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Identification Of Leading Sectors In Batam: LQ, DLQ, and Shift-Share Analysis

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Abstract: The purpose of this research is to find out which sector is the leading sector in Batam. This research uses LQ, DLQ, and Shift-share Analysis. LQ analysis shows that Processing Industry, Electricity and Gas Procurement, Water Supply, Waste Management, Waste and Recycling, Construction, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Information and Communication, and Financial and Insurance Services can fulfill domestic needs in Batam and export products from these sectors to other regions. Using DLQ, it is found that Agriculture, Forestry, and Fisheries have the potential for rapid growth and development. Using shift-share, Processing Industry, Construction, Information and Communication, and Financial and Insurance Services have rapid growth rates, good competitiveness, and are progressive. Based on these findings, it is expected that the Batam Government and the Head of BP Batam can focus development on these leading sectors, in order to drive economic growth.
Keywords: Location Quotient; Dynamic Location Quotient; Analisis Shift-share; Economic Growth; Batam.

Abstak: Tujuan dari penelitian ini adalah untuk mengetahui sektor mana yang menjadi sektor unggulan di Batam. Penelitian ini menggunakan analisis LQ, DLQ, dan Shift-share. Analisis LQ menunjukkan bahwa sektor Industri Pengolahan, Pengadaan Listrik dan Gas, Pengadaan Air, Pengelolaan Sampah, Limbah dan Daur Ulang, Konstruksi, Transportasi dan Pergudangan, Penyediaan Akomodasi dan Makan Minum, Informasi dan Komunikasi, serta Jasa Keuangan dan Asuransi dapat memenuhi kebutuhan domestik di Batam dan mengekspor produk dari sektor-sektor tersebut ke wilayah lain. Apabila menggunakan DLQ, ditemukan bahwa sektor Pertanian, Kehutanan, dan Perikanan memiliki potensi pertumbuhan dan perkembangan yang cepat. Dengan menggunakan shift-share, ditemukan bahwa sektor Industri Pengolahan, Konstruksi, Informasi dan Komunikasi, serta Jasa Keuangan dan Asuransi memiliki tingkat pertumbuhan yang cepat, daya saing yang baik, dan progresif. Berdasarkan temuan ini, diharapkan Pemerintah Kota Batam dan Kepala BP Batam dapat memfokuskan pembangunan pada sektor-sektor unggulan tersebut, guna mendorong pertumbuhan ekonomi di Batam.
Kata Kunci: Location Quotient; Dynamic Location Quotient; Shift-share Analysis; Pertumbuhan Ekonomi; Batam.

INTRODUCTION

Riau Islands Province occupies the third position with the highest economic growth in Sumatra Island and the 18th at the national level (KEPRI, 2023). This economic growth is supported by the processing industry which is a business field with a contribution to GRDP of 42 per cent, followed by construction at 18 per cent, mining and quarrying sector at 12 per cent, and other sectors. Distribution of GRDP of Riau Islands can be seen in **Figure 1**. The contribution of the processing industry, construction, mining and quarrying which is very large makes the sustainability of these sectors very important. On the other hand, the dependence of a region's economy on only a few sectors will be risky if there are shocks to these sectors.

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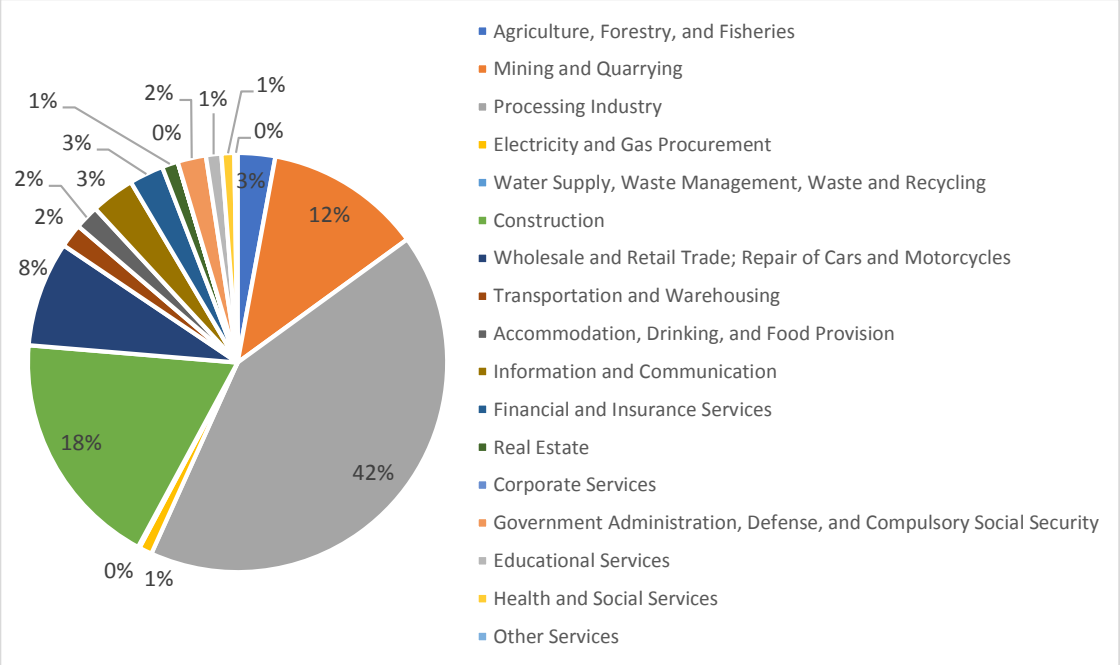

Figure 1. GRDP of the Riau Islands in 2022 at constant prices by business field (per cent)
Source: Statistics Indonesia of Riau Islands

The risk of shocks was proven, where in 2020 there was a decrease in GRDP due to the COVID-19 pandemic. It even took several years for Riau Islands GRDP to return to pre-pandemic levels. Based on the results of a survey conducted by the Ministry of Manpower, around 88 per cent of companies were affected by COVID-19, starting from a decrease in sales which led to a decrease in production, and ultimately increased unemployment (Barenbang, 2020). The survey also explained that the biggest impact was felt by Construction, Real Estate, and Accommodation, Drinking, and Food Provision.

As one of the cities in Riau Islands, Batam also contributes to the GRDP of Riau Islands. It can be seen in **Figure 2** that the GRDP of Batam City contributes more than 50 per cent of the GRDP of Riau Islands Province. This is interesting because Batam is not the capital of Riau Islands, but Tanjung Pinang. According to Negara and Hutchinson (2020), Batam was once the fastest-growing region in Indonesia by utilizing its strategic location, which is close to Singapore and along world shipping routes. Batam was once one of the centers of the manufacturing industry in Indonesia thanks to investment support from Singapore, Japan, and Europe. In addition, the shipbuilding sector also grew rapidly from 2011 to 2013, with almost half of all shipyards in Indonesia located in Batam. Together with the tourism sector, these three sectors are a source of foreign exchange revenue for Indonesia.

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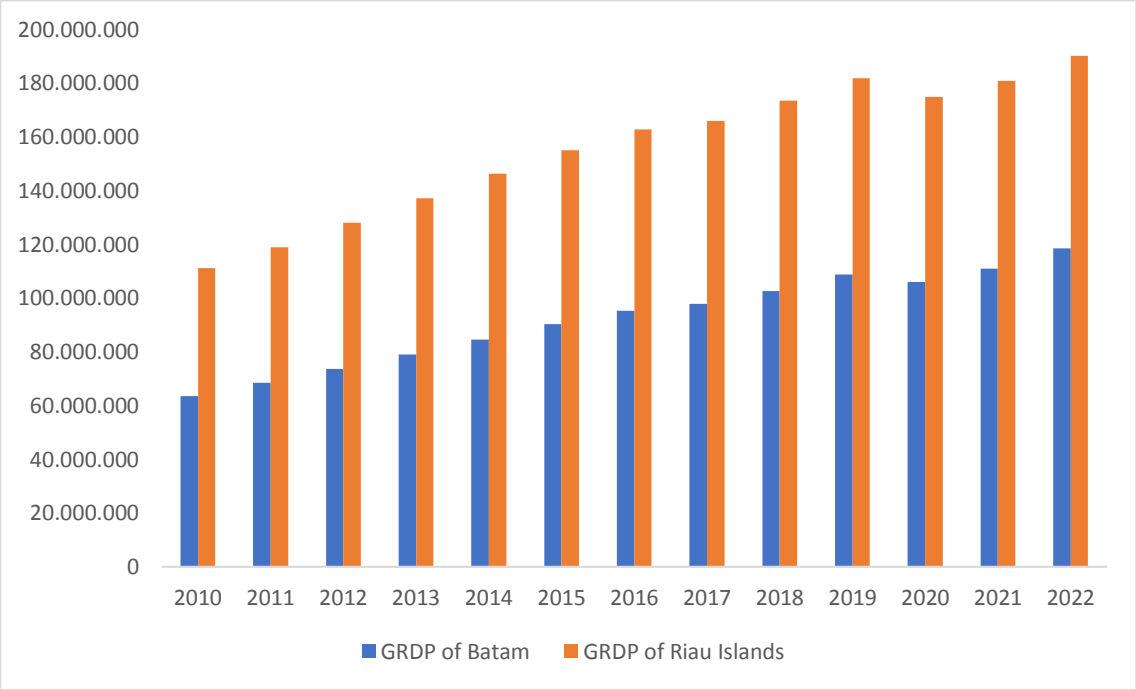

Figure 2. GRDP of Batam and Riau Islands in Millions of Rupiah
Source: Statistics Indonesia of Riau Islands and Statistics Indonesia of Batam

In 2017, there was a decline in economic growth to be lower than the national economic growth (Negara and Hutchinson, 2020). The decline was caused by declining FDI and exports, coupled with the closure of a leading electronics company, a sluggish shipping industry, and rising unemployment (Hutchinson, 2017). Two factors led to this condition. First, the decentralization policy has made business in Batam much more complicated. Investors have to deal with several authorities such as BP Batam and Batam City Government to obtain licenses. Second, structural changes in the Indonesian economy and changes in corporate strategies indicate that foreign investment in Batam is seeking to enter the Indonesian domestic market rather than the international market through exports. In this case, Batam becomes unattractive due to its distance from large population centers, poor connectivity, high labor costs, and unattractive taxation framework.

This study is different from previous studies because it uses Location Quotient, Dynamic Location Quotient, and Shift-share methods to identify the leading sector in Batam. Location Quotient can identify the base sector in Batam by comparing the production amount or value added of a sector in Batam to the production amount or value added of the same sector in the Riau Islands. Then, the Dynamic Location Quotient can see the growth rate of a sector in Batam so that it can be known which sectors have the potential to experience rapid growth. Lastly, Shift-share can be used to determine the extent of overall economic growth, determine the effect of economic growth on an economic sector, determine the components that affect the value added or GRDP in Batam, and determine the economic shifts in Batam as a result of economic changes in Riau Islands and Batam. The period in this study also uses the most extended period available at BPS, which is from 2010 to 2022. This study also uses the latest sectoral classification by BPS. (Aji and Nasriyah, 2021) conducted a similar study but the period used was only from 2019 to 2020 and only used Location Quotient. Another study by (Aritenang, 2017) only used the Location Quotient method with a fairly old period, namely 2001 to 2011 and nine business field so it is less relevant to the current condition. Meanwhile, (Misbah et al., 2019) used various methods,

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such as Location Quotient, Dynamic Location Quotient, Shift-share, and Klassen Typology, but were limited to the agricultural sector and livestock subsector. While (Wira et al., 2023) used Location Quotient, Shift-share, Overlay, and Klassen Typology but were limited to the maritime sector.

To overcome the above problems, the author is interested in researching and answering this research question, namely what is the leading sector in Batam. After knowing which sector has great potential and performance, this study is expected to be useful in policy making by the government to further develop the sector and increase economic growth of Batam that has begun to be sluggish.

THEORITICAL REVIEW

Economic Growth. The rate of economic growth will be measured through indicators of GRDP development from year to year. Economic growth can also be interpreted as an increase in GRDP, regardless of whether the increase is greater or less than population growth or whether changes in the economic structure apply or not. At the regional level, economic growth discusses why a region can grow fast compared to the economy in the wider region, while others are less developed, and what economic factors determine the economic growth of the region (Kurniawan, 2017).

Economic Base Theory. The economic base theory is a conventional theoretical framework used to explain the main factors of economic development in the short run in an open economy (Poinsot and Ruault, 2019). The theory states that money coming in from other regions, i.e. external income, is the main driver of economic activity at the local level. As a result, a distinction is made between base and non-base sectors. Base sectors are those that drive the economy and are export-oriented because domestic needs are met. On the other hand, non-base sectors are sectors whose ability to meet the needs of goods and/or services is still limited, and the scope of production and marketing is still local. This assumption implies that a region will have a leading sector if the region can win the competition in the same sector with other regions so that it can generate exports (Kurniawan, 2017). Base analysis or economic base theory can be used to identify base and non-base areas, which includes the Location Quotient (LQ) method.

Previous Studies. (Aji and Nasriyah, 2021) found that Mining and Quarrying, Processing Industry, Water Supply, Waste Management, Waste and Recycling, and Construction are the leading sectors in Riau Islands. The potential of the industrial estate in Batam makes Riau Islands quite superior in the industrial sector. The COVID-19 pandemic has not changed the composition of the leading sectors in Riau Islands. Although the results of the LQ analysis have a slight difference, it has not changed the category of the leading sector in Riau Islands. This study succeeded in identifying the leading sectors in Batam, but there is a weakness. The period of data used in this study is too narrow, only from 2nd quarter of 2019 to 2nd quarter of 2020.

(Mardiyah et al., 2022) found similar results where Mining and Quarrying, Processing Industry, Water Supply, Waste Management, Waste and Recycling, and Construction are leading sectors in Riau Islands.

Research by (Napitupulu and Nugroho, 2016) found that the industrial sector has the largest contribution to the Riau Islands GRDP with a contribution of 50 per cent. The significant difference between the industrial sector and other sectors in the contribution of GRDP indicates that the focus of industrial sector development is highly prioritized in Riau Islands, especially in Batam, so that the city's economy is better than other cities/regencies.

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The largest proportion of contribution from the industrial sector comes from Batam. The role of industry in Batam has created a strong economy for the people of Batam, in terms of income, expenditure, employment, and migration. The existence of industrial activities also affects Batam's poverty, labor participation rate, and unemployment. The development of industrial activities also has a positive impact on the trade and services sector. The development of trade and services refers to trade and services in the vicinity of the industrial area that grew after the operation of industrial enterprises. This is a normal phenomenon, seen from the workers' needs for trade and services, such as food stalls and restaurants to eat during breaks, services such as banks and tire patchers, and other trade and service activities. The relationship between industrial firms and trade and service activities is an indirect multiplier, meaning that there is no direct link between industrial firms and trade and service activities, but these activities grow because of the presence of industrial firms operating and there is a relationship between workers and trade and service activities. This study does not directly state which sector is the leading sector in Batam but only states that the industrial sector is the largest contributor to GRDP.

Another findings by (Aritenang, 2017) stated that the information and communication technology sector is a driver of economic growth in Batam. Initially, Batam was one of the centers of the electrical and electronic industry in Indonesia. At its peak, it contributed more than fifty per cent to the export of electronic components and parts. The advancement of the information and communication technology sector in Batam has attracted an inflow of foreign investment and multinational companies, which reflects Batam's competitive advantage over other regions. This study succeeded in identifying the leading sectors in Batam, but there are still some weaknesses. First, the period of data obtained is old, i.e. from 2001 to 2011 so it is less relevant to the current condition. Second, this study still uses GDRP calculation according to nine business fields. Third, the method used in this study is only LQ so it can only identify leading sectors, but not sectors that have good growth rates and competitiveness.

(Misbah et al., 2019) tried to find the leading subsector in the agricultural sector, as well as the leading commodity in the subsector. As a result, it was found that the livestock subsector was the leading subsector in the agricultural sector in Riau Islands. All growth components in this subsector are positive. In addition, pigs are the leading commodity in the livestock subsector. All growth components of the pig commodity are positive. Pig farming in Riau Islands is centered on Bulan Island, Batam, where this island is devoted to the development of this commodity. The main purpose of the pig farms is for export to Singapore. In the future, cattle and goats are expected to become the leading commodities in Riau Islands Province.

The other study by (Wira et al., 2023) examined the maritime sector in Riau Islands. As a result, Batam has twelve maritime base activities based on the LQ method, including the cracker manufacturing industry, the freezing and refrigeration industry of marine products, the salting and preservation industry of marine biota, the canned fish processing and preservation industry, the canned shrimp processing and preservation industry, the offshore building industry, the ship and boat industry, the other ship production industry, the wholesale and retail trade industry excluding cars and motorcycles, the sea transportation industry, the river and lake crossing industry, and the accommodation, food, and beverage industry. Then based on the shift-share analysis method, the stone and sand mining industry, the canned fish processing and preservation industry, the canned shrimp processing and preservation industry, and the river and lake crossing industry are industries that experience rapid growth and have good competitiveness.

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METHODS

The type of research used is quantitative research using secondary data. The data in this study were obtained from Statistics Indonesia of Riau Islands and Statistics Indonesia of Batam. The analysis techniques used were Location Quotient (LQ), Dynamic Location Quotient (DLQ), and Shift-share Analysis. Further details about the data used can be seen in **Table 1.**

Table 1. Data Description

Data	Unit	Year
GRDP of Riau Islands at Basic Year 2010 Constant Prices by Business Field in Million Rupiah	Million Rupiah	2010 to 2022
GRDP of Batam at Basic Year 2010 Constant Prices by Business Field in Million Rupiah	Million Rupiah	2010 to 2022

Source: Statistics Indonesia of Riau Islands and Statistics Indonesia of Batam

Location Quotient (LQ). Location Quotient is the ratio of the amount of production or provision of added value in a particular sector in a region to the amount of production or added value for the same sector in a region that has wider administrative coverage (Muljanto, 2021). This method aims to identify the base sector in a certain area by comparing the production amount or value added of a sector in a certain area to the production amount or value added of the same sector in a wider administrative area. In this study, LQ is used to find the base sector in Batam. The formula for calculating LQ is as follows:

$$LQ = \frac{Yxk/Yk}{Yxp/Yp} \quad \text{..... (1)}$$

where LQ is the Location Quotient value of each sector in Batam, Yxk is the GRDP value of x sector in Batam, Yk is the total value of GRDP from all sectors in Batam, Yxp is the GRDP value of x sector in Riau Islands, and Yp is the total GRDP value of all sectors in Riau Islands.

If the LQ value of x sector is more than one, it indicates that the role of x sector in Batam is more prominent than the role of x sector in Riau Islands, so x sector is called the basic or leading sector. However, if the LQ value of x sector is less than one, it indicates that the role of x sector in Batam is less prominent than the role of x sector in Riau Islands, so it is called a non-base sector.

Dynamic Location Quotient (DLQ). Dynamic Location Quotient (DLQ) is a modification of LQ, by accommodating the factor of economic sector output growth rate over time, in this calculation the economic growth factor in the observation area is considered (Basuki, 2017). The difference with the location quotient lies in the consideration of existing economic growth factors, the location quotient in its calculation does not consider economic growth. In this study, DLQ aims to see the growth rate of a sector in Batam so that it can be known which sectors have the potential to experience rapid growth. The formula for calculating DLQ is as follows:

$$DLQ = \frac{\frac{1+gxk}{1+gk}}{\frac{1+gxp}{1+gp}} \quad \text{..... (2)}$$

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Where DLQ is the Dynamic Location Quotient of each sector in Batam, gxk is growth rate of sector x in Batam, gk is the average growth rate of x sector in Batam, gxp is the growth rate of x sector in Riau Islands, and gp is the Total GRDP value of all sectors in Riau Islands.

If the DLQ value of x sector is more than one, it indicates that the potential development of x sector in Batam is faster than the development of x sector in Riau Islands, so it is called a prospective sector. And if the DLQ value of x sector is more than one, it indicates that the potential development of x sector in Batam is faster than the development of x sector in Riau Islands, so it is called a prospective sector. However, if the DLQ value of x sector is less than one, it indicates that the potential development of x sector in Batam is slower than the development of x sector in Riau Islands, so it is called a non-prospective sector.

Shift-share Analysis. The shift-share analysis is a technique that can be used to analyze regional industry statistics and economic activity (Kurniawan, 2017). If regions whose growth is solely due to the emergence of several sectors of economic activity or industry grow faster when compared to national growth, it can be said that regional growth per sector is better than national growth. This is because there are differences in the characteristics of economic sectors and regional conditions that are not the same as the national level.

The shift-share analysis method begins with changes in the GRDP value of a sector between two periods, namely the base year period and the final period. This method is based on the basic assumption that the economic growth of a region is influenced by three main components, which are national growth, sectoral growth, and regional competitiveness growth. (Kurniawan, 2017) stated that shift-share analysis has at least four essential uses, among others to determine the extent of overall economic growth, to determine the effect of economic growth on an economic sector, to determine the components that affect the value added or GRDP in the study area, and to determine the economic shifts in the study area as a result of economic changes in the reference area and the study area. In this study, shift-share aims to see which sectors in Batam have rapid growth rates, good competitiveness, and are progressive. The steps in the shift-share analysis are as follows:

Calculating the ratio of economic activity indicators

$$rx = \frac{Y'xk - Yxk}{Yxk} \quad \text{.....(3)}$$

Where rx is the growth rate of GRDP value of sector x in Batam, Yxk is the GRDP value of x sector in Batam in the base year, and Y'xk is the GRDP value of x sector in Batam in the final year.

$$Rx = \frac{Y'xp - Yxp}{Yxp} \quad \text{.....(4)}$$

Where Rx is the growth rate of GRDP value from x sector in Riau Islands, Yxp is the GRDP value of x sector in Riau Islands in the base year, and Y'xp is the GRDP value of x sector in Riau Islands in the final year.

$$Ra = \frac{Y'p - Yp}{Yp} \quad \text{.....(5)}$$

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Where Ra is the growth rate of total GRDP value in Riau Islands, Yp is the total GRDP value in Riau Islands in the base year, and Y'p is the total GRDP value in Riau Islands in the final year.

Calculating the regional growth component

$$PNxk = Ra\ x\ Yxk \quad \text{.....(6)}$$

Where PNxk is the growth component of x sector in Batam, Ra is the growth rate of total GRDP value in Riau Islands, and Yxk is the GRDP value of x sector in Batam in the base year.

$$PPxk = (Rx - Ra)\ x\ Yxk \quad \text{.....(7)}$$

Where PPxk is the growth component of x sector in Batam, Rx is the growth rate of GRDP value of x sector in Riau Islands, Ra is the growth rate of total GRDP value in Riau Islands, and Yxk is the GRDP value of x sector in Batam in the base year.

If the value of PPxk is more than zero, it indicates that the growth of x sector in Batam is fast. On the other hand, if the value of PPxk is less than zero, it indicates that the growth of the x sector in Batam is slow.

$$PPWxk=(rx-Rx)\ x\ Yxk \quad \text{.....(8)}$$

Where PPWxk is the growth component of regional share of sector x in Batam, rx is the growth rate of GRDP value of x sector at Batam, Rx is the growth rate of GRDP value from x sector in Riau Islands, and Yxk is the GRDP value of x sector in Batam in the base year.

If the value of PPWxk is more than zero, it indicates that the competitiveness of x sector in Batam is better than the competitiveness of x sector in Riau Islands. On the other hand, if the value of PPWxk is less than zero, it indicates that the competitiveness of x sector in Batam is relatively poor compared to the competitiveness of x sector in Riau Islands.

Calculating net shift

$$PBxk = PPxk + PPWxk \quad \text{.....(9)}$$

Where PBxk is the net shift of x sector in Batam, PPxk is the growth component of x sector in Batam, and PPWxk is the growth component of regional share of x sector in Batam.

If the value of PBxk is more than zero, it indicates that the growth of x sector in Batam is progressive. On the other hand, if the value of PBxk is less than zero, it indicates that the growth of x sector in Batam is sluggish.

Evaluating the growth profile of the business sector. The business sector growth profile is used to assess the growth of a sector in a certain area and within a certain period. PPW is the ordinate, while PP is the abscissa. Quadrant I indicates that a sector in a particular region has rapid growth and good competitiveness. Quadrant II indicates that a sector in a particular region has fast growth, but relatively poor competitiveness. Quadrant III indicates that a sector in a particular region has slow growth and relatively poor competitiveness. Quadrant IV indicates that a sector in a particular region has slow growth, but good competitiveness. Then there is a diagonal line with a slope angle of 45° that intersects quadrants II and IV.

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Sectors above or to the right of the line indicate progressive sectors, while sectors below or to the left of the line indicate sluggish sectors.

RESULTS

GRDP of Batam. The value of Batam's GRDP per sector can be seen in **Table 2**. It can be seen that on average, Batam's GRDP has grown by 5.367 per cent per year. However, it cannot be denied that the COVID-19 pandemic also caused a decrease in Batam's GRDP by -2.547 per cent in 2020. That year was also the only year from 2010 to 2022 when Batam experienced an economic contraction. The analysis of economic growth per sector in Batam can be detailed as follows:

Agriculture, Forestry, and Fisheries. It can be seen that this sector experienced an average growth of 3.379 per cent per year. It is noted that from 2010 to 2022, the Agriculture, Forestry, and Fisheries sector experienced two decreases in GRDP, namely in 2019 by -0.473 per cent and in 2020 by -0.335 per cent.

Mining and Quarrying. The Mining and Quarrying sector experienced an average growth of 1.326 per cent per year. It can be seen that this sector experienced two decreases in GRDP, namely in 2018 by -1.776 per cent and in 2020 by -3.636 per cent.

Processing Industry. The average growth of this sector is 5.588 per cent per year. The Processing Industry sector is one of the sectors in Batam that has never experienced a decline in GRDP from 2010 to 2022.

Electricity and Gas Procurement. The Electricity and Gas Procurement sector experienced an average annual growth of 6.046 per cent. This sector only experienced a decline in GRDP twice, namely in 2018 by -1.018 per cent and in 2020 by -2.669 per cent.

Water Supply, Waste Management, Waste and Recycling. This sector experienced an average growth of 3.839 per cent per year. It is noted that during the period 2010 to 2022, the Water Supply, Waste Management, Waste and Recycling sector experienced two decreases in GRDP, namely in 2017 by -0.385 per cent and in 2020 by -2.833 per cent.

Construction. It can be seen that the Construction sector experienced an average growth of 5.882 per cent each year from 2010 to 2022. In the same period, this sector only contracted once, namely by -6.980 per cent in 2022.

Wholesale and Retail Trade; Repair of Cars and Motorcycles. The average growth of the Wholesale and Retail Trade; Repair of Cars and Motorcycles sector is 5.123 per cent per year. This sector also only contracted in 2020 by -14.732 per cent.

Transportation and Warehousing. This sector experienced an average growth of 1.725 per cent per year. However, the Transportation and Warehousing sector has experienced three contractions, namely in 2019 by -17.016 per cent, in 2020 by -44.520 per cent, and in 2021 by -10.477 per cent.

Accommodation, Drinking, and Food Provision. The Accommodation, Drinking, and Food Provision sector experienced an average growth of 5.803 per cent annually with the largest increase of the entire sector in 2022 at 48.778 per cent. However, this sector also experienced a decline in GRDP by -45.486 per cent in 2020 and -6.444 per cent in 2021.

Information and Communication. It can be seen that this sector experienced an average growth of 9.351 per cent each year. This figure is the highest average compared to other sectors in Batam. In addition to the Processing Industry, the Information and Communication sector also never experienced contraction from 2010 to 2022, with 2020 being the year with the largest growth for this sector, at 18.090 per cent.

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Financial and Insurance Services. The average growth of this sector is 4.835 per cent per year. From 2010 to 2022, the Financial and Insurance Services sector only contracted in 2020 by -1.181 per cent.

Real Estate. The Real Estate sector experienced an average growth of 2.432 per cent per annum. This sector contracted in 2018 by -5.129 per cent and in 2020 by -16.740 per cent.

Corporate Services. This sector experienced an average growth of 1.468 per cent annually. The Corporate Services sector also contracted twice in 2019 by -8.739 per cent and in 2020 by -43.329 per cent.

Government Administration, Defense, and Compulsory Social Security. It can be seen that the Government Administration, Defense, and Compulsory Social Security sector experienced growth of 5.209 per cent per year on average. This sector only experienced a decrease in GRDP in 2017 of -0.018 per cent.

Educational Services. The average growth of the Educational Services sector was 2.626 per cent per year. This sector experienced two contractions, amounting to -5.960 per cent in 2020 and -4.078 per cent in 2021.

Health and Social Services. This sector experienced growth of 4.715 per cent each year on average. The Health and Social Services sector only experienced a decrease in GRDP in 2020 of -2.090 per cent.

Other Services. It can be seen that this sector is the only sector in Batam that experienced a negative average growth of -0.842 per cent annually. In addition, in 2020 the Other Services sector contracted by -67.980 per cent. This contraction is the largest compared to other sectors from 2010 to 2022. Apart from 2020, this sector also contracted by -0.700 in 2011 and -6.058 in 2021.

LQ Analysis of Batam. The result of the LQ analysis is presented in **Table 3**. If the average value of LQ is above one, it is called the base sector. Otherwise, it is called the non-base sector. It is known that eight sectors become the basic sectors in Batam, including Processing Industry, Electricity and Gas Procurement, Water Supply, Waste Management, Waste and Recycling, Construction, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Information and Communication, and Financial and Insurance Services. Meanwhile, there are nine non-base sectors in Batam, namely Agriculture, Forestry, and Fisheries, Mining and Quarrying, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Real Estate, Corporate Services, Government Administration, Defense and Compulsory Social Security, Educational Services, Health and Social Services, and Other Services.

DLQ Analysis of Batam. Table 4 shows the results of DLQ analysis in Batam and shows which sectors are prospective. If the DLQ value is above one, the sector is called a prospective sector. Conversely, if the DLQ value is below one, the sector is called a non-prospective sector. The result of the DLQ analysis shows that there is only one prospective sector in Batam, namely Agriculture, Forestry, and Fisheries. On the other hand, there are 16 non-prospective sectors in Batam City, namely Mining and Quarrying, Processing Industry, Electricity and Gas Procurement, Water Supply, Waste Management, Waste and Recycling, Construction, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Information and Communication, Financial and Insurance Services, Real Estate, Corporate Services, Government Administration, Defense, and Compulsory Social Security, Educational Services, Health and Social Services, and Other Services.

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Table 4. Dynamic Location Quotient (DLQ) of Batam for the Period 2010 to 2022

Business Field	DLQ
A. Agriculture, Forestry, and Fisheries	1.109
B. Mining and Quarrying	0.916
C. Processing Industry	0.935
D. Electricity and Gas Procurement	0.909
E. Water Supply, Waste Management, Waste and Recycling	0.936
F. Construction	0.922
G. Wholesale and Retail Trade; Repair of Cars and Motorcycles	0.837
H. Transportation and Warehousing	0.794
I. Accommodation, Drinking, and Food Provision	0.858
J. Information and Communication	0.956
K. Financial and Insurance Services	0.919
L. Real Estate	0.912
M, N. Corporate Services	0.832
O. Government Administration, Defense, and Compulsory Social Security	0.996
P. Educational Services	0.847
Q. Health and Social Services	0.893
R, S, T, U. Other Services	0.536

Source: Processed by the author

Shift-share Analysis of Batam. The results of the shift-share analysis in Batam can be seen in **Table 5**. The sectors with the value of PPxk less than zero are Agriculture, Forestry, and Fisheries, Mining and Quarrying, Water Supply, Waste Management, Waste and Recycling, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Real Estate, Corporate Services, Government Administration, Defense and Compulsory Social Security, Educational Services, and Other Services. Meanwhile, the sectors with the value of PPxk more than zero are Procesing Industry, Electricity and Gas Procurement, Construction, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Information and Communication, Financial and Insurance Services, and Health and Social Services.

Table 5. Shift-share Analysis of Batam for the Period 2010 to 2022 (per cent)

Business Field	PP_{xk}	PPW_{xk}	PB_{xk}
A. Agriculture, Forestry, and Fisheries	-48.692	26.311	-22.381
B. Mining and Quarrying	-55.055	0.615	-54.440
C. Processing Industry	17.164	3.581	20.745
D. Electricity and Gas Procurement	30.319	-1.578	28.741
E. Water Supply, Waste Management, Waste and Recycling	-18.052	3.550	-14.502
F. Construction	24.390	1.175	25.565
G. Wholesale and Retail Trade; Repair of Cars and Motorcycles	24.027	-17.446	6.581
H. Transportation and Warehousing	-53.153	-23.441	-76.595
I. Accommodation, Drinking, and Food Provision	-2.282	-16.034	-18.316
J. Information and Communication	108.522	10.152	118.674
K. Financial and Insurance Services	3.432	0.443	3.875
L. Real Estate	-38.350	-2.788	-41.138
M, N. Corporate Services	-59.043	-10.790	-69.832
O. Government Administration, Defense, and Compulsory Social Security	-3.510	15.210	11.700
P. Educational Services	-25.565	-10.164	-35.730
Q. Health and Social Services	6.119	-4.103	2.015

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R, S, T, U. Other Services	-91.206	-25.105	-116.310

Source: Processed by the author

In addition to PPxk to measure the speed of growth of a sector, there is also PPWxk. Sectors with the value of PPWxk more than zero are Agriculture, Forestry, and Fisheries, Mining and Quarrying, Processing Industry, Water Supply, Waste Management, Waste and Recycling, Construction, Information and Communication, Financial and Insurance Services, and Government Administration, Defense, and Compulsory Social Security. Meanwhile, sectors with the value of PPWxk less than zero are Electricity and Gas Procurement, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Real Estate, Corporate Services, Educational Services, Health and Social Services, and Other Services.

Another metric that can be used in the shift-share analysis is PBxk. Sectors with the value of PBxk more than zero are Processing Industry, Electricity and Gas Procurement, Construction, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Information and Communication, Financial and Insurance Services, Government Administration, Defense and Compulsory Social Security, and Health and Social Services. In conntrast, sectors with the value of PBxk less than zero are Agriculture, Forestry, and Fisheries, Mining and Quarrying, Water Supply, Waste Management, Waste and Recycling, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Real Estate, Corporate Services, Educational Services, and Other Services.

The shift-share quadrant analysis in Batam is shown in **Figure 3**. Based on the analysis, it is found that Processing Industry, Construction, Information and Communication, and Financial and Insurance Services sectors are included in Quadrant I. Then those included in Quadrant II are Electricity and Gas Procurement, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Health and Social Services. Then the sectors included in Quadrant III are Real Estate, Corporate Services, Educational Services, Accommodation, Drinking, and Food Provision, Transportation and Warehousing, and Other Services. Finally, sectors included in Quadrant IV are Mining and Quarrying, Water Supply, Waste Management, Waste and Recycling, Government Administration, Defense and Compulsory Social Security, and Agriculture, Forestry and Fisheries.

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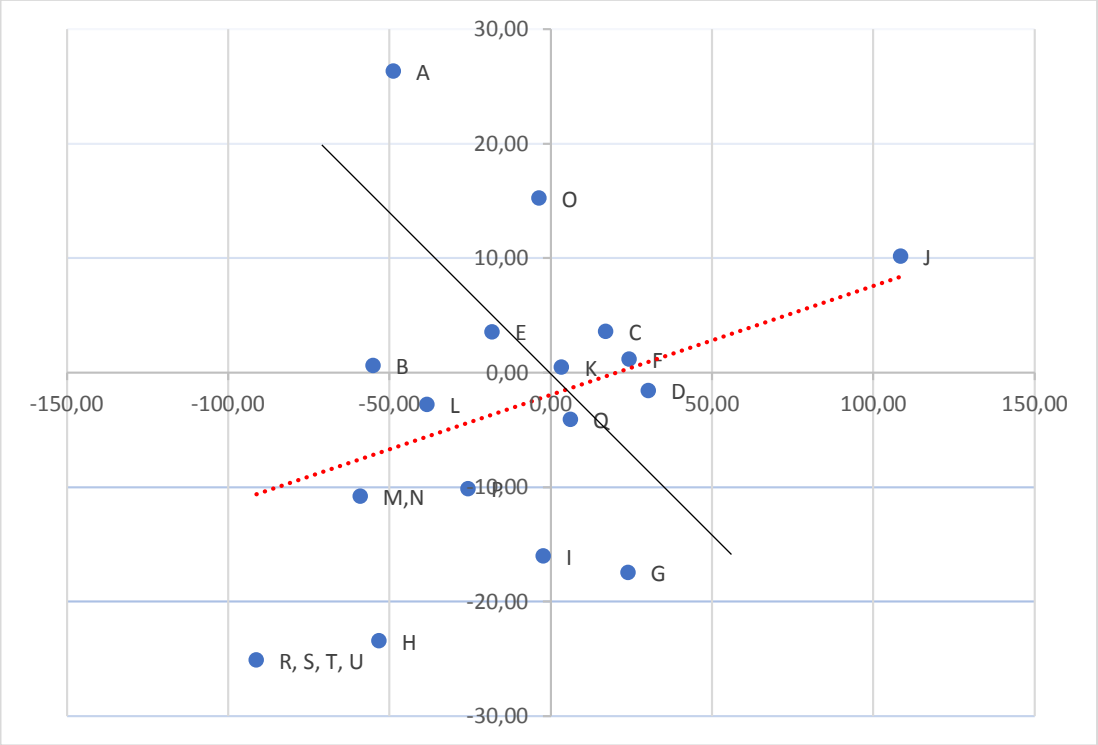

Figure 3. Shift-share Curve of Batam for the Period 2010 to 2022
Source: Processed by the author

DISCUSSION

Based on the LQ Analysis, Processing Industry, Electricity and Gas Procurement, Water Supply, Waste Management, Waste and Recycling, Construction, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Information and Communication, and Financial and Insurance Services are considered able to fulfill domestic needs in Batam and able to export products from these sectors to other regions. Meanwhile, Agriculture, Forestry, and Fisheries, Mining and Quarrying, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Real Estate, Corporate Services, Government Administration, Defense and Compulsory Social Security, Educational Services, Health and Social Services, and Other Services are considered unable to meet domestic needs and tend to import from other regions.

This result resembles the findings of (Napitupulu and Nugroho, 2016) who found that the Processing Industry created a strong economy for the people of Batam, in terms of income, expenditure, employment, and migration. The existence of industrial activities also affects Batam's poverty, labor participation rate, and unemployment. The development of industrial activities also has a positive impact on other sectors. Another study by (Aritenang, 2017) obtained similar results, where the Information and Communication sector is still the base sector and the driver of economic growth in Batam, adding to the Processing Industry sector.

The result of the DLQ analysis shows that Agriculture, Forestry, and Fisheries is the only sector to be considered to have the potential for rapid growth and development. This indicates that although Agriculture, Forestry, and Fisheries only experienced growth of 3.379 per cent annually, there is potential for even greater growth if the sector is further developed and explored. On the other hand, the Mining and Quarrying, Processing Industry,

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Electricity and Gas Procurement, Water Supply, Waste Management, Waste and Recycling, Construction, Wholesale, and Retail Trade; Repair of Cars and Motorcycles, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Information and Communication, Financial and Insurance Services, Real Estate, Corporate Services, Government Administration, Defense, and Compulsory Social Security, Educational Services, Health and Social Services, and Other Services are considered to have lower growth and development potential. This finding implies that these sectors may have reached their maximum growth potential or may not have the potential to be developed.

(Misbah et al., 2019) stated that pigs are the leading commodity in the livestock sub-sector, whereas livestock is the leading sub-sector in the Agriculture, Forestry, and Fisheries sectors. This finding is supported by the existence of a special island used as a pig farm in Batam, namely Bulan Island. Bulan Island has the largest pig farm in Indonesia and can fulfill up to 15 per cent of Singapore's pig import needs (Badan Karantina Pertanian, 2023). Going forward, the Agriculture, Forestry, and Fisheries sector through Bulan Island has the potential to further penetrate the pig import market in Singapore.

According to the Shift-share analysis, Agriculture, Forestry, and Fisheries, Mining and Quarrying, Water Supply, Waste Management, Waste and Recycling, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Real Estate, Corporate Services, Government Administration, Defense and Compulsory Social Security, Educational Services, and Other Services are considered fast-growing sectors. Meanwhile, the Processing Industry, Electricity and Gas Procurement, Construction, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Information and Communication, Financial and Insurance Services, and Health and Social Services are considered slow-growing sectors.

It can be seen that there are more sectors with slow growth than sectors with fast growth, i.e. ten slow-growing and seven fast-growing sectors. When compared to the research by (Justyanita et al., 2021), there are some similarities and differences. In that study, the Information and Communication sector is also a sector with significant growth and the Other Services sector is also a slow-growing sector. However, the difference is in the Government Administration, Defense, and Compulsory Social Security sector, which in that study is considered a sector that has increased well.

In addition to showing sectors based on their growth speed, shift-share analysis can also identify sectors based on their competitiveness. Agriculture, Forestry, and Fisheries, Mining and Quarrying, Processing Industry, Water Supply, Waste Management, Waste and Recycling, Construction, Information and Communication, Financial and Insurance Services, Government Administration, Defense, and Compulsory Social Security are considered to be more competitive. Meanwhile, Electricity and Gas Procurement, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Real Estate, Corporate Services, Educational Services, Health, and Social Services, and Other Services are considered to be less competitive.

Although Construction is a sector with good competitiveness, it is in fact one of the sectors that felt the strongest shock from the COVID-19 pandemic according to a survey by the Ministry of Manpower (Barenbang, 2020). This means that Construction is only competitive under normal economic conditions.

The shift-share analysis can also show which sectors are progressive or slow. Processing Industry, Electricity and Gas Procurement, Construction, Wholesale, and Retail Trade; Repair of Cars and Motorcycles, Information and Communication, Financial and Insurance Services, Government Administration, Defense and Compulsory Social Security,

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and Health and Social Services are considered progressive sectors. In contrast, Agriculture, Forestry, and Fisheries, Mining and Quarrying, Water Supply, Waste Management, Waste and Recycling, Transportation and Warehousing, Accommodation, Drinking, and Food Provision, Real Estate, Corporate Services, Educational Services, and Other Services are considered slow.

These findings are supported by (Purnomo et al., 2023) which states that information and communication technology is a prerequisite for sustainable economic growth through increased efficiency, time, and consumption. In addition, information and communication technology can also increase the efficiency of education for the community to encourage growth and reduce economic inequality.

According to the shift-share quadrant analysis, Processing Industry, Construction, Information and Communication, and Financial and Insurance Services have rapid growth and good competitiveness. Then, Electricity and Gas Procurement, Wholesale and Retail Trade; Repair of Cars and Motorcycles, Health and Social Services have rapid growth, but weak competitiveness. Subsequently, Real Estate, Corporate Services, Educational Services, Accommodation, Drinking, and Food Provision, Transportation and Warehousing, and Other Services have slow growth and weak competitiveness. Finally, Mining and Quarrying, Water Supply, Waste Management, Waste and Recycling, Government Administration, Defense and Compulsory Social Security, and Agriculture, Forestry, and Fisheries have slow growth, but good competitiveness.

CONCLUSION

Based on the results of LQ analysis, the basic sectors in Batam are Processing Industry, Electricity and Gas Procurement, Water Supply, Waste Management, Waste and Recycling, Construction, Transportation and Warehousing, Accommodation and Food Supply, Information and Communication, and Financial and Insurance Services. These sectors can fulfill domestic needs in Batam and can export products from these sectors to other regions. When using DLQ analysis, it is found that the prospective sectors in Batam is Agriculture, Forestry, and Fisheries. This means that the Agriculture, Forestry, and Fisheries sector has the potential for rapid growth and development. Then when using shift-share analysis, four sectors have rapid growth rates, good competitiveness, and are progressive. These four sectors are Processing Industry, Construction, Information and Communication, and Financial and Insurance Services.

Based on these findings, it is expected that the Batam City Government and the Head of BP Batam can focus development in the Processing Industry, Construction, Information and Communication, and Financial and Insurance Services sectors because they are the leading sectors. These four sectors are considered base sectors, have rapid growth rates, good competitiveness, and are progressive. By focusing resources on these sectors, a significant increase in economic growth in Batam is expected.

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