

Strengthening ASEAN-Guangxi Trade Relations: Enhancing Regional Integration and Industrial Collaboration

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Abstract

A complex array of global disruptions—including the COVID-19 pandemic, the US-China trade war, the Russia-Ukraine conflict, retaliatory tariffs, economic stagflation, supply chain breakdowns, and the rise of artificial intelligence technologies—has significantly challenged the foundational structure of regional economic development. This study investigates the key barriers hindering ASEAN-Guangxi trade from achieving sustainable and accelerated economic growth. Trade data from 2019 to 2024 were analyzed, and empirical data were collected through structured questionnaires administered to 200 business practitioners and policymakers across ASEAN member states and Guangxi. The data were processed and validated using the Statistical Package for the Social Sciences (SPSS). The results indicate that enhanced regional integration and the presence of positive spillover effects are pivotal in promoting sustainable trade relations between ASEAN and Guangxi. These findings offer actionable insights for companies operating in the region and serve as a valuable reference for policymakers and future researchers seeking to strengthen regional economic cooperation. This study contributes to the literature by identifying integration and spillovers as critical drivers of resilient regional trade amid contemporary global uncertainties.

Keywords: trade; sustainability; spillover effect; ASEAN-Guangxi

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1. Introduction

The global trade landscape has been profoundly influenced by a series of disruptive events, including the COVID-19 pandemic, escalating trade tensions between the United States and China, retaliatory tariffs, economic stagflation, supply chain disruptions, and the rapid advancement of artificial intelligence technologies. These multifaceted challenges have significantly impacted the economic sustainability of regions worldwide, particularly affecting the trade dynamics between the Association of Southeast Asian Nations (ASEAN) and China. The ASEAN-China Free Trade Area (ACFTA), established in 2010, was envisioned to enhance economic integration and mutual growth. However, despite over a decade of cooperation, the trade relationship between ASEAN and China's Guangxi province has exhibited persistent imbalances. Data from the General Administration of Customs of the People's Republic of China indicate that Guangxi has consistently experienced trade deficits with ASEAN countries. Notably, trade commodities predominantly consist of common agricultural products and low-cost technology goods, even amidst the global shift toward Industry 4.0 and high-tech industrialization (Zhan, 2022).

Several factors contribute to this enduring trade imbalance. First, Guangxi's comparative advantage in producing low-cost goods has led to an influx of inexpensive Chinese products into ASEAN markets, often

undercutting local industries and exacerbating trade deficits (Asia Society Policy Institute, 2025). Second, the limited diversification of export commodities from ASEAN to Guangxi—primarily centered on agricultural products—has hindered the development of a more balanced trade structure. Additionally, infrastructural constraints and non-tariff barriers have further impeded the efficient flow of goods and services between the regions.

The recent completion of negotiations for the upgraded China–ASEAN Free Trade Area 3.0 aims to address some of these challenges by incorporating new sectors such as the digital and green economies, enhancing supply chain connectivity, and deepening the integration of production and supply chains (Reuters, 2025). This development underscores the urgency for both regions to reassess and revitalize their trade strategies to foster a more equitable and sustainable economic partnership.

In light of these developments, the present study seeks to investigate the underlying causes of the persistent trade deficit between ASEAN and Guangxi, focusing on the predominance of low-value trade commodities. Furthermore, it aims to explore how effective trade relations, strategic industrial collaboration, and proactive regional integration can bolster Guangxi’s trade resilience against external shocks and foster a new trajectory of economic development between ASEAN and Guangxi. To achieve these objectives, the study analyzes trade data from 2019 to 2024 and collects empirical data through structured questionnaires administered to 200 business practitioners and policymakers across ASEAN member states and Guangxi. The data are processed and validated using the Statistical Package for the Social Sciences (SPSS). The findings are anticipated to provide actionable insights for companies operating in the region and serve as a valuable reference for policymakers and future researchers seeking to strengthen regional economic cooperation.

2. Literature Review

The global trade environment has been characterized by volatility and uncertainty, driven by factors such as geopolitical tensions, economic policy fluctuations, and unforeseen events like the COVID-19 pandemic (Vo & Tran, 2021). Despite these challenges, Guangxi’s imports from ASEAN countries have shown robust growth over five consecutive years (2019–2024). Cited data from the General Administration of Customs of the People’s Republic of China (Table 1), the import trade values (Unit: Billion) between Guangxi, China and ASEAN were ¥15,759,708,492.00, ¥17,404,975,104.00, ¥21,065,876,817.00, ¥21,446,619,025.00, ¥26,825,596,209.00, and ¥30,645,076,893.00, in 2019, 2020, 2021, 2022, 2023, and 2024, respectively. In contrast, export trade values between Guangxi, China, and ASEAN were significantly lower. The export values were ¥8,860,485,056.00, ¥7,832,744,335.00, ¥7,572,097,586.00, ¥9,894,676,199.00, ¥9,502,867,668.00, and ¥8,710,869,487.00, in 2019, 2020, 2021, 2022, 2023, and 2024, respectively. This persistent trade gap indicates a consistent trade deficit in Guangxi’s trade relations with ASEAN countries over the period under review.

Table 1. Trade values between Guangxi, China and ASEAN from 2019 to 2024.

Year	Import trade value (Billion)	Export trade value (Billion)
2019	¥15,759,708,492.00	¥8,860,485,056.00
2020	¥17,404,975,104.00	¥7,832,744,335.00
2021	¥21,065,876,817.00	¥7,572,097,586.00
2022	¥21,446,619,025.00	¥9,894,676,199.00
2023	¥26,825,596,209.00	¥9,502,867,668.00
2024	¥30,645,076,893.00	¥8,710,869,487.00

Source: General Administration of Customs of the People’s Republic of China.

A trade deficit occurs when a country’s imports exceed its exports—that is, when a nation spends more on imports than it earns from exports (Saif et al., 2021). The negative influences of trade deficits are mentioned in articles; some economists argue that trade deficits may negatively affect economic growth by potentially leading to a loss in domestic production and jobs (Sahin & Mucuk, 2014). Other studies suggest that a trade deficit can have positive implications. For instance, Aydin and Esen (2016) found a positive relationship between trade deficits and economic growth, arguing that deficits may enable a country to import goods and services that are not produced domestically, thereby enhancing productivity and efficiency (Nyoni et al., 2017).

Ahmad and Lugman (2012) further noted that while a trade deficit might contribute positively to economic growth in the short run, persistent deficits could have adverse effects on long-term prosperity.

From 2019 to 2024, Yunnan's overall trade with ASEAN significantly exceeded that of Guangxi. On the import side, Yunnan's total import trade with ASEAN reached ¥219,909,450,817.00, compared to Guangxi's ¥133,147,852,540.00. In contrast, Guangxi's total export trade with ASEAN was ¥52,373,740,331.00, while Yunnan's exports amounted to ¥84,643,526,954.00. Yunnan consistently maintained a higher trade volume, and Guangxi demonstrated a faster growth rate in imports. Specifically, Guangxi's import trade grew by 94.45%, rising from ¥15,759,708,492.00 in 2019 to ¥30,645,076,893.00 in 2024, whereas Yunnan's imports increased by 57.12%, from ¥28,475,678,086.00 in 2019 to ¥44,741,251,300.00 in 2024. In common, both regions experienced persistent trade deficits over this period. Guangxi's trade deficit reached ¥80,774,112,209.00, while Yunnan's deficit was considerably higher at ¥135,265,923,863.00. Although Guangxi's deficit was about 40% lower than Yunnan's, this disparity is partly due to the overall smaller scale of Guangxi's trade.

During the COVID-19 pandemic, both regions saw increases in imports from ASEAN. Guangxi's imports grew from ¥21,065,876,817.00 in 2021 to ¥26,825,596,209.00 in 2023, whereas Yunnan's imports increased from ¥31,277,083,141.00 to ¥49,315,400,264.00 over the same period. However, in terms of exports, Guangxi exhibited greater resilience. While Guangxi's exports experienced a slight decline of 3.33%, from ¥7,572,097,586.00 in 2020 to ¥7,832,744,335.00 in 2021, Yunnan's exports dropped sharply by 28.40%, from ¥22,204,875,166.00 in 2021 to ¥15,899,390,711.00 in 2020. Figure 1 illustrates import and export trends for both Guangxi and Yunnan over the period 2019–2024, as data provided by the General Administration of Customs of the People's Republic of China would provide additional clarity and visual support to these findings. In summary, while Yunnan's trade value with ASEAN countries significantly exceeded that of Guangxi from 2019 to 2024, both regions have consistently maintained trade deficits. Notably, Guangxi's export sector leveraged the pandemic as an opportunity for growth, with export values in 2022, 2023, and 2024 surpassing those in 2021. Conversely, Yunnan's export performance was adversely affected by the pandemic and has yet to recover to pre-pandemic levels.

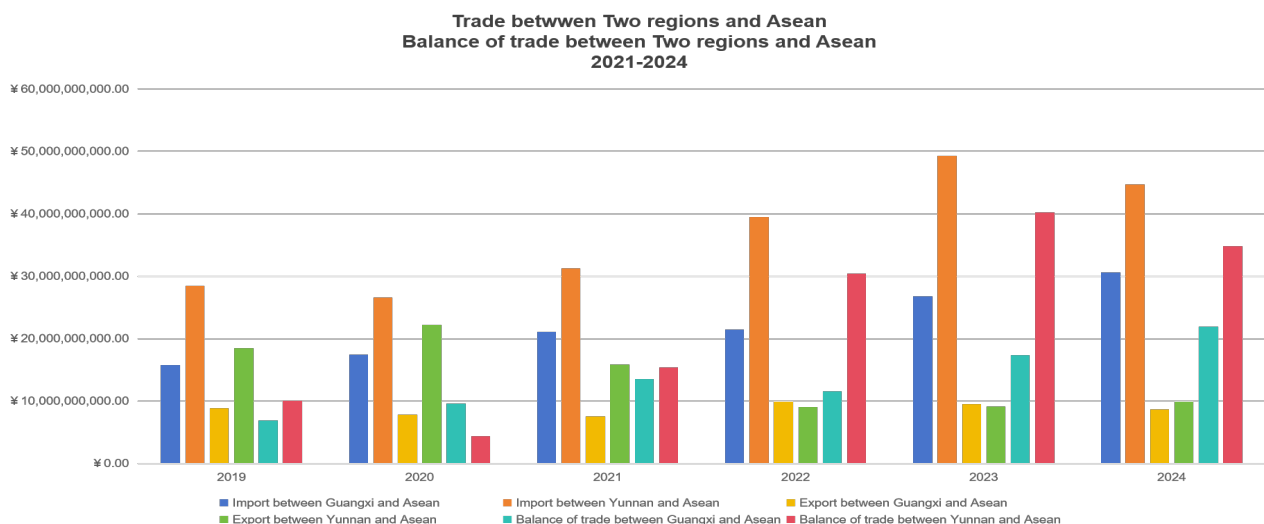


Figure 1. Trade between two regions and ASEAN, Balance of trade between two regions and ASEAN in 2021-2024.

2.1. Government Policy

Despite several headwinds, China and ASEAN have experienced rapid growth in economic cooperation and have fostered healthy relationships over the past decades. In 1991, the bilateral trade volume between China and ASEAN was a mere USD 6.3 billion, while by 2020, the overall trade volume had exceeded USD 684.6 billion (Shen, 2023). In 2018, on the occasion of the 15th anniversary of the establishment of the strategic partnership between China and ASEAN, the vision of the China-ASEAN Strategic Partnership 2030 was announced, marking that China-ASEAN relations had officially entered a new era (Bhowmilk et al., 2021).

Insight into the trade between China and ASEAN countries reveals that total exports from China to ASEAN member states jumped to USD 294.8 billion in 2018, up from USD 22.7 billion in 2000 and USD 129.0 billion in 2010. This indicates that within less than 20 years, China's exports to ASEAN increased thirteenfold. Total imports to China from Southeast Asian countries also grew dramatically, reaching USD 202.7 billion in 2018, compared to USD 16.9 billion in 2000, USD 54.7 billion in 2005, and USD 114.4 billion in 2010. Consequently, the balance of trade has remained in China's favor (Hiep et al., 2020). However, only three out of the ten ASEAN member countries—Brunei, Laos, and Malaysia—registered higher exports to China than imports from China. While Brunei (USD 1 billion) and Laos (USD 0.6 billion) recorded relatively small surpluses, Malaysia's trade surplus with China reached USD 17.8 billion, driven primarily by exports in electrical and electronics products, rubber products, and palm oil-based agricultural products. These goods, considered important raw materials and intermediate inputs, saw a surge in demand as production capacities in China returned to pre-pandemic levels (Li, 2021).

Previous studies have argued that local governments in Yunnan and Guangxi have played an important and positive role in strengthening the relations between China and ASEAN and promoting regional economic development. Guangxi Zhuang Autonomous Region, strategically located in southern China, serves as a crucial nexus between China and the Association of Southeast Asian Nations (ASEAN). Its unique geographical position endows it with significant economic and geopolitical importance, particularly in facilitating regional trade and integration (Li, 2019). Moreover, as the only Chinese region bordering ASEAN both by land and sea, Guangxi has been pivotal in advancing the Belt and Road Initiative (BRI) and the New International Land-Sea Trade Corridor, thereby enhancing connectivity and economic cooperation between China and Southeast Asian countries (Bing, 2022). In a strategic push by the State Council of the People's Republic of China and the People's Government of Guangxi Zhuang Autonomous Region, Guangxi became an official member of the Greater Mekong Subregion (GMS) cooperation scheme in 2005, joining Yunnan Province (Li, 2019). More importantly, through various lobbying efforts, Guangxi secured central government support to permanently host the annual China-ASEAN Expo in its capital city, Nanning (Li, 2019). Yunnan is the most southwestern province in China, another economic corridor that connects China and ASEAN. As part of the plans to promote economic activities in Yunnan Province, the government initiated the concept of a "pivot" for South Asia and Southeast Asia for the period 2016 to 2020 (Li & Zhang, 2020). Several constructions have been completed, as Yunnan is actively involved in the construction of energy pipelines and foreign trade, seeking further economic growth by strengthening its economic ties with Myanmar (Yoshikawa, 2022). In contrast, ineffective government policy has low public support and hinders a region's ability to achieve its economic goals. Low public support for government intervention in health, environmental, and other policy domains can be a barrier to implementation (Reynolds et al., 2020).

H1: Government policy (e.g., trade facilitation measures, economic incentives) significantly impacts the sustainability of Guangxi–ASEAN and Yunnan–ASEAN import and export trade.

2.2. Regional Integration

Regional economic integration theory examines how neighboring countries or regions collaborate through trade, investment, and policy harmonization to optimize resource allocation and achieve mutual economic growth. This theory posits that reducing trade barriers, fostering the free movement of goods, services, capital, and labor, and harmonizing regulatory frameworks can lead to a more competitive and efficient regional market (Balassa, 2013). Over the past few decades, regional integration has become a critical driver of economic development, especially in Southeast Asia, where initiatives such as the ASEAN Free Trade Area (AFTA), the ASEAN Economic Community (AEC), and the Regional Comprehensive Economic Partnership (RCEP) have significantly influenced trade dynamics.

In the context of China-ASEAN cooperation, regional integration is vital for enhancing bilateral and multilateral trade relations. Regions like Guangxi and Yunnan, due to their strategic geographic proximity to ASEAN countries, have actively embraced integration processes. By aligning with regional integration policies, these regions work to reduce non-tariff barriers, improve infrastructure connectivity, and streamline economic regulations. Such efforts are not only aimed at boosting trade volumes but also at creating a more

resilient and sustainable trade environment (Hill & Menon, 2012). Furthermore, successful integration initiatives often generate spillover effects, wherein improved trade relationships and collaborative frameworks extend benefits beyond immediate partners, ultimately contributing to broader regional economic stability (Athukorala & Kohpaiboon, 2012). Yunnan also plays a pivotal role in regional interaction with ASEAN. Zhu (2011), in "Rescaling the Chinese State and Regionalization in the Great Mekong Subregion," found that the Chinese state deploys two spatial strategies — upward coordination with international organizations and GMS national governments, and downward implementation throughout Yunnan Province — to establish an interstellar regulatory regime.

On the other hand, regional economic growth is difficult to produce when countries can't integrate in a scientific approach, according to Genna et al. (2024). Integrating with similarly sized economies is less beneficial than partnering with larger, wealthier nations. Their study also indicates that multiple memberships in regional integration organizations (RIOs) can decrease GDP per capita growth, particularly in less-developed countries. However, this negative effect diminishes when an RIO includes a large economic partner.

H2: Regional integration significantly impacts the relationship between government policies/industrial structure and trade sustainability in Guangxi and Yunnan.

2.3. Industrial Structure

An optimized industrial structure is fundamental to fostering trade resilience in a region, as industrial network characteristics can enhance resilience and circumvent economic collapse (Yi, 2022). A diversified and technologically advanced industrial base not only improves production efficiency but also enhances a region's capacity to innovate and adapt to fluctuating market conditions. For instance, well-developed industrial clusters can generate knowledge spillovers that boost productivity and contribute to more stable trade performance (Tan, 2006). Moreover, Lazzarini (2015) posits that diversification within an industry mitigates risks and strengthens competitive advantage, thereby enabling regions to withstand external shocks better.

In the context of China–ASEAN trade, both Guangxi and Yunnan have undergone significant industrial transformations in recent years. Through the adoption of advanced technologies and improved production processes, industrial upgrading has played a key role in bolstering export competitiveness and maintaining a balanced trade profile. Gereffi et al. (2021) emphasize that integration into global value chains is crucial for economic upgrading, as it enhances the resilience of trade flows by embedding regional industries in broader international networks. Furthermore, empirical research indicates that emerging economies benefit from an optimized industrial structure by reducing vulnerability to external shocks and supporting long-term trade sustainability (Frankel & Roubini, 2001). Together, these findings underscore the importance of continuous industrial development in reinforcing trade resilience amidst global economic uncertainties.

In recent years, Yunnan's industrial structure has faced challenges from technological transformation, industrial transformation, etc. To tackle these challenges, Yunnan's government has published a new outline of the program for industrial development. Besides the original top five pillar industries—tobacco, hydropower, minerals, bio-industrial, and tourism—another five industries, including the photoelectric industry, ferrous metal, non-ferrous metal, petrochemical trade and circulation, and equipment manufacturing, are also listed as priorities. As measured by the outline of the program, the annual sales revenue of these ten industries was projected to reach 2,000 billion yuan by 2015. Yunnan's industrial development is expected to enter a new phase (Zhu, 2011). However, some industrial structures negatively affect economic development. The primary industry employs the largest proportion of the total workforce but makes the least economic contribution to GDP. In contrast, the secondary and tertiary industries have a comparatively balanced level of output value and employment structure, occupying a smaller proportion of the labor force.

H3: Industrial Structure significantly impacts the resilience and sustainability of Guangxi–ASEAN and Yunnan–ASEAN trade.

2.4. Industrial Collaboration

In recent years, industrial collaboration has made a remarkable comeback, driven by global crises such as economic stagnation, the COVID-19 pandemic, disruptive technology, workforce challenges, localization, and climate sustainability. Nations are revolutionizing their industrial collaboration, focusing on economic resilience, balance of trade, technological self-reliance, foreign direct investment (FDI), and social development.

Over the 30 years since the establishment of a dialogue between China and ASEAN, economic and trade relations have grown rapidly, attributed to both sides' strong cooperation on infrastructure connectivity, production networks, industrial upgrades, and regional value chains. The analysis finds that road, port, shipping, and communication infrastructure positively impact the bilateral trade volume, among which ports exert the greatest impact and roads have the least impact (Shen, 2023). "The Impact of Infrastructure Development on China-ASEAN Trade—Evidence from ASEAN." In the competitive landscape of modern manufacturing and industrial operations, staying ahead often requires industrial collaboration and industrial upgrades. "An Industrial Human-Robot Collaboration Case Study for Workers' Well-Being" reports that the AI system balances the trade-off between process needs and operator well-being by considering buffer levels, workers' perceived physical fatigue, and hand preferences. The results show a reduction between 17% and 32% in the total cycle time, better workload balance, increased job satisfaction, and reduced perceived fatigue. The development of technology has posed significant challenges to manufacturing firms' traditional business models and pushed them to adopt the trend of industrial development. Thus, "Collaborative Robots" are utilized in several methods and a wide range of application areas. These elevate manufacturing and other operations to new heights. They also collaborate with humans to balance the demand for safety and the need for flexibility and efficiency (Sutton & Arku, 2022). "Significant Applications of Cobots in the Field of Manufacturing." Yunnan has also cooperated with ASEAN's parks under the China-ASEAN initiative. Li and Zhang (2020) point out the cooperation direction and construction guidelines for collaboration between Yunnan Province and overseas parks. This cooperation promotes the rapid development of industrial parks through partnerships in agriculture, production capacity, and tourism with neighboring countries. However, collaboration does not always result in positive outcomes. It can discourage individual creativity and erode resilience. Opportunistic negative collaboration behaviors within the network can lead to risk generation, risk propagation, and potential dysfunction of the entire collaboration network (Sun et al., 2025).

H4: Industrial Collaboration significantly impacts the creativity of business model and economic resilience of Guangxi-ASEAN and Yunnan-ASEAN trade.

2.5. External Shocks

External Shocks and Trade Imbalance Theory examines how external factors, such as pandemics, geopolitical tensions, and economic policy fluctuations, affect international trade flows and economic stability. Central to this theory is the analysis of trade imbalances, which occur when a region's imports consistently exceed its exports. Such imbalances may reflect underlying structural issues, including competitiveness gaps and suboptimal industrial configurations (Bagnai, 2009). External shocks can exacerbate these imbalances by disrupting supply chains, altering demand patterns, and increasing exchange rate volatility (Tröster & Küblböck, 2020). For instance, the COVID-19 pandemic has led to significant trade volatility globally, highlighting vulnerabilities in regional trade systems (Ahmed, 2024). In this context, regions like Guangxi and Yunnan, which are key players in China-ASEAN trade, face heightened risks of trade deficits that can impede sustainable economic growth.

To counteract these challenges, proactive government interventions and industrial structure optimizations are essential. By implementing targeted policies and encouraging strategic industrial upgrading, Guangxi and Yunnan can mitigate the negative impacts of external shocks, thereby reducing trade deficits and promoting a more balanced trade environment. Moreover, integration into global value chains can further buffer these regions against external disturbances by facilitating necessary exchange rate adjustments and fostering deeper market linkages (Solingen et al., 2021).

Overall, External Shocks and Trade Imbalance Theory provides a useful framework for understanding the dynamics of trade imbalances in an era marked by global uncertainty. It underscores the importance of robust policy measures and structural reforms in maintaining trade sustainability and regional economic stability. Whereas the force of external shocks is beyond economic resistance ability, the 2008 financial crisis adversely affected many countries and had heterogeneous effects on regions globally, with some regions being more adversely impacted than others (Sutton & Arku, 2022).

H5: External shock (e.g., geopolitical tensions, economic policy fluctuations, pandemics) significantly impacts the nexus among government policies, industrial structure, and regional integration on trade sustainability, such that higher shock intensity attenuates the positive effects while moderate or low-intensity shocks allow the synergy to fully manifest.

2.6. Synergistic Effects

Synergistic effects occur when multiple elements—such as government policies, industrial restructuring, and regional integration—work together to generate greater outcomes than they would individually (Porter, 1998). The recent China-ASEAN synergy has provided a roadmap for better regional cooperation and social development, as strengthening cybersecurity cooperation between China and ASEAN not only helps safeguard each other's cybersecurity interests but also promotes the building of a multilateral, democratic, and transparent global digital governance system and a solid community of shared future in cyberspace. "ASEAN Cybersecurity Policy and China-ASEAN Cooperation."

China and ASEAN, working together to tackle climate issues, focus on emissions, soil and solid waste management, practicing scientific innovation, incentive mechanisms, and optimizing industrial structure. They take green development as a great opportunity to boost cooperation in technology transfer, policy innovation, resource efficiency improvement, and cultural exchange, and jointly build the "Maritime Silk Road" (Ting & Yongkun, 2023). "China-ASEAN Green Development Practice." China-ASEAN continuous investment and effective collaborations focus on the health industry, not just to promote the rapid development of vaccines, medical devices, and equipment, but also to contribute to reducing the disease burden worldwide. For example, the China-ASEAN Beijing Declaration on Cooperation in Innovation of Health Products and Technologies, held on June 23-28, 2024, has played an active role in regional public health governance and development cooperation, promoting the R&D accessibility of health products in the region and helping achieve faster and more equitable access to health products for a broader population (Xu et al., 2025). "A New Phase of China-ASEAN Health Cooperation: The China-ASEAN Beijing Declaration on Cooperation in Innovation of Health Products and Technologies."

There may be a positive synergistic effect, as described above, and a negative synergistic effect, as ecological negative synergy results from placing more demand on the environment than it can process within the capability of its restorative powers. Ultimately, the negative synergistic effect results in a less productive or permanently unproductive environment (Mathews, 2006). In the energy field, any renewable energy policy mix (REPM) including tradable green certificates had no synergistic effect, and there were no REPMs with negative synergy (Zha et al., 2023).

H6: Synergistic Effect has interplayed among government policies, industrial structure, and regional integration, exerting a combined effect on the resilience and sustainability of Guangxi-ASEAN and Yunnan-ASEAN trade, even under external shocks.

2.7. Spillover Effects

Spillover effects, in turn, refer to the diffusion of these benefits to surrounding areas, fostering broader economic stability and trade expansion (Audretsch & Feldman, 2004). Optimizing the synergy solution is essential to advancing regional economic sustainable development, as the results of "Spillover Effects of China's Trade and Growth Shocks on ASEAN Countries: Evidence from GVAR Model" indicate that heterogeneity among countries should be considered more seriously when conducting empirical research.

This creates the need for more research on the interaction between these countries to better understand the economic integration process (Liao, 2025).

In the context of Guangxi and Yunnan, this theory is particularly relevant in analyzing how government-driven industrial coordination, investment in infrastructure, and cross-border trade facilitation create positive externalities that reinforce economic resilience. For example, research suggests that targeted policy interventions, such as the establishment of special economic zones (SEZs) and trade hubs, lead to productivity gains that not only benefit the host region but also spill over to adjacent areas, enhancing interregional trade efficiency (Krugman, 1991). Furthermore, the development of industrial clusters in Guangxi and Yunnan strengthens synergistic effects by fostering innovation, reducing transaction costs, and increasing market competitiveness (Audretsch & Feldman, 2004). These clusters promote knowledge-sharing and technological advancements which, when coupled with regional trade agreements and supply chain integration, generate a self-reinforcing cycle of economic growth. The China-ASEAN Free Trade Area (CAFTA) serves as an example of policy-induced synergy, where coordinated efforts in tariff reduction, infrastructure connectivity, and trade facilitation lead to increased trade volume and diversified investment flows, benefiting both core economic zones and peripheral regions (Li & Whalley, 2014). Conversely, social problems, climate issues, and culture shock may contribute to negative spillover effects; some concerns prevail about whether the BRI would quicken global energy consumption, cause local environmental stress transfer, and depreciate the global ecological environment (Hu et al., 2022).

The ideal interplay between synergistic and spillover effects ultimately shapes the trade resilience of Guangxi and Yunnan by embedding them in a broader regional economic framework. By strategically leveraging these dynamics, policymakers can enhance economic stability, mitigate risks associated with trade volatility, and ensure sustainable long-term development.

H7: The spillover effect significantly impacts the nexus among government policies, industrial structure, and regional integration on trade sustainability in Guangxi and Yunnan, generating spillover benefits that enhance broader regional economic stability and promote sustainable trade practices in neighboring areas.

Based on related literature reviews, government policies, and previous studies discussed above, the authors developed a conceptual framework to study the factors that could impact Guangxi's China-ASEAN trade sustainability (Figure 2).

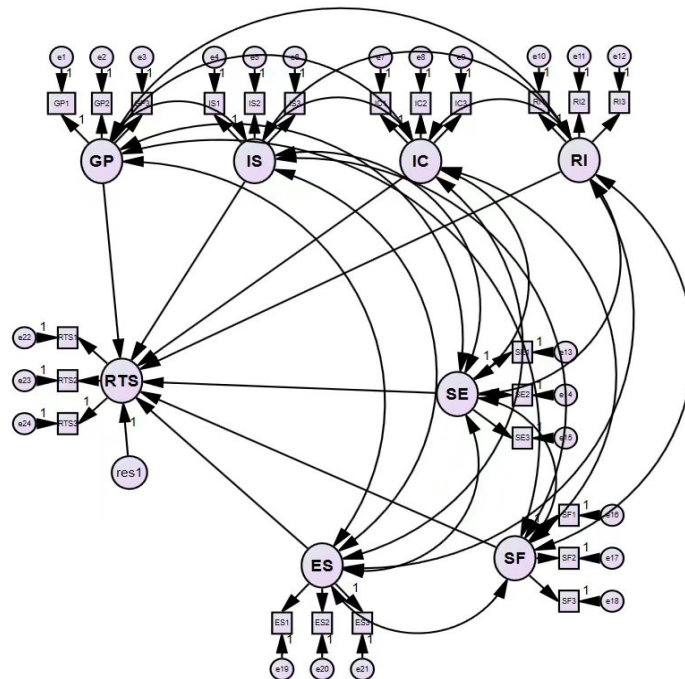


Figure 2. Conceptual framework of regional trade sustainability.

Note: GP = Government Policy; RI = Regional Integration; IS = Industrial Structure; IC = Industrial Collaboration; ES = External Shocks; SE = Synergistic Effects; SF = Spillover Effects; RTS = Regional Trade Sustainability.

3. Methodology

3.1. Sampling Approach

China and ASEAN have made remarkable achievements under the Belt and Road Initiative (BRI) and the ASEAN-China Free Trade Area (ACFTA). However, Guangxi, one of the provinces connected with ASEAN, has had a long-standing trade deficit with ASEAN. According to trade data from the General Administration of Customs of the People's Republic of China, most trade commodities between Guangxi and ASEAN are low-value and possess fewer competitive advantages, rather than being high-value and highly competitive. The results of this study are believed to be useful for business management and investment and also provide relevant background for comparison and further research in other Asian countries trading with Guangxi, China.

The primary objective of the study was to identify factors that affect trade sustainability between ASEAN and Guangxi. To achieve this, data were collected through a self-administered internet survey targeting 200 individuals interested in ASEAN-Guangxi trade sustainability from March to April 2025. The survey data were measured and validated using the Statistical Package for the Social Sciences (SPSS) and Structural Equation Modeling (SEM) for data analysis.

Participants were sampled from different occupational groups. The first group consisted of students studying international business management, public management, and investment management at universities. The second group included employees working for companies and state-owned enterprises engaged in trade between ASEAN and Guangxi. The third group comprised teachers and researchers studying the trade and political relationship between ASEAN and Guangxi. The objective was to understand why Guangxi has maintained a trade deficit with ASEAN for so long and how stakeholders can support Guangxi's rapid international business development in the future.

3.2. Questionnaire Development

In this paper, a structured questionnaire was used, employing a specified and clear pattern with sequential questions (see Appendix). The questions are pre-coded and commonly used in data collection processes, consisting mainly of closed-ended questions with various response schemes, ranging from checklists and multiple choices to rating scales. These are the preferred question types in self-administered questionnaires, as they typically do not cause difficulties for respondents and require less assistance. Regarding the rating format, Likert Scaling was mostly used, a summative scaling type that arranges opinions on a range from extremely positive to extremely negative (Hamed, 2022). However, personal information was not collected in this questionnaire, as respondents commonly prefer not to provide precise details such as age and income. Asking such questions may demotivate participants (Agrawal, 2010).

To ensure that participants were willing and able to answer the questions, and to align with the primary objective of the study, 15 respondents with similar backgrounds, educational levels, interests, and attitudes were invited to pre-test the questionnaire before it was distributed to 200 respondents. The feedback from this pre-test was used to revise the questionnaire (Agrawal, 2010).

Structural Equation Modeling (SEM) was used in this study, as it is a scientific framework encompassing a broad range of statistical techniques (e.g., path analysis, confirmatory factor analysis). Path analysis models are highly flexible in terms of hypothesized relationships among variables and variable structure, enabling a wider range of research questions to be addressed. Additionally, path models provide a framework to move away from an overreliance on the somewhat simplified mindset associated with null-hypothesis significance testing (NHST), toward model-based reasoning—where relationships between variables are viewed as part of a broader explanatory system that is evaluated as such (Larsson et al., 2021).

4. Results

Thus, statistical analysis methods were used to further explore and analyze the data on RMR, GFI, RMSEA, and P-value to obtain the findings of this study. The default model (Table 2) shows a low Root Mean Square Residual (RMR = 0.054) and high Goodness-of-Fit Index (GFI = 0.917), as well as Adjusted GFI (AGFI = 0.892), indicating that it captures the covariance structure of the data well. The Parsimonious GFI (PGFI = 0.667) also suggests an acceptable level of model parsimony. In comparison, the saturated model (which theoretically has a perfect fit) shows ideal indices, while the independence model, which assumes no relationships among variables, yields much poorer fit indices (RMR = 0.125, GFI = 0.480, AGFI = 0.310). This comparison confirms that the default model is far more effective in representing the data than the baseline independence model.

Table 2. Fit indices comparison (RMR & GFI Series).

	Default Model	Saturated Model	Independence Model
RMR	0.054	0.000	0.125
GFI	0.917	1.000	0.480
AGFI	0.892	1.000	0.310
PGFI	0.667	N/A	0.253

For the default model (Table 3), the RMSEA value (0.058) falls within the acceptable range (typically 0.05–0.08), and the narrow 90% confidence interval (0.045–0.072), along with a PCLOSE value of 0.12, indicates a good approximate fit. In contrast, the independence model's RMSEA is much higher (0.185), with a 90% CI ranging from 0.170 to 0.200 and a PCLOSE of 0, which confirms that the independence model provides a very poor fit. This further supports that the default model is much better at capturing the underlying data structure than the independence model.

Table 3. RMSEA, 90% confidence intervals, and PCLOSE comparison.

Model	RMSEA	90% CI Lower (LO90)	90% CI Upper (HI90)	PCLOSE
Default Model	0.058	0.045	0.072	0.12
Independence Model	0.185	0.170	0.200	0.000

Regional Integration (R.I.) and Spillover Effects (S.E.) appear to have significant effects on the sustainability of trade between Guangxi, China, and ASEAN countries, as their p-values are 0.034 and 0.031, respectively, both less than 0.05 (Table 4).

Table 4. P-values.

Variable	Regression Coefficient	p-value	Interpretation
Regional Integration (Q2.2)	0.1304	0.034 ✓	Significant positive effect—stronger regional integration improves trade cooperation ratings.
Spillover Effects (Q2.7)	0.1186	0.031 ✓	Significant positive effect—policy spillover effects enhance trade cooperation.
Government Policy (Q2.1)	0.0224	0.719 ×	Not significant
Industrial Structure (Q2.3)	0.0657	0.316 ×	Not significant
Industrial Collaboration (Q2.4)	-0.0046	0.939 ×	Not significant
External Shocks (Q2.5)	0.0351	0.537 ×	Not significant
Synergistic Effects (Q2.6)	0.0414	0.498 ×	Not significant

Government policy may affect regional cooperation and development, as effective government functions and policy coordination are essential for successful regional coordinated development. They ensure balanced growth, reduce disparities, and enhance overall regional sustainability (Shi, 2025). Regional economic resilience may be influenced by the industrial structure. In “Industrial structure or agency: What affects regional economic resilience? Evidence from resource-based cities in China,” regional economic resilience is decomposed into an industrial structure effect and an agency effect. The findings indicate that for Chinese RBCs, overall economic resilience is mainly determined by the agency effect, while the industrial structure generally has a negative effect. Scientific industrial collaboration may strengthen firms’ cooperation by pursuing common interests and a shared future. The findings of “The development of regional collaboration for resource efficiency: A network perspective on industrial symbiosis” suggest that preferential growth is a dominant process widely held in self-organized IS networks, indicating an enduring disparity of firms’

capabilities in building IS (Zhu & Ruth, 2014). Regional integration may help optimize the distribution of resources within a region and thereby impact economic and environmental development. The results of “Impact of regional integration policy on urban ecological resilience: A case study of the Yangtze River Delta region, China” showed that regional integration can bolster urban ecological resilience by refining industrial structures and advancing green technological innovations (Yin et al., 2024). The article “Exploration of the spillover effects of cross-regional cooperation under the Belt and Road Initiative: A discussion based on the regulation of financial technology” explains that economic development induced by BRI cooperation can extend to neighboring provinces and cities, thereby amplifying overall regional growth (Liao, 2025). Finally, the article “The impact of cross-regional social and ecological interactions on ecosystem service synergies” suggests that the above factors should form a combined effort to achieve more than the sum of their individual contributions, as achieving these synergies is crucial; they can lead to positive interactions between different ecosystem services, creating complex and interconnected relationships (Ze & Xiangzheng, 2024).

5. Discussion

The questionnaire results were contributed by 200 respondents, mainly from ASEAN and Guangxi. Ten out of 200 questionnaires were invalid, as the respondents found some questions somewhat technical and thus declined to complete the questionnaire. Using the SEM model to analyze the questionnaire results, we found that regional integration and spillover effects are key factors affecting trade sustainability between ASEAN and Guangxi.

The findings of this paper align with recently published articles. “The Nexus Between Regional Trade Integration and ASEAN Macroeconomic Indicators: Evidence from Bayesian Panel Regression Approach” also highlights that regional integration plays an important role in boosting regional economic development. Their empirical findings suggest that regional export diversification and trade intensity promote economic growth across ASEAN, whereas the regional value chain stimulates employment. Furthermore, regional trade integration significantly reduces inflation (Nathapornpan & Arwatchanakarn, 2022). In addition, “Assessing the Trade Relationship Between Guangxi Province and ASEAN Countries under China-ASEAN Free Trade Area” suggests that Guangxi should actively work with ASEAN nations to optimize regional integration. Guangxi province should increase imports of products from ASEAN countries to maintain its trade balance and promote economic development, while also strengthening its market development in Indonesia, Thailand, and the Philippines, based on existing cooperation with Vietnam, Singapore, and Malaysia (Zhen et al., 2022). “The Regional Economic Spatial Spillover Effect of China and ASEAN” also states that the economies of China and the 10 ASEAN countries are spatially correlated, with positive spatial spillover effects (Xu et al., 2025). The authors of “Resource Trade and the Spillover Effect Between Two Regions” also found that two regions can both benefit from positive spillover through resource trade if the ratio is set properly (Di et al., 2013).

Nowadays, the world is changing faster than ever. There are many uncertain factors that may affect not only the trade relations between ASEAN and Guangxi but also Guangxi’s industrial structure and business environment. It is believed that future researchers may identify more factors influencing ASEAN-Guangxi sustainability at different stages of economic and social development.

The findings of this study have important implications for policymakers and business leaders aiming to enhance trade sustainability between Guangxi and ASEAN countries. By highlighting the critical roles of regional integration and spillover effects, the research suggests that coordinated government policies and strategic collaboration among stakeholders are essential to foster balanced economic growth and reduce trade deficits. Moreover, understanding these dynamics can guide targeted interventions to strengthen infrastructure, optimize industrial structures, and promote innovation-driven clusters, ultimately improving the competitiveness of trade commodities. These insights also provide a foundation for future research to explore additional factors influencing trade sustainability in evolving economic contexts, enabling more adaptive and resilient trade strategies in the region.

6. Conclusion

China and the Association of Southeast Asian Nations (ASEAN) have been working together to strengthen cooperation in various areas, becoming each other's largest trade partners for years, increasing capital flow, improving investment efficiency, and promoting stable regional economic development. Guangxi, as one of the Chinese provinces connected with ASEAN, has significant advantages in location, culture, language, climate, transportation, and policy, and should actively seize opportunities in digital and industrial transformation, unlocking more cooperation opportunities in the green industry and digital economy with ASEAN to advance all-round collaboration. Meanwhile, Guangxi should upgrade its industrial structure, infrastructure, education, financial management, and business environment to build a more stable and smoother cross-border industrial and supply chain. This article not only helps readers understand the factors influencing the sustainability of Guangxi-China-ASEAN trade but also provides practical suggestions for governments to optimize the trade and industry structure between ASEAN and Guangxi, helping Guangxi better embrace industrial transformation and promote scientific regional economic management. Our findings and independent variables may provide evidence for future researchers studying trade relations between ASEAN and Guangxi. The data on ASEAN-Guangxi trade value from 2019 to 2024, extracted from the General Administration of Customs of the People's Republic of China, may help businesses innovate their business models to align with market development trends and provide suggestions for investors to further optimize their investment portfolios to realize greater returns on investment.

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Appendix – Questionnaire

- Q1. What is Guangxi, China biggest trade partner in Asean countries? Ex. Thailand, Singapore, Malaysia, Brunei, Laos, Vietnam, Philippines?
- Q2. Please rank the following factors affecting the balance of trade between Guangxi, China and Asean countries from the scale of 0 to 7; 0 (No effect), 1 (Minimum effect), 2 (Mild),....., 7 (Maximum effect).
- 2.1 GPE. Government policy effectiveness (From the scale of 0 to 7)
 - 2.2 RI. Regional integration (From the scale of 0 to 7)
 - 2.3 IS. Industrial structure (From the scale of 0 to 7)
 - 2.4 IC. Industrial collaboration (From the scale of 0 to 7)
 - 2.5 ES. External shocks (From the scale of 0 to 7)
 - 2.6 SY. Synergistic effect (From the scale of 0 to 7)
 - 2.7 SP. Spillover effect (From the scale of 0 to 7)
- Q3. Please rank the following on the scale of 1 (Strongly disagree) to 5 (Strongly agree):
- 3.1.1 I believe government policy effectiveness would causes unsustainable regional trade.
 - 3.1.2 I believe government policy effectiveness makes regional trade difficult to maintain its growth momentum.

- 3.1.3 I believe regional trade that can get rapidly development by government policy effectiveness will become more sustainable than those that cannot.
- 3.2.1 I believe regional integration causes unsustainable regional trade.
- 3.2.2 I believe regional integration makes regional trade easy to maintain its growth momentum.
- 3.2.3 Regional integration effect regional economic development dramatically and unpredictably making it hard to stabilize income.
- 3.3.1 I believe industrial structure causes unsustainable regional trade.
- 3.3.2 I believe industrial structure makes regional economic difficult to maintain its growth momentum.
- 3.3.3 I believe the upgrade of industrial structure causes regional trade to transform their regional trade structure too often to survive so it's difficult to sustain,
- 3.4.1 I believe industrial collaboration causes unsustainable regional trade.
- 3.4.2 I believe industrial collaboration makes regional trade difficult to maintain its growth momentum.
- 3.4.3 Industrial collaboration effect regional economic development dramatically and unpredictably making it hard to stabilize income.
- 3.5.1 I believe external shocks cause unsustainable regional trade
- 3.5.2 I believe external shocks makes regional trade difficult to maintain its growth momentum.
- 3.5.3 External shocks effect regional economic development dramatically and unpredictably making it hard to stabilize income.
- 3.6.1 I believe synergistic effect causes unsustainable regional business.
- 3.6.2 I believe synergistic effect makes regional trade difficult to maintain its growth momentum.
- 3.6.3 Synergistic effects regional economic development dramatically and unpredictably making it hard to stabilize income.
- 3.7.1 I believe spillover effect causes unsustainable regional trade.
- 3.7.2 I believe spillover effect makes regional trade difficult to maintain its growth momentum.
- 3.7.3 Spillover effect effects regional economic development dramatically and unpredictably making it hard to stabilize income.

Section 1: Trade Partner Identification

Q1. What is the largest trade partner for Guangxi, China, among the following ASEAN countries? (Select one)

- Thailand
- Singapore
- Malaysia
- Brunei
- Laos
- Vietnam
- Philippines
- Other: _____

Section 2: Impact Ratings on Trade Balance

Please rate the impact of the following factors on the balance of trade between Guangxi, China and ASEAN countries on a scale from 0 (No effect) to 7 (Maximum effect). Below are some simple explanations and definitions of academic terms that appear in our questionnaire for your convenience:

Government Policy

- Definition: Refers to the measures and regulations established and implemented by the government that influence economic activities, trade facilitation, and industrial development.
- Explanation: In this study, "government policy" encompasses the strategic interventions and initiatives taken by the government to promote regional trade and economic development.

Regional Integration

- Definition: The process by which neighboring countries or regions reduce trade barriers, coordinate policies, and enhance cooperation to foster economic interdependence and resource sharing.
- Explanation: This variable measures the degree of economic and infrastructural connectivity, reflecting how closely the economies are integrated within a region.

Industrial Structure

- Definition: The composition, proportion, and interrelationship among various industries within a region, reflecting the diversity and specialization of economic activities.
- Explanation: An optimized industrial structure, characterized by a higher share of high-tech and value-added industries, enhances regional competitiveness and efficiency.

Industrial Collaboration

- Definition: The cooperative interactions among firms or industries that facilitate information sharing, resource integration, and innovation.
- Explanation: Effective industrial collaboration can reduce transaction costs and foster competitive advantage, thereby supporting sustainable trade and economic growth.

External Shocks

- Definition: Unforeseen external events such as pandemics, geopolitical tensions, or economic policy fluctuations that disrupt international trade and economic stability.
- Explanation: This variable assesses how these unpredictable events impact trade balance and overall economic resilience.

Synergistic Effects

- Definition: The phenomenon whereby the combined impact of multiple factors (e.g., government policy, industrial structure, and regional integration) is greater than the sum of their individual effects.
- Explanation: In this study, synergistic effects are examined to understand how the interaction of different policies and strategies enhances trade sustainability.

Spillover Effects

- Definition: The diffusion of benefits from a particular policy or economic activity to neighboring regions, which results in broader positive impacts on economic stability and development.
- Explanation: This concept helps measure how successful initiatives in one area can extend their advantages to adjacent regions, promoting overall economic growth.

Trade Sustainability

- Definition: The ability of a region to maintain stable and consistent trade growth over the long term, even when faced with various challenges.
- Explanation: As a core outcome variable in the study, trade sustainability evaluates the enduring nature of trade relationships and economic development.

Trade Resilience

- Definition: The capacity of a trade system to recover quickly from external shocks and maintain stability.
- Explanation: Trade resilience is assessed by measuring the volatility and recovery speed of trade flows, reflecting the adaptability of the regional economy.

Trade Balance

- Definition: The difference between a region's exports and imports, indicating whether the region experiences a trade surplus (exports exceed imports) or a trade deficit (imports exceed exports).
- Explanation: This metric is used to evaluate the overall health of regional trade and understand the impact of various factors on economic stability.

Q2.1. Government Policy – How significantly do government policies affect the trade balance?

Q2.2. Regional Integration – How significantly does regional integration impact the trade balance?

Q2.3. Industrial Structure – How significantly does the optimization of industrial structure affect the trade balance?

Q2.4. Industrial Collaboration – How significantly does collaboration among industries impact the trade balance?

Q2.5. External Shocks – How significantly do external shocks (e.g., COVID-19, geopolitical tensions) affect the trade balance?

Q2.6. Synergistic Effects – How significantly does the combined effect of government policy, industrial structure, and regional integration affect the trade balance?

Q2.7. Spillover Effects – How significantly do the spillover benefits from effective policies and collaboration affect the overall trade balance?

Section 3: Perceptions of Key Factors Affecting Regional Trade Sustainability

For each of the following statements, please indicate your level of agreement on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.1 Government Policy

Q3.1.1: I believe that government policies contribute to sustainable regional trade.

Q3.1.2: I believe that inconsistent or ineffective government policies hinder the growth momentum of regional trade.

Q3.1.3: I believe that coordinated government policies enhance the overall stability of regional trade.

3.2 Regional Integration

Q3.2.1: I believe that deeper regional integration positively influences the sustainability of regional trade.

Q3.2.2: I believe that effective regional integration helps maintain the growth momentum of trade.

Q3.2.3: I believe that unpredictable or weak regional integration can disrupt economic stability and trade continuity.

3.3 Industrial Structure

Q3.3.1: I believe that an optimized industrial structure is crucial for sustaining regional trade.

Q3.3.2: I believe that frequent changes in industrial structure may negatively affect trade stability.

Q3.3.3: I believe that upgrading the industrial structure improves competitiveness and enhances trade sustainability.

3.4 Industrial Collaboration

Q3.4.1: I believe that effective industrial collaboration fosters sustainable trade practices.

Q3.4.2: I believe that poor industrial collaboration can hinder the growth of regional trade.

Q3.4.3: I believe that stronger industrial collaboration contributes to overall regional economic resilience.

3.5 External Shocks

Q3.5.1: I believe that external shocks (e.g., pandemics, geopolitical tensions) negatively impact regional trade sustainability.

Q3.5.2: I believe that external shocks disrupt the growth momentum of regional trade.

Q3.5.3: I believe that regions that can effectively mitigate external shocks exhibit higher trade resilience.

3.6 Synergistic Effects

Q3.6.1: I believe that the combined effect of government policy, industrial structure, and regional integration significantly enhances regional trade sustainability.

Q3.6.2: I believe that the absence of synergistic effects results in lower trade performance.

Q3.6.3: I believe that a synergistic approach contributes to more resilient regional economic development.

3.7 Spillover Effects

Q3.7.1: I believe that positive outcomes from effective policies and industrial collaboration generate beneficial spillover effects to neighboring regions.

Q3.7.2: I believe that spillover effects play a crucial role in stabilizing regional economic growth.

Q3.7.3: I believe that regions benefiting from spillover effects are more likely to maintain sustainable trade practices.

Section 4: Overall Evaluation of ASEAN–Guangxi Trade Sustainability

Q4. How would you rate the overall economic cooperation between China and ASEAN countries? Scale: 1 (Very Poor) to 5 (Excellent)

Q5. In your opinion, which of the following factors most significantly influences the trade balance between Guangxi, Yunnan, and ASEAN countries? (Select one)

- Government Policy
- Industrial Structure
- Regional Integration
- External Shocks
- Synergistic Effects
- Spillover Effects

Q6. Please provide any additional comments or suggestions regarding the challenges and opportunities for enhancing trade sustainability in the context of China-ASEAN economic cooperation.
