-0.052	-0.474	0.604
2016	-0.782	-0.117	0.166	0.728	-0.084	-0.716	0.546
2017	-1.117	-0.233	0.052	-0.148	-0.116	-0.416	0.555
2018	-0.485	-0.180	0.088	0.557	-0.075	-0.396	0.557
2019	-0.556	-0.162	0.241	0.102	-0.007	-0.434	0.615
2020	-0.736	-0.167	0.397	0.125	-0.116	-0.758	0.362
2021	-0.553	-0.171	0.482	0.177	-0.087	-0.579	0.262
2022	-0.578	-0.126	0.600	0.009	-0.040	-0.714	0.505

Source: Estimated by the authors on the basis of data from the OEC database, 2024

Thailand once again achieved the highest scores among all member countries in terms of comparative advantage for the product raw sugar and a greater level of trade specialisation, similar to the results shown in Table 3. India has achieved the second-highest trade specialisation and comparative advantage among the remaining member countries, mirroring its earlier success. Remarkably, Nepal exhibited minimal positivity but neutrality, indicating that it lacks a comparative advantage and specialisation. Following this, Myanmar, Bhutan, Sri Lanka, and Bangladesh exhibit negative values, indicating a comparative disadvantage and a lack of or limited indications of trade specialisation.

4.3.3 Result of Welch one-way ANOVA of raw sugar trade at BIMSTEC Level

Using the three well-known indices developed between 2005 and 2012, this study attempted to run a one-way analysis of the variance model of the type.

$$x_{ij} = \mu + \alpha_i + \varepsilon_{ij}, \text{ where } \varepsilon_{ij} \sim N(o, \sigma_\varepsilon{}^2)$$

It turned out that the respective assumptions of normality and homoscedasticity were far from being satisfied when the necessary checks and diagnostic stages were carried out. In light of this, the Welch one-way analysis of variance was conducted. Table 5 provides a list of the details.

Table 5: Summary of Welch ANOVA findings on parameters relating to trade indices of BIMSTEC nations during the period 2005-2022

Sl No.	Trade index	Statistic	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand	F-statistic	Prob (F-statistic)
1	RSCA	Mean	-0.916	-0.998	0.103	-0.121	-0.754	-0.954	0.470	F(6.375,6,50.92)	0.000
		N	18	18	18	18	18	18	18		
2	Lafay	Mean	-0.921	-0.125	0.135	-0.059	0.009	-0.831	0.535	F(4.429,6,106.7)	0.000
		N	18	18	18	18	18	18	18		

Source: Estimated by the authors

Initially, the study applied a one-way ANOVA model to test whether there were any significant statistical differences between the two indices, namely the RSCA index and the Lafay index, among the selected countries, but due to lack of normality (Shapiro Wilk normality test statistic) and lack of homoscedasticity (Bartlett's test of homogeneity of variances) in the indices as presented in the Table 6. Welch's analysis of variance (ANOVA) and Games --Howell's post-hoc estimation were used.

Table 6: Summary of two parameters of ANOVA for all the indices:

Trade index	**Bartlett's K-squared test**	**p-value**	**The Shapiro Wilk normality test statistic**	**p-value**
RSCA	251.94	0.0000	0.8623	0.0000
Lafay	28.961	0.0000	0.9788	0.04508

Source: Estimated by the authors

Even though the Welch ANOVA reveals statistical differences between the nations in terms of each of the indices, the fact that this analysis discovers a statistical significance between the countries on a pair-wise basis is noteworthy.

Table 7: Summary of Games--Howell Post-hoc estimation relating to the RSCA index of BIMSTEC nations during the period 2005-2022

Sl No.	Between Countries	estimate	conf. low	conf. high	p.adj	p.adj.sig.
1	Bangladesh- Bhutan	-0.082	-0.169	0.005	0.071	ns
2	Bangladesh- India	1.019	0.694	1.344	0.000	****
3	Bangladesh- Myanmar	0.795	0.288	1.302	0.001	***
4	Bangladesh- Nepal	0.162	-0.245	0.568	0.839	ns
5	Bangladesh- Sri Lanka	-0.038	-0.127	0.050	0.783	ns
6	Bangladesh- Thailand	1.386	1.244	1.528	0.000	****
7	Bhutan- India	1.101	0.783	1.420	0.000	****
8	Bhutan- Myanmar	0.877	0.374	1.380	0.000	***
9	Bhutan- Nepal	0.244	-0.158	0.646	0.437	ns
10	Bhutan- Sri Lanka	0.044	0.021	0.067	0.000	****
11	Bhutan- Thailand	1.468	1.346	1.591	0.000	****
12	India- Myanmar	-0.224	-0.791	0.342	0.867	ns
13	India- Nepal	-0.857	-1.341	-0.374	0.000	****
14	India- Sri Lanka	-1.058	-1.376	-0.739	0.000	****
15	India- Thailand	0.367	0.035	0.699	0.024	*
16	Myanmar- Nepal	-0.633	-1.241	-0.025	0.037	*
17	Myanmar- Sri Lanka	-0.833	-1.337	-0.330	0.001	***
18	Myanmar- Thailand	0.591	0.080	1.102	0.017	*
19	Nepal- Sri Lanka	-0.200	-0.602	0.202	0.651	ns
20	Nepal- Thailand	1.224	0.812	1.636	0.000	****
21	Sri Lanka- Thailand	1.424	1.301	1.548	0.000	****

Source: Authors' estimation

Note: (1) *, **, ***, **** represent significance at the 10%, 5%,1% and 0.1% levels, respectively; (2) p-value >0.05 means normality assumption for ANOVA is satisfied; (3) p-value<0.05 means the homoscedasticity assumption for ANOVA is satisfied; (4) ns: result was insignificant at the second level and hence no question of post -hoc estimation

From Tables 5 and 6 above, it is found that the result is statistically significant for the RSCA index; hence, it is concluded that there exists a statistically significant difference in the RSCA index at the national level during the period 2005-2022. Accordingly, the post-hoc Games--Howel estimation at the country level is performed, and the result is summarised in Table 7. It can be seen that out of 21 central pairs of countries for the RSCA index, 15 statistically significant respective

differences exist at the BIMSTEC during the period under study. In addition, it was also found that there were no significant differences between six pairs.

Table 8: Summary of the Games--Howell post-hoc estimation relating to the Lafay index of BIMSTEC nations during the period 2005-2022

Sl No.	Between Countries	estimate	conf. low	conf. high	p.adj	p.adj.sig.
1	Bangladesh- Bhutan	0.689	0.502	0.875	0.000	****
2	Bangladesh- India	1.024	0.797	1.252	0.000	****
3	Bangladesh- Myanmar	0.880	0.628	1.131	0.000	****
4	Bangladesh- Nepal	0.806	0.614	0.997	0.000	****
5	Bangladesh- Sri Lanka	0.099	-0.162	0.360	0.892	ns
6	Bangladesh- Thailand	1.346	1.138	1.554	0.000	****
7	Bhutan- India	0.336	0.164	0.507	0.000	****
8	Bhutan- Myanmar	0.191	-0.015	0.397	0.080	ns
9	Bhutan- Nepal	0.117	0.011	0.223	0.023	*
10	Bhutan- Sri Lanka	-0.590	-0.807	-0.372	0.000	****
11	Bhutan- Thailand	0.657	0.517	0.797	0.000	****
12	India- Myanmar	-0.145	-0.387	0.097	0.508	ns
13	India- Nepal	-0.219	-0.396	-0.042	0.009	**
14	India- Sri Lanka	-0.925	-1.177	-0.673	0.000	****
15	India- Thailand	0.321	0.126	0.517	0.000	***
16	Myanmar- Nepal	-0.074	-0.284	0.136	0.911	ns
17	Myanmar- Sri Lanka	-0.780	-1.053	-0.507	0.000	****
18	Myanmar- Thailand	0.466	0.241	0.691	0.000	****
19	Nepal- Sri Lanka	-0.706	-0.928	-0.485	0.000	****
20	Nepal- Thailand	0.540	0.393	0.688	0.000	****
21	Sri Lanka- Thailand	1.247	1.011	1.482	0.000	****

Source: Author's estimation

Note: (1) *, **, *** and **** represent significance at the 10%, 5%, 1% and 0.1% levels, respectively; (2) p-value >0.05 means normality assumption for ANOVA is satisfied; (3) p-value<0.05 means the homoscedasticity assumption for ANOVA is satisfied; (4) ns: result was insignificant at the second level; and hence no question of post -hoc estimation

From Tables 5 and 6 above, it is found that the result is statistically significant for the Lafay index; hence, it is concluded that there exists a statistically significant difference in the Lafay index at the national level during the period 2005-2022. Accordingly, the post-hoc Games-Howell estimation at the country level is performed, and the result is summarised above in Table 8, it can be seen that for

the Lafay index out of 21 central pairs of countries, 17 statistically significant respective differences exist, at the BIMSTEC during the period under study. In addition, no significant differences were found between four pairs.

4.4 Discussions

Based on the empirical estimation, this study found that Thailand topped the list for exports in the raw sugar market, in the BIMSTEC region during the period under study, followed by India. Although India's exports of raw sugar have increased significantly in the recent years, surpassing the performance of Thailand, Thailand too, is steadily recovering after the COVID-19 pandemic. On the other hand, Bangladesh continues to be the top importer in the BIMSTEC in region. It is also evident that India headed the list of raw sugar importers from 20018 to 2010, but India overcame this situation and became a net exporter as opposed to a net importer of raw sugar. In this study the level of competitive advantage and trade specialisation in the raw sugar market was analysed in the context of the BIMSTEC region by using two well-known indices – the RSCA index and the Lafay index. The RSCA index was used to capture the export performance of member nations, whereas the Lafay index was used to identify the level of trade specialisation in the raw sugar market. These two trade indices were then, compared using a one-way ANOVA model. Due to the lack of normality in the residuals of this model as well as the absence of homoscedasticity in the variances, this study further developed the assumptions to address the failure to fulfill the two aforementioned assumptions for a pair wise comparison of the performance of the countries, using the Games-Howell post-hoc estimation, revealed that out of 21 (7C2) combinations, 15 pairs show statistically significant differences. The result is consistent with the trend shown in Figure 1. In the case the of the Lafay index, only 4 out of a total of 21 (7C2) combination pairs are not statistically significant. Another interesting fact is that, the combinations Bangladesh-Bhutan, Bangladesh-Myanmar and Nepal-Sri Lanka are not statistically significant in terms of the RSCA index of BIMSTEC, whereas the same pairs show statistically significant differences under the Lafay index. Moreover, the pair Myanmar-Nepal reported in serial number 16 in both Tables 7 and 8 shows opposite results. As mentioned earlier, the RSCA index captures the relative import performance during the period under study, with Bangladesh, Bhutan, and Sri Lanka being net importers, whereas Myanmar was also a net importer up to 2014, but then shows a continuous improvement in exports, at least untill 2021.

The Lafay index captures a member country's trade specialisation through both exports and imports, and the analysis reveals that Myanmar's export performance is, gradually surpassing its share of import. Similarly, Nepal's exports have exhibited better performance than its imports. Finally, this study found that majority of the member nations of BIMSTEC have significantly increased their raw sugar production as a part of their import substitution policy.

5. CONCLUSION

BIMSTEC is Asia's sole prospect for integration following the ineffectiveness of the SAARC area. It seeks to unite against other regional blocs by strengthening capabilities and achieving specialisation. This would also aid in mitigating the primary problem of its economy, namely poverty, by providing ample investment opportunities to the global community. The study's findings unequivocally demonstrated that India and Thailand are prominent raw sugar exporters and possess a robust comparative advantage in the raw sugar trade. India and Thailand exhibit more competitiveness in the raw sugar trade than the other BIMSTEC countries. Indian sugar has a major competitive advantage and thus needs to be monitored consistently to retain its promising position in the global market. Furthermore, Myanmar is a country that not only exports tomatoes but also possesses a significant competitive advantage in the sugar trade. India and Thailand are engaged in a competitive sugar trade with the other BIMSTEC members. India and Thailand have a substantial edge in sugar exports due to their high production capacities and favourable geographical proximity to major importing nations. Hence, it is advisable to implement export-oriented government policies in India and Thailand to enhance their competitive advantage in the global market. The study shows that India and Thailand have high capacity and potential in producing raw sugar. They outperform most countries in this regard. Therefore, the national governments need to amend their sugar policies to increase the market share of this commodity and optimise the terms of trade in agriculture. This will ultimately improve the nations' respective trade balances with the other BIMSTEC countries. This paper recommends governmental measures to enhance the growth of intra-BIMSTEC trade in sugar products. The findings support the enactment of beneficial policy measures by governments to enhance raw sugar production, exports, and imports between BIMSTEC states. A public-private partnership can significantly enhance anation's

raw sugar exports by offering upgraded infrastructure and extensive information. It is crucial to investigate new markets to improve competitive and comparative advantages and boost raw sugar export revenue. Furthermore, the progress of raw sugar will rapidly stimulate industrialisation and improve export growth.Marketing strategies aimed at entering untapped markets may enhance demand and improve the global positioning of raw sugar exports. However, the study asserts that the results are sufficiently reliable to formulate raw sugar policy recommendations. Nevertheless, it suggests that future research should include an analysis of both trade and non-trade barriers, as well as the influence of the local market factors that were not included within the scope of this investigation.

This study will be helpful for policymakers of BIMSTEC nations for formulate respective national policies to increase the raw sugar levels as this region is conducive to producing raw sugar. Moreover, geographical proximity can enhance the intra-regional trade among the member nations of the region, which can reduce the transaction costs in raw sugar trade. To reap the maximum benefit in this market, an integrated tariff and non-tariff policy can establish this region as a significant hub in the international trade of raw sugar, which can pave the way for a new beginning in 2030 when the BIMSTEC as a region will implement trade facilitation policies in the whole region.

In this study, we have utilized only two trade indices. However, this study could have been improved in multiple dimensions of trade specialisation of raw sugar by using other indices. Another limitation of the study is the use of raw sugar as a homogeneous commodity, whereas further classification of raw sugar commodities could be used by researchers in the future to gain a better understanding of the raw sugar trade.

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APPENDIX: LIST OF TABLES

Table A1: Raw Sugar Exports (in USD) of BIMSTEC Countries

Year	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand
2005	51,757	4,972	40,111,005	805,227	5,026,432	979,970	758,396,357
2006	230,928	2,805	656,762,773	239,411	292,614	939,260	740,123,559
2007	8,892,072	4,413	1,008,282,853	61,310	8,287,313	928,987	1,319,629,159
2008	8,957,140	0	1,529,061,210	6,446,575	6,978,398	388,981	1,486,902,146
2009	7,530,913	0	65,456,395	21,140,826	217,158	187,648	1,832,965,530
2010	31,809	76	930,015,053	9,651,623	4,332	612,037	2,324,078,043
2011	22,890	159	2,151,465,775	8,278,631	14,326	233,233	4,019,499,643
2012	14,597,823	0	2,155,731,136	6,957,175	1,277	222,258	4,084,542,390
2013	22,017,380	0	979,796,050	47,009,982	128	2,065,655	2,969,576,137
2014	4,942,667	0	1,171,418,664	17,813,118	6,108	584,039	2,914,359,118
2015	885,638	0	1,257,869,171	238,997,742	0	674,801	2,798,654,595
2016	7,180,903	0	1,604,903,899	1,067,719,804	13,180	835,603	2,584,861,911
2017	2,378,974	0	1,005,250,682	452,458,365	18,609	1,261,760	2,896,709,299
2018	1,252,666	0	985,020,698	605,421,326	31,355	837,250	3,033,482,554
2019	17,203	0	1,856,967,646	112,273,800	3,089	708,723	3,078,476,669
2020	20,077	0	2,701,513,992	84,741,120	1,182	765,132	1,841,375,451
2021	87,628	11,880	4,112,870,095	115,701,311	1,357	2,731,253	1,575,448,242
2022	69,916	0	6,034,263,140	50,431,627	4,138	876,275	3,224,226,771

Table A2: Raw Sugar Imports (in USD) of BIMSTEC Countries

Year	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand
2005	174,416,153	933,607	277,542,346	2,202,069	7,784,225	178,755,435	2,515,538
2006	386,821,158	655,739	6,567,693	2,563,270	2,772,479	267,472,678	6,494,491
2007	247,217,343	458,751	24,959,795	1,907,986	3,443,871	170,641,376	630,053
2008	411,690,553	548,209	51,708,447	1,512,007	11,898,372	246,191,953	3,871,601
2009	544,766,640	3,532,892	1,645,168,693	2,305,117	8,884,100	260,633,610	4,305,340
2010	571,170,875	1,330,280	1,405,681,342	32,394,231	14,163,139	414,208,776	38,237,049
2011	898,750,414	1,443,441	129,450,007	58,640,775	5,496,947	464,961,950	39,431,363
2012	820449,109	1,277,028	481,167,216	39,520,573	16,884,487	372,058,100	45,339,508
2013	738,537,160	257,045	476,398,361	74,974,637	10,454,980	258,139,879	21,314,531
2014	723,480,297	1,080,384	648,547,404	69,093,353	11,674,941	235,430,321	8,874,578
2015	833,558,223	942,430	483,470,647	514,621,855	16,983,887	232,668,796	15,120,062
2016	674,435,913	1,473,182	891,662,076	1,213,253,404	38,393,626	322,528,738	18,064,187
2017	1,119,856,598	3,084,748	954,768,766	717,674,965	71,724,123	201,870,551	21,437,041
2018	556,279,291	3,305,210	559,719,423	487,536,195	71,023,618	169,320,932	22,123,181
2019	636,908,501	3,526,812	273,951,064	83,305,224	5,605,875	18,8875,553	1,165,173
2020	725,121,540	4,398,785	502,371,474	44,010,415	6,6761,755	258,995,596	33,986,671
2021	874,271,196	5,199,956	123,403,727	50,406,788	72,778,752	26,8976,938	43,890,414
2022	972,026,884	4,908,092	233,482,168	50,533,792	31,283,367	286,570,860	65,194,089