

Retraction

Retracted: The Influence of Hong Kong-Zhuhai-Macao Bridge on the Development of Urban Agglomeration in the Pearl River Delta

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] W. Zhang, "The Influence of Hong Kong-Zhuhai-Macao Bridge on the Development of Urban Agglomeration in the Pearl River Delta," *Security and Communication Networks*, vol. 2022, Article ID 6483176, 13 pages, 2022.

Research Article

The Influence of Hong Kong-Zhuhai-Macao Bridge on the Development of Urban Agglomeration in the Pearl River Delta

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Known as one of the “seven wonders of the modern world”, the Hong Kong-Zhuhai-Macao Bridge connects Hong Kong, Zhuhai, and Macao. The bridge, which lasted 14 years from design to construction, spans the Lingdingyang waters of the South China Sea to the west, connects Macao and Zhuhai artificial islands, and ends at Zhuhai Hongwan. The bridge, which shortens the traffic distance between the three places and allows the economy, culture, and technology of the three places to communicate with each other, opened up a new world. This paper intends to review the process of the construction of the Hong Kong-Zhuhai-Macao Bridge and sort out the expected benefits of the bridge’s opening to traffic. Then, the paper explains the new situation faced by the Hong Kong-Zhuhai-Macao Bridge. Based on the outward service function model of city flow and the interaction strength model, we conduct an empirical study on the economic status of the Guangdong-Hong Kong-Macao Greater Bay Area. This paper analyzes the interaction between the cities which are in the Greater Bay Area and uses panel data to conduct regression analysis to verify the important impact of the Hong Kong-Zhuhai-Macao Bridge on the development of cities in the Pearl River Delta. Finally, conclusions are drawn: Hong Kong-Zhuhai-Macao Bridge is undoubtedly of positive significance to strengthen economic and social ties between the West Bank of the Pearl River and Hong Kong, and Hong Kong has a large economic radiation capacity to the cities that are in the Pearl River Delta and Macao in the construction, finance, transportation, warehousing, and communications industries. And corresponding suggestions are put forward.

1. Introduction and Research Reviews

The route of the Hong Kong-Zhuhai-Macao Bridge project is from Hong Kong’s artificial island port near Hong Kong International Airport, connecting to Zhuhai’s artificial island/Macau port and Zhuhai connecting line, and ends at Zhuhai Hong Kong Bay, with a total length of 55 kilometers. It started construction on December 15, 2009, took 14 years from design to construction, and finally officially opened on October 24, 2018. The Hong Kong-Zhuhai-Macao Bridge connects Guangdong Province (Zhuhai City) and Macao Special Administrative Region to the west and the Hong Kong Special Administrative Region to the east. As a component of the Ring Road in the Pearl River Delta region in the national expressway network planning and a key project crossing the waters of Ling ding yang, a new road transport channel which connects the east and west sides of

the Pearl River is formed. The opening of the Hong Kong-Zhuhai-Macao Bridge greatly reduces the traveling time between the cities on the west bank of the Pearl River Estuary, such as Zhuhai and Macao, and Hong Kong, thus forming a two-hour arrival circle between the cities on the west bank of the Pearl River Estuary and Hong Kong, and extending the radiation range of Hong Kong to the interior of cities on the west bank of the Pearl River Estuary. At the same time, the completion of the Hong Kong-Zhuhai-Macao Bridge has made transportation from the Pearl River Estuary to the west coast easier, and the improvement of transportation infrastructure has broken the balance between centrifugal force and centripetal force between cities in the Greater Bay Area and changed the spatial layout of urban economic activities and urban scale. The opening and operation of the bridge are of great significance to the development of the Guangdong-Hong Kong-Macao Greater

Bay Area. How to play the role of the bridge's sea-crossing channel and improve the efficiency of the bridge has always attracted attention from all walks of life.

The Hong Kong-Zhuhai-Macao Bridge was once called the "Mount Qomolangma" in the bridge industry, which is a strong manifestation of the comprehensive national strength of China. In their book "The Hong Kong-Zhuhai-Macao Bridge: One of the Seven Wonders of the Modern World", scholars Wang Zhongyao and Wu Chunyan emphasize that the Hong Kong-Zhuhai-Macao Bridge has a lot of the world's best. It is the world's longest, most expensive, longest submarine immersed tube, the most challenging, the longest expected service life, and the highest-value cross-sea bridge. Moreover, behind the "world's best" are the arduous efforts of HZMB to fill in many "gaps in China" and even to fill the "world gap" in the engineering technology, construction management, environmental protection, construction safety, and other fields, which forms a series of "Chinese standards" [1].

Moreover, the Hong Kong-Zhuhai-Macao Bridge has a significant impact on the construction of the Guangdong-Hong Kong-Macao Greater Bay Area. The Hong Kong-Zhuhai-Macao Bridge will play a powerful role to build the Guangdong-Hong Kong-Macao Greater Bay Area into a dynamic world-class city cluster and an international center of scientific and technological innovation. In "Taking the Opening of the Hong Kong-Zhuhai-Macao Bridge as an opportunity to Build a Modern Industrial System in the Guangdong-Hong Kong-Macao Greater Bay Area", scholar Chen Xiuying emphasized that the Greater Bay Area is faced with severe problems such as unsmooth flow and allocation of innovation elements, sluggish development of industrial service, slow development of smart finance and industrial science and technology, and asymmetrical concentration of high-end talents in the industry. In order to truly transform labor-intensive industries into knowledge-intensive industries and make better use of science and finance in promoting the transformation and upgrading of industries, the Hong Kong-Zhuhai-Macao Bridge can only be truly utilized and actively use and explore the convenient conditions for the Hong Kong-Zhuhai-Macao Bridge to connect the two sides of the Pearl River, so as to allow the full flow of innovative resources, and promote the Guangdong-Hong Kong-Macao Greater Bay Area toward the direction of building a "Ring Bridge Free Trade Port" [2].

The construction and operation of the Hong Kong-Zhuhai-Macao Bridge also radiate the surrounding cities. In "The Integrated Development of Bridges and Three Places", scholar Heli takes Zhuhai, the only Bay Area city which connects with the Hong Kong-Macao Land Bridge in the mainland, as an example, and tells the story that the construction and operation of the Hong Kong-Zhuhai-Macao Bridge, Zhuhai, are changing from a traffic terminal to a traffic hub city. Zhuhai has now integrated the advantages of labor, storage, logistics, etc., and occupies a place in foreign trade. Through the Hong Kong-Zhuhai-Macao Bridge, Hong Kong will also better carry out economic exchanges with more cities in the mainland, promote its long-term

stable development, and better play its role as a first-tier city in the world [3].

The existing research results are abundant, and the positive role of the Hong Kong-Zhuhai-Macao Bridge is analyzed, which is of reference significance to this study, but there is a lack of quantitative empirical research. And the review of available literature lacks critical synthesis. This paper intends to review the construction process of the Hong Kong-Zhuhai-Macao Bridge and sort out the expected benefits of its opening to traffic during the construction process. Then, from the completion of the Guangdong-Hong Kong-Macao Greater Bay Area, the world economic situation, the evolution of Hong Kong's economic structure, and the construction of the Shenzhen-China Corridor (Shenzhen-China Bridge) and other aspects, the paper explains the new situation which the Hong Kong-Zhuhai-Macao Bridge is facing. Based on the outward service function model of city flow and the interaction strength model, this paper conducts an empirical study on the economic status quo of the Guangdong-Hong Kong-Macao Greater Bay Area and analyzes the interaction among the cities in the Greater Bay Area. And regression analysis using panel data verifies the influence of the Hong Kong-Zhuhai-Macao Bridge on the development of cities in the Pearl River Delta. Finally, some suggestions are put forward for the purpose of playing the part of the Hong Kong-Zhuhai-Macao Bridge as a cross-sea channel, which will accelerate the integration of the Guangdong-Hong Kong-Macao Greater Bay Area, increase traffic flow, and promote investment recovery.

2. The Construction Process and Expected Benefit of the Hong Kong-Zhuhai-Macao Bridge

2.1. The Construction Process. In 1983, Hong Kong businessman Hu Yingxiang suggested building a cross-border bridge linking Hong Kong and Zhuhai. At that time, the British Hong Kong government reacted coldly to this idea, while Zhuhai responded positively. Later, Zhuhai began to plan the construction of the Lingdingyang Bridge and even set up the Lingdingyang Bridge Headquarters in 1988. The project of Lingdingyang Bridge was approved by the relevant government departments on December 30, 1997, but was then shelved for various reasons. In 2002, the Guangdong-Hong Kong-Macao sea-crossing bridge project once again caused concern and controversy. Afterward, the governments of Guangdong, Hong Kong, and Macao and the central government, respectively, expressed their support for the bridge's construction. In August 2003, the State Council approved the preliminary work of the Hong Kong-Zhuhai-Macao Bridge project and proposed setting up a coordination group for the preliminary work of the Hong Kong-Zhuhai-Macao Bridge and appointed the Hong Kong Special Administrative Region government as the convenor. In December 2006, in order to further speed up the preliminary work of the Hong Kong-Zhuhai-Macao Bridge project, with the approval of the State Council, the "Hong Kong-Zhuhai-Macao Bridge Task Force" was established under the



FIGURE 1: The spatial structure of the Hong Kong-Zhuhai-Macao Bridge.

leadership of the National Development and Reform Commission which is to coordinate the major issues of the preliminary work of the project. In August 2008, the Hong Kong-Zhuhai-Macao Bridge financing plan finally decided to abandon the enterprise investment plus government subsidy plan and switch to government investment. The main body of the bridge adopts the financing method stating that “the government pays the capital in full, and the other part shall be settled by the project management agency jointly established by Guangdong, Hong Kong, and Macao through loans”. The construction of ports and connecting lines of Guangdong, Hong Kong, and Macao is funded by the governments of Guangdong, Hong Kong, and Macao. And after the completion of the bridge, the loan will be paid through fees. With the continuous promotion of the governments of Guangdong, Hong Kong, and Macao and the central government, the main work of construction of the Hong Kong-Zhuhai-Macao Bridge began in December 2009. In July 2017, the main construction work of the Hong Kong-Zhuhai-Macao Bridge was completed. And on October 23, 2018, the Hong Kong-Zhuhai-Macao Bridge was officially opened to traffic.

The bridge has gone through many discussions since it was proposed in the final construction plan. Over the years, from the beginning of the bridge to the exit of the middle section of the bridge, the route selection scheme of the bridge has gone through many discussions and arguments. In the 1980s, Zhuhai proposed the Lingdingyang Bridge, starting from Zhuhai Jinding, passing Qi’ao Island and Neilingding Island, and directly to Tuenmen, Hong Kong, making the bridge a channel connecting Zhuhai and Hong Kong. Four major cities in the Pearl River Estuary—Hong Kong, Macao, Zhuhai, and Shenzhen—are among the various proposals being discussed. Finally, a single Y scheme was selected, deciding Macao Port and Zhuhai Port as the west starting point and the west artificial island of Hong Kong International Airport as the east starting point.

In addition, issues such as the bridge’s investment and financing methods and customs inspection methods have been widely concerned. At present, the bridge adopts the customs clearance mode of “three places and three inspections” and implements the 24-hour customs clearance. The three ports shall be established and managed by the three local governments, respectively. Among them, Zhuhai and Macao put the innovative mode of “coordinated check and one-time release” into use. Figure 1 shows the spatial structure of the Hong Kong-Zhuhai-Macao Bridge.

2.2. Expected Benefits of the Hong Kong-Zhuhai-Macao Bridge. As early as 1983, when the idea of a cross-sea bridge was proposed, the role of this transboundary passage was defined as a land transportation channel that connects the west and east sides of the Pearl River Estuary. A document on the Hong Kong-Zhuhai-Macao Bridge published by the Transportation Committee of the Hong Kong Legislative Council shows that the HZMB’s values include helping Hong Kong to establish more direct links with the west coast of the Pearl River Delta and more investment and expansion opportunities for Hong Kong enterprises from the west coast of the Pearl River Delta, to strengthen Hong Kong’s position as a aviation and shipping center, and to promote the tourism development in Hong Kong, Zhuhai, and Macao [4]. It is not difficult to find that the expectations for the Hong Kong-Zhuhai-Macao Bridge include direct and indirect benefits. The direct benefit is mainly manifested in saving transportation cost, saving transportation time, and inducing traffic volume for the three places; the indirect benefit is mainly reflected in the inducement of investment in the three places [5]. The academic studies on the benefits of the bridge mainly focus on the impact of the bridge on the economic development of the east and west banks of the Pearl River Estuary [6], the impact on the economic pattern of the Pearl River Delta [7], the impact on the spatial pattern

of the Pearl River Delta [8], the impact on the cooperation between cities, and the social and economic impact on the pan-Pearl River Delta. According to some studies, the bridge will reduce transportation costs from Hong Kong and Zhuhai to the east and west banks of the Pearl River Delta, improve the regional advantages of the west bank of the Pearl River Estuary, and enhance the linkage of economic between the two sides of the Pearl River. Moreover, it will indirectly improve the economic structure of the two sides of the Pearl River. Hong Kong's advantages in trade and service industries will be further highlighted, while the tourism and real estate industries in the west coast will continue to benefit [7]. Other studies have pointed out that as the relationship between Guangdong and Hong Kong has shifted to trade in services and tourism consumption from trade in goods, the HZMB will play a limited role in the future transport of goods, while passenger transport will play an important role. Therefore, it is necessary to optimize the itinerary of passengers passing through the Hong Kong-Zhuhai-Macao Bridge and shorten the travel time of passengers as much as possible, so that the bridge can play a role in passenger transportation, so as to better realize the value of the bridge [9].

The logistics connection between Zhuhai and Hong Kong used to take 4–5 hours, but after the bridge opened, the time has been shortened by more than one hour. By October 23, 2021, more than 21 million passengers and 3.1 million vehicles have entered and exited the country through Zhuhai highway ports. From October 2018 to September 2021, the HZMB Customs supervised 2.48 million tons of goods worth 338.38 billion yuan. The destination of import and export through HZMB port covers 31 provinces in mainland China, and the market covers 219 countries and regions around the world. The reporter learned from the cross-border e-commerce operation site located at the Zhuhai road port of the Hong Kong-Zhuhai-Macao Bridge where outbound logistics trucks can complete border inspection within 3 minutes from here and reach Hong Kong airport in 30 minutes, Hong Kong Kwai Chung Ferry terminal in 1 hour, and Macao airport in 15 minutes.

In summary, the Hong Kong-Zhuhai-Macao Bridge, as a cross-river passage of the Pearl River Estuary, has greatly improved the convenience of road connections from Hong Kong to the west bank of the Pearl River and even western China, and it will greatly influence the spatial pattern of the Greater Pearl River Delta. Regardless of the institutional obstacles faced by vehicles crossing the border, the bridge will have positive benefits for increasing the demand for cross-border transportation, reducing transportation costs, and driving the development of industries on the west bank of the Pearl River, especially the promotion of tourism and real estate. However, it is also important to recognize that due to the long construction period of the bridge, the international and domestic environment, as well as Hong Kong's own development situation, has changed since the beginning of the bridge project. Therefore, under the new situation, it is necessary to explore the way to further play the role of the bridge and improve its benefit of the bridge as early as possible.

3. The New Situation of Bringing the Hong Kong-Zhuhai-Macao Bridge into Full Play

It took more than ten years from the beginning of construction of the Hong Kong-Zhuhai-Macao Bridge to its completion and opening, during which the economic development at home and abroad and even the industrial development trend of Hong Kong have undergone great changes. At the beginning of the bridge construction, a series of expected objectives were put forward: to strengthen direct links between Hong Kong and the west bank of the Pearl River Delta, to obtain more commodities from the west bank of the Pearl River Delta, to guide more Hong Kong investment to the west bank of the Pearl River Delta, and to promote the development of Hong Kong-Zhuhai-Macao tourism. Judging from the current new situation, the goal is still promising. As the new situation has brought opportunities and challenges which need to be better dealt with, it is necessary to sort out and analyze the new situation after the opening of the bridge.

3.1. The Construction of the Guangdong-Hong Kong-Macao Greater Bay Area Has Provided New Opportunities for the Bridge to Bring Economic Benefits into Play. The construction process of the Guangdong-Hong Kong-Macao Greater Bay Area provides a good opportunity for the Hong Kong-Zhuhai-Macao Bridge to exert positive economic benefits. On the one hand, the demand for regional integration makes the need for convenient traffic connection from the east to west banks of the Pearl River more urgent. On the other hand, the Bay Area construction provides an opportunity for institutional innovation for the bridge to open to traffic.

The Guangdong-Hong Kong-Macao Greater Bay Area is a new concept of regional cooperation which is proposed by China under the "One Belt and One Road" strategy. With a long history of cooperation and a good foundation of cooperation, Guangdong, Hong Kong, and Macao will be the hub of the "One Belt and One Road" strategy of our country due to their geographical location and development level. Therefore, an important development goal of the Guangdong-Hong Kong-Macao Greater Bay Area is to break up the bottleneck of regional cooperation and development and to better play the role of the Greater Bay Area in the "One Belt and One Road" strategy. The operation of the Hong Kong-Zhuhai-Macao Bridge has provided a new channel for Hong Kong to connect easily with cities in the west bank of Pearl River, as well as cities in western Guangdong and western China. This is exactly to meet the needs of strengthening the connection between the west and east sides of Pearl River and promoting integrated regional development of the Guangdong-Hong Kong-Macao Greater Bay Area. It can be seen that the demand for the Greater Bay Area construction provides opportunities for the bridge to play the role of passenger and cargo connection.

Moreover, the operation of the Guangdong-Hong Kong-Macao Greater Bay Area also provides opportunities for much-needed institutional innovation for the operation of the Hong Kong-Zhuhai-Macao Bridge. The Guangdong-

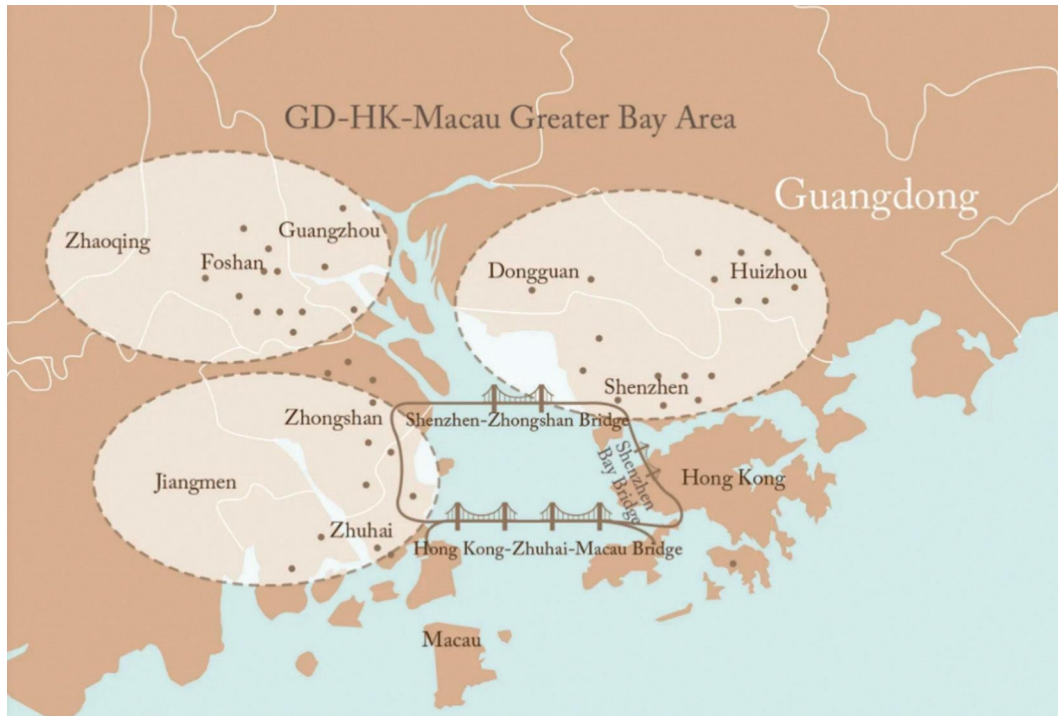


FIGURE 2: The construction of Guangdong-Hong Kong-Macao Greater Bay Area.

Hong Kong-Macao Greater Bay Area concept was raised at the national level, which determines that the in-depth regional cooperation of the Greater Bay Area is in urgent need of innovative development [10]. Looking back on the development process and effectiveness of cooperation between the service industry of Guangdong and Hong Kong driven by a series of innovative systems since the return of Hong Kong and Macao, it is predictable that in the context of the urgent need for the Guangdong-Hong Kong-Macao Greater Bay Area to enhance its overall competitiveness, a series of problems faced by the operation of the Hong Kong-Zhuhai-Macao Bridge can probably be gradually solved through institutional innovation [11]. It is also an important opportunity for the bridge to play its role and enhance its economic benefits. Figure 2 shows the construction of the Guangdong-Hong Kong-Macao Greater Bay Area.

3.2. The Links between Macao and Hong Kong Show a Trend of Strengthening. As free ports, the close links between Macao and Hong Kong will help enhance the internationalization of the Greater Bay Area and will appropriately diversify Macao's economy. During the early 1970s, the economic and trade relations between Hong Kong and Macao were once very close due to the influence of European and American textile quotas, tariffs, deep-water ports, and other factors. Lots of Hong Kong funds establish factories in Macao for production, and goods produced in Macao are then reexported through Hong Kong. Nearly 80 percent of Macao's early gaming visitors came from Hong Kong. Statistics show that in 1971, about 1.6 million tourists arrived in Macao, among which 1.338 million were tourists from Hong Kong, accounting for 82.7%. Since Macao returned to the

motherland, the overall import and export trade between Macao and Hong Kong has been increasing. In 2016, the combined trade volume between Macao and Hong Kong was nearly three times that of 1999 (Table 1). Hong Kong's investment in Macao has also increased year by year, from 16.8 billion patacas in 2001 to 68.9 billion patacas in 2016. However, from the perspective of investment proportion, in Macao's foreign direct investment, the proportion of funds from Hong Kong shows a declining trend, accounting for about 50% at the beginning of the handover and about 23% in 2016.

In 2017, Hong Kong and Macao governments signed the "Closer Economic Partnership Arrangement between the Hong Kong and Macao Special Administrative Regions". This is the first time that Hong Kong and Macao signed a separate bilateral trade protocol, which aims at promoting trade liberalization and acceleration and further promoting economic cooperation and development of the two places.

To sum up, the trade and economic cooperation between Hong Kong and Macao enjoys a sound foundation, and the economic and personnel ties between the two places have been increasingly strengthened since they return to China. The operation of the Hong Kong-Zhuhai-Macao Bridge undoubtedly provides great convenience for the closer cooperation between the two places. Hong Kong and Macao should further explore how to make full use of the bridge links and leverage the strengths of Hong Kong and Macao to promote the international competitiveness of the Greater Bay Area [12].

3.3. The Shipping Industry of Hong Kong Is Facing an Upgrading Trend as Port Cargo Volumes Decline. As mentioned earlier, one of the expected values of the HZMB is to

TABLE 1: The volume of import and export of Macao and Hong Kong from 1999 to 2016 (million patacas).

year	1999	2001	2004	2007	2010	2013	2016
Import	2945	2660	2950	4359	4628	10501	6211
Export	1195	1178	2864	2674	3003	4856	5559
Total	4140	3838	5814	7033	7631	15357	11770

Source: official website of Macau Bureau of Statistics and Census.

strengthen Hong Kong's status as an international center for shipping and aviation. Hong Kong has an excellent natural deep-water port and its container flow has been among the highest in the world since the 1990s. In the early 21st century, Hong Kong's container throughput once ranked first in the world. From 2001 to 2004, the container throughput of Hong Kong ranked 1st in the world all the time. In 2005, Hong Kong's container throughput ranked second among the world's container ports. In recent years, with the improvement of inland ports in terms of transportation links, vessel turnaround time, and container transfer capabilities, as well as the advantages of port terminal processing fees, the competitiveness of Hong Kong ports and their counterparts in the Pearl River Delta in fighting for inland sources of goods has been weakened. According to the "Hong Kong Port Development Strategy 2030 Study" published by the Hong Kong Transport and Housing Bureau, Hong Kong's port share in the supply of goods from South China dropped from nearly 80% in 2001 to less than 40% in 2011, which also affected Hong Kong's ranking among the ports in the world. In 2017, Hong Kong ranked sixth among the container throughput ports in the world, down one place from the fifth in 2016. Hong Kong's port cargo throughput for the full year of 2021 was 213.7 million metric tons, down 14.3% from 2020. Among them, the inbound port cargo and the outbound port cargo decreased by 20.6% and 0.7%, respectively, compared with the whole year of 2020, reaching 134.9 million metric tons and 78.8 million metric tons. The decline in Hong Kong's port throughput indicates that the mainland has more mainland ports to choose from, rather than transporting goods to Hong Kong as expected at the beginning of the HZMB project [13].

However, the comprehensive strength of Hong Kong's port and shipping industry still exists, and some advantages are still unmatched by many ports in the mainland. For example, the international liner network in Hong Kong is more complete and mature than that in mainland ports, which is still very attractive for shipping companies with high transshipment efficiency; the attractiveness of the Hong Kong port for handling China-related transshipment cargo will also continue with the entry into force of the Coastal Shipping Rights Regulation. As of the end of 2021, Hong Kong's merchant marine fleet accounts for 9.8% of the world's fleet, and the shipping ecosystem is booming. There are more than 900 shipping-related companies developing in Hong Kong, providing various maritime services. In addition, in recent years, the government of HKSAR has consciously promoted the development of the shipping industry toward high value-added and high-end services, such as ship

registration, management, trading, insurance, and arbitration. It will also transform and upgrade traditional industries terminal businesses into high value-added shipping services and maintain Hong Kong's international status as a shipping center.

In recent years, Hong Kong's container throughput has declined in the global rankings, reflecting to a certain extent the status of Hong Kong as a transshipment port for foreign trade for the mainland has declined. Considering that the comprehensive strength of Hong Kong port still has obvious competitive advantages, the port of Hong Kong should accelerate the development of high value-added shipping business to attract suppliers in the western region who need to use the bridge to seek corresponding services in Hong Kong. Figure 3 shows the shipping radiation of Guangdong-Hong Kong-Macao Greater Bay Area.

3.4. The Opening of Other Crossings across the Pearl River Estuary Will Expose the Bridge to Competition. At the beginning of the HZMB project, the Humen Bridge was the only major highway crossing the Pearl River Estuary. As the regional economy develops rapidly, the congestion situation of Humen Bridge has become increasingly serious. According to the "Thirteenth Five-Year Plan for the Development of Comprehensive Transportation System in Guangdong Province" released in 2017, there will be four major sea-crossing passages across the Pearl River Estuary in the next five years. In addition to the Humen Bridge, which is currently open to traffic, it also includes the Hong Kong-Zhuhai-Macao Bridge, Shenzhong Passage, and Humen Second Bridge. According to the plan, 12 road and rail cross-river passages will be built along the west and east banks of the Pearl River Estuary by 2030. The opening and use of these river-crossing channels have increased the choice of east-west connection of the Greater Bay Area and also formed more or less competition with the Hong Kong-Zhuhai-Macao Bridge in terms of passenger and cargo flow.

For instance, the Shenzhen-Zhong Bridge under construction is closest to the Hong Kong-Zhuhai-Macao Bridge, which is about 38 kilometers apart. The length of the former is about 24 kilometers, while the length of the latter is about 55 kilometers. Cities in the west of Guangdong can directly take the Kaiyang Expressway-Zhongjiang Expressway, through the Shenzhen-China Channel to Shenzhen. In addition, Shenzhen-Zhong Corridor is a combination of highway and railway structures. Compared with the Hong Kong-Zhuhai-Macao Bridge, which is only a road bridge, it has a stronger capacity for individual passengers.



FIGURE 3: The shipping radiation of Guangdong-Hong Kong-Macao Greater Bay Area.

Construction of the Shenzhong Bridge has started and Shenzhong Bridge’s rivalry with the Hong Kong-Zhuhai-Macao Bridge is already predictable.

3.5. *The Mode of Trade and Economic Cooperation between Hong Kong and Guangdong Has Changed.* Since the late 1970s, the cooperation between the service industry of Hong Kong and the manufacturing industry of Guangdong, established by Hong Kong’s direct investment in Guangdong, has created the trade and economic cooperation mode of “front shop and back factory” between Hong Kong and Guangdong. Processing trade was a major area of cooperation between Hong Kong and Guangdong during the period from reform and opening up to Hong Kong returning to the motherland. Statistics show that the top 12 industries in terms of the gross industrial output value of “foreign-funded” enterprises in Guangdong are also the 12 industries with the largest industrial output value in Guangdong, and their products are the main products imported from Guangdong by Hong Kong and Macao.

With the improvement of the economic development level of Guangdong, the demand of Guangdong’s manufacturing industry for Hong Kong’s intermediary function began to weaken gradually from the middle and late 1990s. After entering the 21st century, Guangdong’s overall demand level for the service industry has been greatly improved. The industrial collaboration between Hong Kong and Guangdong has also evolved from the simple cooperation between manufacturing and service industries to the complementarity between modern manufacturing and advanced service industries and then to the cooperation between service industries. In particular, the signing and implementation of CEPA in 2003 have made service trade a focus of trade and economic collaboration between Hong Kong and Guangdong. The transformation of the mode of collaborate of economic and trade between Hong Kong and Guangdong means that more exploration should be made on how to transfer Hong Kong’s advantages in the service industry to western Guangdong and even western China more conveniently through the Hong Kong-Zhuhai-Macao Bridge.

4. An Empirical Study on the Impact of Hong Kong-Zhuhai-Macao Bridge on the Pearl River Delta Urban Agglomeration

4.1. The Impact of Hong Kong-Zhuhai-Macao Bridge on the Economic Connection Volume of Guangdong-Hong Kong-Macao Greater Bay Area

4.1.1. Analysis of City Flow in Guangdong-Hong Kong-Macao Greater Bay Area

(1) *Model Specification.* According to the calculation formula of city flow intensity by Chen Qunyuan and Song Yuxiang [14], city flow can be measured:

$$F = E \times N. \tag{1}$$

In Equation (1), F represents the intensity of city flow, represents the intensity generated by factor flow when the diffusion effect is generated by intercity agglomeration, and reflects the influence capacity of intercity economic radiation; N represents the city’s functional benefits, which is the actual and effective impact of the external functional capacity of each city unit on other cities in the city cluster; E represents the outward function of a city, and the value depends on the location entropy of each industry [15]. Location entropy is expressed as

$$P_{ij} = \frac{(I_{ij}/q_i)}{(L_j/Q)}. \tag{2}$$

The calculation formula of the outward function of the I city j industry is as follows:

$$E_{ij} = \frac{I_{ij} - q_i \times L_{ij}}{Q(\text{if } P_{ij} > 1; \text{ else } E_{ij} = 0)}, \tag{3}$$

whereinto P_{ij} is the location entropy of region i and industry j , I_{ij} is the number of employees in industry j in the region I , L_j is the number of employees in industry j in the Guangdong-Hong Kong-Macao Greater Bay Area, Q_i is the number of all employees in the region I , and Q is the number of all employees in the Greater Bay Area. If P_{ij} is less than 1, it shows that, compared with the Guangdong-Hong Kong-

Macao Greater Bay Area, industry J cannot provide services for the outside areas of city I , that is, the amount of outward function $E = 0$. If P_{ij} is greater than 1, it shows that Department j can provide services for the external areas of city i and has external radiating influence, that is, the outward power $E > 0$.

Functional benefit N_i of city i is expressed as the per capita output value of employees in city i :

$$\frac{N_i = V_i}{G_i}, \quad (4)$$

where V_i represents the GDP of city I and G_i represents the number of employees in city i .

Data on the number of employees and GDP in each city and industry are from the Statistical Yearbook of China Cities 2019.

(2) *Empirical Results and Analysis.* In view of the validity and availability of data from Hong Kong and Macao, this paper selects manufacturing, construction, transportation, storage and communications, and financial industries as representatives. The city flow intensity of each industry is calculated and the external economic radiation capacity of four industries in each city is described.

According to Equations (2) and (3), the location entropy and outward function of each city and industry can be calculated, respectively. Among all cities and industries, the financial industry of Hong Kong has the largest location entropy value, indicating that the financial industry of Hong Kong is of a high degree of agglomeration and outstanding advantages in the financial industry. Shenzhen and Zhuhai have the largest location entropy values in the Pearl River Delta. Among the cities in the Greater Bay Area, Shenzhen has the largest outbound function of manufacturing, and the second is Dongguan. Hong Kong, Macao, and Shenzhen were the top three cities with the strongest outward function in the construction industry. Hong Kong, Guangzhou, and Macao were the top three destinations in terms of the outward function of transportation, storage, and communications. Among the cities in the Guangdong-Hong Kong-Macao Greater Bay Area, only the financial location entropy of Macao and Hong Kong is greater than 1, indicating that the development level of the financial industry in the Pearl River Delta region is relatively low compared with Macao and Hong Kong.

The intensity of city flow can be obtained by formula (1). If the location entropy of industry j is less than 1, then the industry j of the city has no driving effect on the external city; that is, the outward function of industry j is $E = 0$. If the location entropy of J industry is greater than 1, then the industry J of the city can provide external services, and the outward function of J industry is $E > 0$. Hong Kong has far more outward functions in construction, finance, transportation, warehousing, and communications than any other city. This indicates that Hong Kong is the radiation center of the construction, financial, logistics, and communications industries of the Guangdong-Hong Kong-Macao Greater Bay Area and can supply external resources

for these industries. The city flow intensity of Hong Kong's construction industry was 119.25 billion yuan, that of the transport, storage, and communications industry was 186.55 billion yuan, and that of the financial industry was 97.44 billion yuan, all higher than that of other cities which are in the Guangdong-Hong Kong-Macao Greater Bay Area. As the core city of the Guangdong-Hong Kong-Macao Greater Bay Area, Hong Kong radiates the development of cities in the Pearl River Delta and Macao. In addition to Macao and Hong Kong, Shenzhen has the largest outward function and city flow intensity in the Pearl River Delta region, which has a greater radiating capacity for the development of the Pearl River Delta region.

4.1.2. Analysis of Intercity Interaction in the Guangdong-Hong Kong-Macao Greater Bay Area

(1) *Model Specification.* The intensity of urban interaction depends on the intensity of mutual connection and attraction between cities. Its size is proportional to the size of cities and inversely proportional to the distance between cities. The value of interaction intensity can not only reflect the radiation capacity of a city to other cities but also reflect the radiation capacity of other cities. With reference to the calculation model of intercity interaction intensity by Dong Qing, Liu Haizhen, Liu Jiazhen, etc. [16], the formula of the measurement model is set as

$$R_{ij} = \frac{\left(\sqrt{P_i W_i} \times \sqrt{P_j W_j}\right)}{r_{ij}^2}. \quad (5)$$

In Equation (5), R_{ij} is the interaction intensity between cities; P_i and P_j represent the number of urban units employed in city i and city j , respectively; W_i and W_j represent the GDP of city i and city j , respectively; r_{ij} is the distance between city i and city j . The employment population and GDP of urban units are from the statistical yearbooks of each city, and the distance between cities is based on actual highway mileage.

(2) *Urban Interaction Intensity before the Connection of the Hong Kong-Zhuhai-Macao Bridge.* By consulting the urban statistical yearbooks of Hong Kong, Zhuhai, and Macao and calculating according to formula (5), the data in Table 2 are obtained. It can be seen that the intensity of intercity interaction in Hong Kong ranks behind that of Guangzhou, Foshan, and Shenzhen, and the amount of economic connection is 7.42, which is unevenly distributed. The intensity of intercity economic interaction is further analyzed by region.

According to the comparative analysis of the economic links between Hong Kong and different regions of the Pearl River Delta (see Table 3), it is found that the economic relationships between Hong Kong and five cities on the west bank of the Pearl River Delta are only 0.36, while the economic relationships between Hong Kong and four cities on the east bank of the Pearl River Delta are 7.08, with an agglomeration degree of 2.16. It can be concluded that

TABLE 2: Urban interaction intensity values in the Guangdong-Hong Kong-Macao Greater Bay Area.

City	Guangzhou	Foshan	Zhaoqing	Shenzhen	Dongguan	Huizhou	Zhuhai	Zhongshan	Jiangmen	Hong Kong	Macao
Guangzhou		7.42	0.26	0.67	1.93	0.12	0.16	0.52	0.52	0.38	0.07
Foshan	7.42		0.20	0.26	0.42	0.03	0.08	0.16	0.67	0.15	0.04
Zhaoqing	0.35	0.29		0.06	0.06	0.02	0.02	0.03	0.06	0.03	0.02
Shenzhen	0.56	0.24	0.07		1.45	0.26	0.08	0.18	0.12	6.14	0.03
Dongguan	1.82	0.42	0.07	1.52		0.12	0.07	0.18	0.08	0.47	0.03
Huizhou	0.21	0.06	0.02	0.26	0.12		0.02	0.03	0.02	0.05	0.00
Zhuhai	0.14	0.05	0.012	0.05	0.07	0.02		0.22	0.04	0.02	1.43
Zhongshan	0.52	0.25	0.03	0.18	0.18	0.03	0.22		0.16	0.06	0.07
Jiangmen	0.61	0.76	0.04	0.12	0.08	0.02	0.05	0.18		0.06	0.02
Hong Kong	0.38	0.24	0.03	6.12	0.49	0.07	0.06	0.09	0.06		0.03
Macao	0.09	0.05	0.02	0.05	0.06	0.00	1.43	0.09	0.02	0.03	
Total	11.87	9.35	0.67	9.28	4.85	0.64	2.07	1.63	1.73	7.43	1.76

Source: the author calculated.

TABLE 3: Intensity analysis of interaction between Hong Kong and different regions of the Pearl River Delta.

Region	Interaction strength	Cluster degree of connection quantity
West coast of Pearl River Delta	0.36	0.07
East coast of Pearl River Delta	7.08	2.16

Source: the author calculated.

TABLE 4: Changes in mileage between the Pearl River Delta and Hong Kong after the connection of the Hong Kong-Zhuhai-Macao Bridge.

City	Zhuhai	Foshan	Jiangmen	Zhaoqing	Zhongshan	Guangzhou	Shenzhen	Dongguan	Huizhou
Before connecting (km)	188.3	189.5	187.8	270.2	163.6	162.1	41.8	110.1	212.1
After connecting (km)	121.7	181.2	146.6	285.3	120.1	170.1	43.1	112.1	210.2
Increase or decrease (%)	-45	-7.1	-28	+5.8	-31.2				

Source: the author calculated.

TABLE 5: Comparison of interaction intensity between Hong Kong and the Pearl River Delta before and after the operation of the Hong Kong-Zhuhai-Macao Bridge.

City	Before connecting	After connecting	Increase or decrease (%)
Zhuhai	0.04	0.11	+175
Foshan	0.15	0.17	+13.3
Jiangmen	0.06	0.11	+83.3
Zhongshan	0.09	0.18	+100.0
Total	0.32	0.53	+65.6

Source: the author calculated.

although the radiation intensity of Hong Kong's overall economy is large, the interaction intensity is low. The cities on the west coast of the Pearl River Delta have low efficiency in utilizing the economic radiation from Hong Kong. It is believed that the long distance between the west coast and Hong Kong affects their economic growth rate.

(3) *Intensity of Urban Interaction after Connection of the Hong Kong-Zhuhai-Macao Bridge.* With the completion of the bridge, cities on the west coast of the Pearl River Delta region will not need to bypass the Humen Bridge and will be able to reach Hong Kong easily by land without the inefficiency of water transportation. For example, the journey from Zhuhai to Hong Kong by way of the Hong Kong-Zhuhai-Macao Bridge at the Choi Chung Container Terminal has been reduced by 45% compared with the original detour from the Humen Bridge (Table 4). The West Coast

cities that have benefited more are Zhuhai, Zhongshan, and Jiangmen.

After the operation of the Hong Kong-Zhuhai-Macao Bridge, the intensity of interaction between Hong Kong and the four cities on the west coast of the Pearl River Delta—Zhuhai, Foshan, Jiangmen, and Zhongshan—has changed significantly, with an overall increase of 65.6% in the amount of economic contact. Among them, Hong Kong and Zhuhai have the most obvious increase, with a 175% increase in the amount of economic contact, as shown in Table 5.

4.2. *Analysis of the Impact of Hong Kong-Zhuhai-Macao Bridge on the Development of Cities in the Pearl River Delta.* The import, export, and utilization of foreign capital of PRD cities from 2009 to 2019 were taken as dependent variables, and the GDP of PRD cities and Hong Kong, per capita GDP,

TABLE 6: The regression results of economic impact in the Pearl River Delta.

	Exports	Imports	FDI
Constant term	14.72261 (-39.11225)	14.33705 (-34.64812)	12.12612 (-51.89386)
lnGDP	0.885231 (-32.39112)	0.771213 (-19.66211)	0.475899 (-16.54889)
lnPGDP	1.231427 (17.55417)	0.928957 (7.146053)	0.662212 (11.14281)
lnDT	-1.76758 (-6.661579)	-1.98882 (-6.54675)	-0.88689 (-4.21469)

Note. *T* values are in parentheses.

and the road distance from PRD cities to Hong Kong were taken as independent variables. Economic indicators are easy to be affected by external macroeconomic fluctuations, so they are treated logarithmically. The regression model is as follows:

$$\frac{\ln \text{EXP}}{(\text{IMP}/\text{FDI})} = \beta_1 \ln \text{GDP} + \beta_2 \ln \text{PGDP} + \beta_3 \ln \text{DT} + \varepsilon, \quad (6)$$

where EXP and IMP represent the amount of exports and imports (US dollars) from cities which are in the Pearl River Delta to Hong Kong; FDI represents the amount of foreign capital utilized by cities that are in the Pearl River Delta (ten thousand US dollars); GDP and PGDP denote GDP (100 million yuan) and per capita GDP (yuan) of cities which are in the Pearl River Delta region; DT represents the road distance (km) from cities in the Pearl River Delta region to Hong Kong.

The results of the regression analysis of the land links between cities which are in the PRD and Hong Kong are shown in Table 6.

The distance from the PRD region to Hong Kong and the gross domestic product of each region have a significant impact on the amount of exports, imports, and utilization of foreign capital of each city. A 1% increase in the road distance to Hong Kong will reduce the value of exports, and imports and actually utilized foreign investment by 1.87%, 1.97%, and 0.90%, respectively. For each one percent increase in local GDP, the value of exports, the value of imports, and the actually utilized foreign capital will increase by 0.89%, 0.75%, and 0.47%, respectively. For every 1% increase in per capita GDP, the value of exports, imports, and actually utilized foreign capital will increase by 1.12%, 0.94%, and 0.52%, respectively. It is observed that the distance between each region and Hong Kong has the most significant impact on the economic development of the Pearl River Delta, and the development level of economic of each region in the Pearl River Delta decreases significantly as the distance between each region and Hong Kong increases.

5. Conclusion

As an important road transportation channel that connects west and east of the Pearl River, the Hong Kong-Zhuhai-Macao Bridge is undoubtedly of positive significance to strengthen economic and social ties between the West Bank of the Pearl River and Hong Kong, accelerate industrial

restructuring and optimization of its distribution, expand space for economic development, enhance the overall competitiveness of the Pearl River Delta, maintain sustained prosperity and stability in Hong Kong and Macao, improve the investment environment in the west bank of the Pearl River, and promote coordinated economic and social development across the Pearl River. In the future, the influence of the Hong Kong-Zhuhai-Macao Bridge will extend westward, connecting Southeast Asia and South Asia, integrating into the third passage of Asia and Europe, and becoming a major transportation artery between the east and the west. There are currently three major routes between Europe and Asia, one from the northeast through Manchuria to Russia, the second from Lianyungang to Xinjiang and extending to the Netherlands, and the third will probably be an overland route from Hong Kong to Singapore. Passenger and cargo traffic on the Hong Kong-Zhuhai-Macao Bridge is also expected to increase dramatically.

The differences in the institution between Guangdong, Hong Kong, and Macao must be taken into account when the bridge plays its role and improves its economic benefits. However, through gradual institutional innovation, it is possible to achieve the goal of customs clearance facilitation and improved traffic efficiency. In this process, it is suggested to excavate the tourist function and tourist channel function of the bridge, to attract the traffic flow through the trial of diversified license plates of two places, and to simplify the customs clearance process by relying on the innovation of customs inspection information technology. It can also be considered to expand the development of surrounding islands on the basis of the Hong Kong-Zhuhai-Macao Bridge so as to further play the role of the Hong Kong-Zhuhai-Macao Bridge under the new situation.

In addition, this paper analyzes the interaction among cities that are in the Greater Bay Area by using the outward service function model of city flow and the interaction intensity model. The study has shown that Hong Kong has a large economic radiation capacity to the cities that are in the Pearl River Delta and Macao in the construction, finance, transportation, warehousing, and communications industries. However, due to location factors, the intensity of mutual effect among Hong Kong and other cities only ranks fourth in the Guangdong-Hong Kong-Macao Greater Bay Area. In particular, the intensity of interaction between cities that are on the west coast of the Pearl River Delta is low and the economic driving effect is poor. Therefore, it is

considered that the distance of land between the west coast of the Pearl River Delta and Hong Kong is an important factor affecting its economic development.

After the operation of the Hong Kong-Zhuhai-Macao Bridge, cities on the west side of the Pearl River Delta can reach Hong Kong via land in a convenient and efficient way, which will have far-reaching significance in expanding foreign trade, attracting foreign investment, improving industrial competitiveness, and integrating into the global market. Among them, the cities that have benefited more in the Guangdong-Hong Kong-Macao Greater Bay Area are Zhuhai, Zhongshan, Jiangmen, and Foshan in order. The import, export, and foreign capital utilization of the four cities have been significantly increased, but within a certain period of time, there is still an obvious gap between the economic development of cities that are on the west bank of the Pearl River Delta and those on the east bank. In addition, the empirical study in this paper also has shortcomings, for example, some data may be heterogeneous, and future studies need to learn from each other.

6. Suggestions for Further Exerting the Effect of the Hong Kong-Zhuhai-Macao Bridge

Cross-border channels are conducive to facilitating the flow and optimal allocation of development factors of the Greater Bay Area. Under the opportunities for development of the Greater Bay Area, it is necessary to explore the potential attraction of the bridge, improve the efficiency of the bridge, relax the restrictions on vehicle license plates, etc., so as to expand the resource advantages of Hong Kong to the west through the bridge, and bring strategic opportunities to the development of relevant cities. In order to further play the part of the Hong Kong-Zhuhai-Macao Bridge and improve its economic benefits, this paper tries to put forward the following suggestions:

6.1. Improve the Tourist Reception Function of the East Artificial Island and Create a "One-Way Multistop" Tourist Channel of the Greater Bay Area. With the combination of bridge and tunnel, the Hong Kong-Zhuhai-Macao Bridge is the longest three-lane cross-sea bridge in the world and has created many world's best. With the longest submerged tube tunnel in the world, it is not only the largest steel bridge in the world but also contains rich cultural connotations, which has a great attraction for tourists. Especially for the tourists who take the west bank of the Pearl River as a tourist destination or take Hong Kong and Macao as their destination for tourists, sightseeing on the bridge by public transport is very feasible. As a matter of fact, the bridge has become a tourist attraction; there is no shortage of classic cases in the world. As a single bridge, the Golden Gate Bridge in California of the United States attracts a large number of tourists to San Francisco every year to the Golden Gate Bridge to take photos.

Among the two artificial islands of the Hong Kong-Zhuhai-Macao Bridge, the East Artificial Island has sightseeing facilities and coffee shops and other leisure facilities,

and it is expected that tourists who cross the bridge can stay for sightseeing and spend. In addition, the bridge has opened shuttle buses and cross-boundary through buses to meet the needs of passengers. It is suggested that the tourism reception function of the artificial island should be improved as early as possible, and tourist service facilities such as bus docking stations, bridge construction museums, and souvenir shops should be set up.

From the construction idea of improving the tourism function of the East Artificial Island, we can further extend to the tourism development idea of "one journey and many stops" in the Greater Bay Area. By promoting the implementation of a more convenient tourist visa policy, the Hong Kong-Zhuhai-Macao Bridge will not only become a tourist attraction of the Guangdong-Hong Kong-Macao Greater Bay Area but still serve as a transportation channel for cross-border tourism to drive the progress of a "multistop" tourist route for the Greater Bay Area.

6.2. Use the Bridge as a Pilot for Customs Clearance to Improve Customs Clearance Efficiency. Currently, the Hong Kong-Zhuhai-Macao Bridge adopts the "three localities and three inspections" mode, and the three governments are responsible for the ports of the three places. Among them, Zhuhai and Macao adopt the new mode of "collaborative inspection, one release" to implement 24-hour customs clearance. The Guangdong Branch of the General Administration of Customs, Hong Kong Customs, and Macao Customs signed the Memorandum of Understanding on Port Cooperation of the Hong Kong-Zhuhai-Macao Bridge in November 2018. And it is reported that the main measures of the port cooperation memorandum include the establishment of the three customs liaison mechanism; application of the "cross-border one-lock" fast customs clearance mode currently in place at the Hong Kong and Shenzhen ports to the Hong Kong and Zhuhai ports of the Hong Kong-Zhuhai-Macao Bridge; implementation of mutual recognition and cooperation based on the results of customs inspections in the three places to improve the efficiency of customs clearance, etc. With the development of big data technique, the establishment and perfection of the electronic port data center can also be considered in the future to strengthen the information sharing of customs clearance vehicles and personnel and law enforcement cooperation. The green channel system will be implemented for vehicles and personnel with good customs clearance records, and generally, only spot checks will be conducted to improve customs clearance efficiency and accelerate the facilitation of entry and exit procedures.

6.3. Consider Piloting Short-Term Licensing Policies for Business Car Owners with Good Driving Records and Good Credit. According to the Hong Kong-Zhuhai-Macao Bridge Authority, the current vehicles which can pass on the bridge are mainly license plate vehicles in Guangdong and Hong Kong, Hong Kong, and Macau license plates, Hong Kong-registered single scooter (with Macau quota), one-time quota applications, and other cars which can pass the Hong

Kong-Zhuhai-Macao Bridge by means of negotiation among the governments of Guangdong, Hong Kong, and Macao. Among them, vehicles with one-time quota applications refer to vehicles with non-two-city license plates. They can apply for a one-time quota for private cars. With a one-off private car quota permit and approval letter, and one-off temporary entry and exit approval notice for cars and drivers, a temporary entry motor vehicle plate, a driving permit, etc., they can obtain a temporary electronic non-parking toll card from the operator.

At present, applications for Hong Kong dual-license business vehicles are not limited to Hong Kong residents but also include a large number of mainland enterprises that have a long-term business bond with Hong Kong and even several Hong Kong enterprises that travel between Hong Kong and Guangdong for a good while. Some citizens think that the current annual fee for dual-place licenses is relatively high. Offering the owners who have long-term business contact needs and can meet the requirements of applying for a long-term dual-place license but do not apply with a short-term dual-place license with the lower application fee, they can directly apply for the short-term license at the port of the Hong Kong-Zhuhai-Macao Bridge in the form of “landing visa”. This will help to encourage car owners to choose the dual license plate, increase the traffic flow of the Hong Kong-Zhuhai-Macao Bridge, further encourage Hong Kong services to actively reach the western Guangdong and even western China market, and expand the advantage of service resources to the west bank of the Pearl River. The economic and trade cooperation between Guangdong and Hong Kong has initiated a service-to-service cooperation mode, and cross-border service cooperation requires frequent communication between service personnel. The point-to-point road traffic mode has its advantages, and the relatively flexible licensing system will promote to spread the advantages of the service industry of Hong Kong to the west. In addition, the pilot scheme for the Guangdong-Hong Kong dual license can also be considered for the application of the Hong Kong and Macao dual license, so as to facilitate more convenient communication between residents in Hong Kong and Macao.

6.4. Strengthen the Development and Construction of the Islands Surrounding the Bridge. The Pearl River Estuary and the northern South China Sea are rich in marine resources, such as natural gas hydrate (combustible ice) in the Shenhu area, which has been successfully tested and is expected to become the development and processing center of new energy in the near future. The bridge is surrounded by many islands, including Niutou Island, which has huge development potential. It can be considered to build an approach bridge at the construction site of the Hong Kong-Zhuhai-Macao Bridge to stimulate the construction and development of islands around the bridge. In the form of an enclave economy, Guangdong, Hong Kong, and Macao will cooperate in the development of combustible ice in the South China Sea, the construction of passenger and cargo terminals, the development of yachts and cruises, the construction

of cold chain trading markets, and dangerous goods storage facilities for potential islands. This will not only increase the traffic volume of the bridge but also promote the development of emerging industries and foster new economic growth points.

Data Availability

The data used to support the findings of this study are available from the website of the National Bureau of Statistics.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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