Global value chain of new tyres for automobiles and commercial vehicles: Brazil and global situation

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Abstract
This study explored the scope of a tyre business in Brazil based on the survey of the global value chain (GVC) of new tyres of approximately 170 countries in 2012, 2019, and 2022. The new-tyre GVC (total trade size, demand, and supply) for motor cars and large commercial vehicles was analysed. Each country's GVC was categorised based on the global competitiveness index values. According to the total GVC analysis of car tyres, Brazil keep around middle of 20s recently. Regarding tyres for large commercial vehicles, they keep around middle of 10s. As a tyre supplier, currently, Brazil does not have a significant presence but is only a regional tyre supplier for Latin America and the United States. Although Brazil imports moulds for tyre production, it is possible to increase the number of domestic suppliers. Hence, Brazil can become a world-class tyre supplier with cooperation from the government and private sectors.

Keywords: "Global value chain", "International competitiveness", "Global competitiveness", "Tyre", "Supply chain", "Mould", "Export hub", "Automobile industry, Brazil"

1. Introduction

The automobile industry occupies a major part of the economy in several industries and requires a variety of technologies for design and manufacture. For emerging countries, establishing an automobile industry and increasing the nationalisation ratio are essential for economic growth. There are several automobile-supporting industries for automobile production in developed countries, which significantly contribute to the economic growth. Furthermore, domestic industries are integral for enforcing research and development (R&D) of new cars and technologies.

Now, the Brazilian government is planning to increase the growth of automobile industry and, in turn, increase the country's nationalisation ratio of automobile production (Rota 2030). To achieve this, the import and export of tyres can be considered an attractive option. To this end, this study aimed to explore scope of the tyre business in Brazil based on the survey of the global value chain (GVC) of new tyres. This study explored the GVC of a new tyre export and import business worldwide and the Brazilian GVC of the tyre business. Furthermore, the current position of Brazil in international tyre business was evaluated.

2. Materials and methods

2.1 Data and study period

To evaluate the GVC of new tyres, the method used by Baba (2022) was adopted in this study. The automobile production rate was calculated using raw data from the Organisation Internationale des Constructeurs d'Automobiles (OICA). Furthermore, the GVC of a new tyre business was calculated using raw data from UN Comtrade.

The Harmonized Commodity Description and Coding System Codes (HS codes) — HS4011, HS401110 and HS401120 — were used to calculate the trade data. HS4011 indicates 'new pneumatic tyres of rubber'. HS 401110 indicates the 'tyre of one of a kind used for motor cars (including station wagons and racing cars)'. HS 401120 indicates the 'tyre of one of a kind used for buses or lorries'. Hereinafter, HS401120 is referred to as a 'tyre used for a large commercial vehicle'.

This study employed raw data collected from 2012 to 2023. In 2023, it looks like on the way to gather trade data. The number of countries involved in the tyre business was lesser in 2023 than in 2022. Therefore, this study primarily used the data collected from 2012 to 2022 and compared the data collected in 2012, 2019 and 2022. The changes observed between 2012 and 2022 were evaluated. Furthermore, the changes observed between 2019 and 2022, that is, before and after the coronavirus 2019 pandemic, were examined.

Strictly speaking, the monetary values of each year are not the same, and it is highly difficult to adjust the data by considering the inflations or deflations in every country participating in the GVC. Therefore, this study used unchanged raw data from the UN Comtrade. The data were mathematically processed to avoid the effect of changes in monetary values.

2.2 Global competitiveness index and categorization

In this study, the countries involved in the GVC of new tyre global trade were examined and the top 20 countries were selected to be compared with Brazil. To analyse the GVC of new tyres, four aspects of the GVC were assessed: supply, demand, the total trade size, and the characteristic of trade. The supply (demand) aspect was evaluated via an export (import) statistic, and the total trade size was calculated by summing the export and import data. To calculate the characteristic of trade, this study used the global competitiveness index (GCI), which is the same as the trade specialisation index (TSI). The GCI formula is presented as follows: GCI = (export – import) / (export + import). The GCI values range from -1 to +1. A GCI value of zero implies that the exports and imports are the same in a given country. As the GCI approaches +1, the export is larger than the import in that country. A GCI value of +1 indicates that only exports and no imports transpire in that country. As the GCI approaches -1, the import is larger than the export, and a GCI value of -1 indicates that only imports and no exports transpire in that country.

This study categorised the GVC according to the GCI values, as presented in Table 1.

Table 1. Categorisation of the GVC according to the GCI values

Range of the GCI Value	Type
$-0.6 \geq GCI$	Import-oriented
$-0.6 > GCI > -0.2$	Rather import-oriented
$-0.2 \geq GCI \geq 0.2$	Balanced
$0.2 < GCI < 0.6$	Rater export-oriented
$0.6 \leq GCI$	Export-oriented

Source: Author

3. GVC of new tyres for motor cars and large commercial vehicles

3.1 GVC of new tyres for motor cars (HS401110) from 2012 to 2022

3.1.1 GVC total (export + import)

(1) Situation in 2022

Table 2 presents the GVC category, GCI values, and global share rank of the top 10 countries, Czechia, Portugal, and Brazil for code HS401110.

As of 2022, 144 countries joined the GVC of a new tyre business for automobiles. Top 10 countries and their share of the trade volume (export + import) are as follows (presented in acceding order): the United States of America (USA) (global share, 13.0%), Germany (9.6%); China (8.0%), France (4.4%), the Netherlands (3.8%), Mexico (3.5%), Thailand (3.3%), South Korea (3.2%), Italy (3.2%), and Japan (3.0%). The next 10 countries are as follows: Poland, Spain, Romania, the United Kingdom (UK), Czechia, Canada, Hungary, Belgium, Slovakia, and Portugal. Brazil was 24th in the world, with a global share of 1.2%. The top 5, top 10, and top 20 countries had a global share of 47.8%, 60.8%, and 79.4%, respectively.

Based on the data presented in Table 2, in 2022, the export-oriented– and rather export-oriented–type countries are China, Thailand, South Korea, Japan, Czechia, and Portugal. Balanced-type countries are Germany, Netherlands, and Mexico. Import-oriented– and rather imported-oriented–type countries are the USA, France, and Italy. Brazil is categorised as a balanced-type country.

Table 2. GVC total of new tyres for motor cars in 2022

2022

	G.Share	Rank	GCI	Type
USA	13.0%	1	▲ 0.8	Imp
Germany	9.6%	2	▲ 0.1	Balance
China	8.0%	3	0.9	Exp
France	4.4%	4	▲ 0.3	R.Imp
Netherlands	3.8%	5	▲ 0.1	Balance
Mexico	3.5%	6	▲ 0.0	Balance
Thailand	3.3%	7	0.8	Exp
S. Korea	3.2%	8	0.5	R.Exp
Italy	3.2%	9	▲ 0.2	R.Imp
Japan	3.0%	10	0.4	R.Exp
Czechia	2.4%	15	0.4	R.Exp
Portugal	1.8%	20	0.6	R.Exp
Brazil	1.2%	24	▲ 0.0	Balance

Source: Calculated using trade statistics

(2) Situation in 2019

In 2019, 166 countries joined the GVC of a new tyre business for automobiles. As presented in Table 3, the top 10 countries and their share of the trade volume are as follows (presented in ascending order): the USA (global share, 11.9%), Germany (9.9%), China (7.3%), France (4.3%), Netherland (4.0%), Thailand (4.0%), South Korea (3.6%), Japan (3.3%), Italy (3.1%), and Mexico (2.8%). The next 10 countries are as follows: the UK, Canada, Poland, Spain, Czechia, Romania, Hungary, Belgium, Russia, and Indonesia. Brazil was 26th in the world, with a global share of 1.0%. The top 5, top 10, and top 20 countries had a global share of 37.4%, 54.1%, and 76.1%, respectively.

Based on the data presented in Table 3, in 2019, the export-oriented– and rather export-oriented–type countries are China, Thailand, South Korea, Japan, Czechia, and Indonesia. Balanced-type countries are Germany, Netherlands, Italy, and Mexico. Import-oriented– and rather imported-oriented–type countries are the USA and France. Brazil is categorised as a balanced-type country.

Table 3. GVC total of new tyres for motor cars in 2019

	2019			
	G.Share	**Rank**	**GCI**	**Type**
USA	11.9%	1	▲ 0.7	Imp
Germany	9.9%	2	▲ 0.0	Balance
China	7.3%	3	0.8	Exp
France	4.3%	4	▲ 0.2	R.Imp
Netherlands	4.0%	5	▲ 0.0	Balance
Thailand	4.0%	6	0.8	Exp
S. Korea	3.6%	7	0.6	R.Exp
Japan	3.3%	8	0.4	R.Exp
Italy	3.1%	9	▲ 0.2	Balance
Mexico	2.8%	10	▲ 0.1	Balance
Czechia	2.5%	15	0.3	R.Exp
Indonesia	1.8%	20	0.9	Exp
Brazil	1.0%	26	▲ 0.0	Balance

Source: Calculated using trade statistics

(3) Situation in 2012

In 2012, 171 countries joined the GVC of a new tyre business for automobiles. As presented in Table 4, the top 10 countries and their share of the trade volume are as follows (presented in ascending order): the USA (global share, 11.5%), Germany (10.7%),

China (7.2%), France (5.2%), Japan (4.8%), Netherlands (3.8%), South Korea (3.6%), Canada (3.1%), the UK (3.0%), and Italy (2.9%). The next top 10 countries are as follows: Spain, Czechia, Thailand, Russia, Mexico, Belgium, Poland, UAE, Hungary, and Indonesia. Brazil was 23rd in the world, with a global share of 1.3%. The global share of the top 5, top 10, and top 20 countries was 39.3%, 55.8%, and 77.0%, respectively.

Based on the data presented in Table 4, in 2012, export-oriented–type and rather export-oriented–type countries are China, Japan, South Korea, and Indonesia. Balanced-type countries are Germany, France, and Italy. Import-oriented– and rather imported-oriented–type countries are the USA, Canada, the UK, and Mexico. Brazil is categorised as a balanced-type country.

Table 4. GVC total of new tyres for motor cars in 2012

	2012			
	G.Share	**Rank**	**GCI**	**Type**
USA	11.5%	1	▲ 0.5	R.Imp
Germany	10.7%	2	▲ 0.0	Balance
China	7.2%	3	0.8	Exp
France	5.2%	4	▲ 0.1	Balance
Japan	4.8%	5	0.6	R.Exp
Netherlands	3.8%	6	0.0	Balance
S. Korea	3.6%	7	0.8	Exp
Canada	3.1%	8	▲ 0.3	R.Imp
UK	3.0%	9	▲ 0.6	R.Imp
Italy	2.9%	10	▲ 0.2	Balance
Mexico	2.2%	15	▲ 0.2	R.Imp
Indonesia	1.6%	20	0.9	Exp
Brazil	1.3%	23	▲ 0.1	Balance

Source: Calculated using trade statistics

3.1.2 Demand side (import)

(1) Situation in 2022

Table 5 shows the GVC of the demand side (Import) in 2022. The top 10 countries and their share values are as follows (presented in ascending order): the USA (global share, 22.5%), Germany (10.0%), France (5.5%), the UK (4.3%), the Netherlands (4.0%), Italy (3.8%), Mexico (3.6%), Canada (3.2%), Spain (2.6%), and Belgium (2.1%). The next top 10 countries are as follows: Australia, Poland, Japan, Slovakia, Czechia, South Korea, Switzerland, the United Arab Emirates (UAE), Sweden, and Brazil. Brazil was 20th in the world, with a global share of 1.2%. The global share of the top 5, top 10, and top 20

countries was 46.3%, 61.6%, and 76.9%, respectively.

Table 5. GVC demand for new tyres for motor cars in 2022

	2022	
	G.Share	**Rank**
USA	22.5%	1
Germany	10.0%	2
France	5.5%	3
UK	4.3%	4
Netherlands	4.0%	5
Italy	3.8%	6
Mexico	3.6%	7
Canada	3.2%	8
Spain	2.6%	9
Belgium	2.1%	10
Czechia	1.5%	15
Brazil	1.2%	20
Brazil	1.2%	20

Source: Calculated using trade statistics

Table 6. GVC demand for new tyres for motor cars in 2019

	2019	
	G.Share	**Rank**
USA	19.8%	1
Germany	10.0%	2
France	5.2%	3
UK	4.6%	4
Netherlands	4.1%	5
Canada	3.6%	6
Italy	3.6%	7
Mexico	3.2%	8
Spain	2.6%	9
Saudi Arabia	2.2%	10
Australia	1.7%	15
UAE	1.3%	20
Brazil	1.0%	25

Source: Calculated using trade statistics

(2) Situation in 2019

In 2019, as presented in Table 6, the top 10 countries and their global shares are as follows: the USA (global share, 19.8%), Germany (10.0%), France (5.2%), the UK (4.6%), the Netherlands (4.1%), Canada (3.6%), Italy (3.6%), Mexico (3.2%), Spain (2.6%), and Saudi Arabia (2.2%). The next top 10 countries are as follows: Belgium, Japan, Russia, Poland, Australia, South Korea, Czechia, China, Slovakia, and the UAE. Brazil

was 25th in the world, with a global share of 1.0%. The global share of the top 5, top 10, and top 20 countries was 43.6%, 58.8%, and 75.2%, respectively.

(3) Situation in 2022

In 2012, as presented in Table 7, the top 10 countries and their global share are as follows: the USA (global share, 17.6%), Germany (11.1%), France (5.7%), the UK (4.7%), Canada (4.2%), the Netherlands (3.7%), Italy (3.4%), Russia (3.2%), Spain (2.8%), and Mexico (2.7%). The next top 10 countries are as follows: Belgium, Australia, Japan, Saudi Arabia, the UAE, Czechia, Brazil, Poland, Switzerland, and Austria. Brazil was 17th in the world, with a global share of 1.4%. The global share of the top 5, top 10, and top 20 countries was 43.3%, 59.1%, and 76.7%, respectively.

Table 7. GVC demand for new tyres for motor cars in 2012

	2012	
	G.Share	**Rank**
USA	17.6%	1
Germany	11.1%	2
France	5.7%	3
UK	4.7%	4
Canada	4.2%	5
Netherlands	3.7%	6
Italy	3.4%	7
Russia	3.2%	8
Spain	2.8%	9
Mexico	2.7%	10
UAE	1.8%	15
Austria	1.2%	20
Brazil	1.4%	17

Source: Calculated using trade statistics

3.1.2 Supply side (export)

(1) Situation in 2022

Regarding the supply side (export) in 2022, as presented in Table 8, the top 10 countries and their global share are as follows: China (global share, 15.1%), Germany (9.1%), Thailand (6.2%), South Korea (5.0%), Japan (4.2%), Romania (4.0%), Poland (3.9%), Hungary (3.7%), the Netherlands (3.6%), and Mexico (3.5%). The next top 10 are as follows: Czechia, Indonesia, France, the USA, Portugal, Spain, Italy, Slovakia, Türkiye, and Belgium. Brazil was 25th in the world, with a global share of 1.2%. The global share of the top 5, top 10, and top 20 countries was 39.7%, 58.4%, and 84.5%, respectively.

Table 8. GVC supply of new tyres for motor cars in 2022

	2022	
	G.Share	**Rank**
China	15.1%	1
Germany	9.1%	2
Thailand	6.2%	3
S. Korea	5.0%	4
Japan	4.2%	5
Romania	4.0%	6
Poland	3.9%	7
Hungary	3.7%	8
Netherlands	3.6%	9
Mexico	3.5%	10
Portugal	2.8%	15
Belgium	1.6%	20
Brazil	1.2%	25

Source: Calculated using trade statistics

(2) Situation in 2019

In 2019, as presented in Table 9, the top 10 countries and their global share are as follows: China (global share, 13.2%), Germany (9.7%), Thailand (7.3%), South Korea (5.7%), Japan (4.5%), the Netherlands (4.0%), USA (3.9%), France (3.5%), Poland (3.4%), and Indonesia (3.2%). The next top 10 countries are as follows: Romania, Hungary, Czechia, Italy, Mexico, Portugal, Spain, UAE, Canada, and Russia. Brazil was 28th in the world, with a global share of 1.0%. The global share of the top 5, top 10, and top 20 countries was 40.5%, 58.4%, and 82.6%, respectively.

Table 9. GVC supply of new tyres for motor cars in 2019

	2019	
	G.Share	**Rank**
China	13.2%	1
Germany	9.7%	2
Thailand	7.3%	3
S. Korea	5.7%	4
Japan	4.5%	5
Netherlands	4.0%	6
USA	3.9%	7
France	3.5%	8
Poland	3.4%	9
Indonesia	3.2%	10
Mexico	2.4%	15
Russia	1.7%	20
Brazil	1.0%	28

Source: Calculated using trade statistics

(3) Situation in 2012

In 2012, as presented in Table 10, the top 10 countries and their global share are

as follows: China (global share, 13.2%), Germany (10.3%), Japan (7.5%), South Korea (6.5%), USA (5.4%), France (4.8%), Thailand (4.0%), the Netherlands (3.9%), Czechia (3.2%), and Indonesia (3.1%). The next top 10 countries are as follows: Poland, Hungary, Italy, Spain, Portugal, Romania, Canada, the UAE, Mexico, and Belgium. Brazil was 25th in the world, with a global share of 1.1%. The global share of the top 5, top 10, and top 20 countries was 42.8%, 61.7%, and 84.3%, respectively.

Table 10. GVC supply of new tyres for motor cars in 2012

	2012	
	G.Share	**Rank**
China	13.2%	1
Germany	10.3%	2
Japan	7.5%	3
S. Korea	6.5%	4
USA	5.4%	5
France	4.8%	6
Thailand	4.0%	7
Netherlands	3.9%	8
Czechia	3.2%	9
Indonesia	3.1%	10
Portugal	2.3%	15
Belgium	1.7%	20
Brazil	1.1%	25

Source: Calculated using trade statistics

3.2 GVC of new tyres for large commercial vehicles (hs401120) from 2012 to 2022

3.1.1 GVC total

(1) Situation in 2022

As of 2022, 145 countries joined the GVC of new tyres for a large commercial vehicle (HS401120). As presented in Table 11, the top 10 countries and their global share of the trade volume are as follows: the USA (global share, 16.9%), China (16.2%), Thailand (5.5%), Germany (5.4%), Canada (3.9%), Mexico (3.1%), Japan (2.6%), Poland (2.6%), Spain (2.4%), and France (2.3%). The next top 10 countries are as follows: Vietnam, Türkiye, South Korea, Slovakia, the Netherlands, Brazil, Belgium, Italy, and India. Brazil was 16th in the world, with a global share of 1.9%. The global share of the top 5, top 10, and top 20 countries was 47.8%, 60.8%, and 79.4%, respectively.

Table 11. GVC total of new tyres for large commercial vehicles in 2022

2022

	G.Share	Rank	GCI	Type
USA	16.9%	1	▲ 0.6	Imp
China	16.2%	2	1.0	Exp
Thailand	5.5%	3	0.9	Exp
Germany	5.4%	4	▲ 0.2	Balance
Canada	3.9%	5	▲ 0.2	Balance
Mexico	3.1%	6	▲ 0.9	Imp
Japan	2.6%	7	0.7	Exp
Poland	2.6%	8	0.2	Balance
Spain	2.4%	9	0.3	R.Exp
France	2.3%	10	▲ 0.3	R.Imp
Netherlands	1.9%	15	▲ 0.4	R.Imp
Australia	1.3%	20	▲ 1.0	Imp
Brazil	1.9%	16	▲ 0.1	Balance

Source: Calculated using trade statistics

Based on the data presented in Table 11, export-oriented–type and rather export-oriented–type countries are China, Thailand, Japan, and Spain. Balanced-type countries are Germany, Canada, and Poland. Import-oriented– and rather imported-oriented–type countries are the USA, Mexico, France, and the Netherlands. Brazil is categorised as a balanced-type country.

Table 12. GVC total of new tyres for large commercial vehicles in 2019

2019

	G.Share	Rank	GCI	Type
China	15.8%	1	1.0	Exp
USA	14.0%	2	▲ 0.5	R.Imp
Germany	5.3%	3	▲ 0.1	Balance
Thailand	4.5%	4	0.9	Exp
Canada	3.6%	5	▲ 0.1	Balance
Mexico	2.9%	6	▲ 0.9	Imp
France	2.8%	7	▲ 0.2	Balance
Japan	2.7%	8	0.7	Exp
Spain	2.5%	9	0.3	R.Exp
Poland	2.4%	10	0.3	R.Exp
Russia	1.8%	15	▲ 0.2	Balance
Viet Nam	1.3%	20	0.3	R.Exp
Brazil	1.5%	18	0.2	R.Exp

Source: Calculated using trade statistics

(2) Situation in 2019

In 2019, as presented in Table 12, the top 10 countries and their share of the trade volume are as follows: China (global share, 15.8%), the USA (14.0%), Germany (5.3%), Thailand (4.5%), Canada (3.6%), Mexico (2.9%), France (2.8%), Japan (2.7%), Spain (2.5%), and Poland (2.4%). The next top 10 countries are as follows: South Korea, Slovakia, Türkiye, Belgium, Russia, Italy, the Netherlands, Brazil, Czechia, and Vietnam. Brazil was 18th in the world, with a global share of 1.5%. The global share of the top 5, top 10, and top 20 countries was 42.2%, 56.4%, and 74.3%, respectively.

Based on the data presented in Table 12, export-oriented–type and rather export-oriented–type countries are China, Thailand, Japan, Spain, Poland, and Vietnam. Balanced-type countries are Germany, Canada, France, and Russia. Import-oriented– and rather imported-oriented–type countries are the USA and Mexico. Brazil is categorised as a rather export-oriented–type country.

(3) Situation in 2012

In 2012, as presented in Table 13, the top 10 countries and their share of the trade volume are as follows: China (global share, 15.4%), the USA (12.8%), Germany (6.2%), Canada (4.2%), Japan (4.0%), France (3.2%), South Korea (3.2%), Mexico (2.7%), Spain (2.4%), and Thailand (2.2%). The next top 10 countries are as follows: Poland, Russia, Slovakia, Brazil, Türkiye, Belgium, the UK, the Netherlands, Australia, and Italy. Brazil was 14th in the world, with a global share of 1.8%. The global share of the top 5, top 10, and top 20 countries was 42.6%, 56.3%, and 74.4%, respectively.

Table 13. GVC total of new tyres for large commercial vehicles in 2012

2012

	G.Share	Rank	GCI	Type
China	15.4%	1	1.0	Exp
USA	12.8%	2	▲ 0.3	R.Imp
Germany	6.2%	3	▲ 0.2	Balance
Canada	4.2%	4	0.1	Balance
Japan	4.0%	5	0.9	Exp
France	3.2%	6	▲ 0.0	Balance
S. Korea	3.2%	7	0.9	Exp
Mexico	2.7%	8	▲ 0.9	Imp
Spain	2.4%	9	0.4	R.Exp
Thailand	2.2%	10	0.8	Exp
Türkiye	1.8%	15	0.2	Balance
Italy	1.6%	20	▲ 0.2	R.Imp
Brazil	1.8%	14	0.1	Balance

Source: Calculated using trade statistics

Based on the data presented in Table 13, export-oriented–type and rather export-oriented–type countries are China, Japan, South Korea, Spain, and Thailand. Balanced-type countries are Germany, Canada, France, and Türkiye. Import-oriented and rather imported-oriented–type countries are the USA, Mexico, and Italy. Brazil is categorised as a balanced-type country.

3.1.2 Demand side (import)

(1) Situation in 2022

Regarding the demand side in 2022, as presented in Table 14, the top 10 countries and their global share are as follows: the USA (global share, 28.1%), Germany (6.5%), Mexico (6.0%), Canada (4.6%), France (3.2%), Netherlands (2.7%), Australia (2.7%), Belgium (2.4%), Italy (2.4%), and Brazil (2.1%). The next top 10 countries are as follows: Poland, the UK, Spain, Türkiye, the UAE, Indonesia, Sweden, Colombia, South Korea, and Chile. As described above, Brazil is 10th in the world, with a global share of 2.1%. The global share of the top 5, top 10, and top 20 countries was 48.4%, 60.7%, and 74.2%, respectively.

Table 14. GVC demand for new tyres for large commercial vehicles in 2022

	2022	
	G.Share	**Rank**
USA	28.1%	1
Germany	6.5%	2
Mexico	6.0%	3
Canada	4.6%	4
France	3.2%	5
Netherlands	2.7%	6
Australia	2.7%	7
Belgium	2.4%	8
Italy	2.4%	9
Brazil	2.1%	10
United Arab E	1.2%	15
Chile	0.9%	20
Brazil	2.1%	10

Source: Calculated using trade statistics

(2) Situation in 2019

In 2019, as presented in Table 15, the top 10 countries and their global share are as follows: the USA (global share, 21.2%), Germany (6.3%), Mexico (5.6%), Canada (4.0%), France (3.3%), the Netherlands (2.5%), Belgium (2.5%), Saudi Arabia (2.5%), Australia (2.4%), and Iran (2.3%). The next top 10 countries are as follows: Italy, Russia,

Poland, the UK, Spain, Egypt, the UAE, Türkiye, Brazil, and Sweden. Brazil was 19th in the world, with a global share of 1.2%. The global share of the top 5, top 10, and top 20 was 40.4%, 52.7%, and 69.9%, respectively.

Table 15. GVC demand for new tyres for large commercial vehicles in 2019

	2019	
	G.Share	**Rank**
USA	21.2%	1
Germany	6.3%	2
Mexico	5.6%	3
Canada	4.0%	4
France	3.3%	5
Netherlands	2.5%	6
Belgium	2.5%	7
Saudi Arabia	2.5%	8
Australia	2.4%	9
Iran	2.3%	10
Spain	1.7%	15
Sweden	1.1%	20
Brazil	1.2%	19

Source: Calculated using trade statistics

Table 16. GVC demand for new tyres for large commercial vehicles in 2012

	2012	
	G.Share	**Rank**
USA	17.6%	1
Germany	7.8%	2
Mexico	5.5%	3
Canada	4.2%	4
France	3.5%	5
Australia	3.5%	6
Saudi Arabia	3.0%	7
Russia	2.8%	8
Netherlands	2.6%	9
Belgium	2.3%	10
Türkiye	1.6%	15
Poland	1.3%	20
Brazil	1.8%	13

Source: Calculated using trade statistics

(3) Situation in 2012

In 2012, as presented in Table 16, the top 10 countries and their global share are as follows: the USA (global share, 17.6%), Germany (7.8%), Mexico (5.5%), Canada (4.2%), France (3.5%), Australia (3.5%), Saudi Arabia (3.0%), Russia (2.8%), the

Netherlands (2.6%), and Belgium (2.3%). The next top 10 countries are as follows: Italy, the UAE, Brazil, the UK, Türkiye, Spain, Egypt, Colombia, Nigeria, and Poland. Brazil was 13th in the world, with a global share of 1.8%. The global share of the top 5, top 10, and top 20 countries was 43.3%, 59.1%, and 76.7%, respectively.

3.1.2 Supply side (export)

(1) Situation in 2023

Regards Supply side in 2022, as presented in Table 17, the top 10 countries and their share are as follows: China (global share, 31.3%), Thailand (10.3%), the USA (6.3%), Germany (4.4%), Japan (4.3%), Vietnam (3.9%), Slovakia (3.5%), South Korea (3.2%), Canada (3.1%), and Poland (3.0%). The next top 10 countries are as follows: Spain, Türkiye, India, Luxembourg, Brazil, Czechia, France, Romania, Italy, and Belgium. Brazil was 15th in the world, with a global share of 1.7%. The global share of the top 5, top 10, and top 20 countries was 56.5%, 73.1%, and 91.7%, respectively.

Table 17. GVC supply of new tyres for large commercial vehicles in 2022

	2022	
	G.Share	**Rank**
China	31.3%	1
Thailand	10.3%	2
USA	6.3%	3
Germany	4.4%	4
Japan	4.3%	5
Viet Nam	3.9%	6
Slovakia	3.5%	7
S. Korea	3.2%	8
Canada	3.1%	9
Poland	3.0%	10
Brazil	1.7%	15
Belgium	1.2%	20
Brazil	1.7%	15

Source: Calculated using trade statistics

(2) Situation in 2019

In 2019, as presented in Table 18, the top 10 countries and their global share are as follows: China (global share, 30.5%), Thailand (8.2%), the USA (7.2%), Germany (4.4%), Japan (4.4%), Slovakia (3.8%), South Korea (8.7%), Canada (3.3%), Spain (3.2%), and Poland (2.9%). The next top 10 countries are as follows: Türkiye, France, India, Czechia, Luxembourg, Brazil Hungary, Vietnam, Russia, and Belgium. Brazil was 16th in the world, with a global share of 1.8%. The global share of the top 5, top 10, and top 20

countries was 54.7%, 71.5%, and 90.1%, respectively.

Table 18. GVC supply of new tyres for large commercial vehicles in 2019

	2019	
	G.Share	**Rank**
China	30.5%	1
Thailand	8.2%	2
USA	7.2%	3
Germany	4.4%	4
Japan	4.4%	5
Slovakia	3.8%	6
S. Korea	3.6%	7
Canada	3.3%	8
Spain	3.2%	9
Poland	2.9%	10
Luxembourg	1.8%	15
Belgium	1.3%	20
Brazil	1.8%	16

Source: Calculated using trade statistics

(3) Situation in 2012

In 2012, as presented in Table 19, the top 10 countries and their global share are as follows: China (global share, 28.4%), the USA (8.6%), Japan (6.9%), South Korea (5.5%), Germany (4.9%), Canada (4.3%), Thailand (3.7%), Spain (3.2%), Slovakia (3.1%), and France (3.0%). The next top 10 countries are as follows: Poland, India, Türkiye, Brazil, the UK, Czechia, Luxembourg, Belgium, Russia, and Italy. Brazil was 14th in the world, with a global share of 1.8%. The global share of the top 5, top 10, and top 20 countries was 54.3%, 71.5%, and 89.3%, respectively.

Table 19. GVC supply of new tyres for large commercial vehicles in 2022

	2012	
	G.Share	**Rank**
China	28.4%	1
USA	8.6%	2
Japan	6.9%	3
S. Korea	5.5%	4
Germany	4.9%	5
Canada	4.3%	6
Thailand	3.7%	7
Spain	3.2%	8
Slovakia	3.1%	9
France	3.0%	10
UK	1.8%	15
Italy	1.1%	20
Brazil	1.8%	14

Source: Calculated using trade statistics

4. Discussion

4.1 Behaviour model of the GVC type shift

Figure 1 shows the transition model of a GVC type. Although the GVC behaviours may differ in every country based on various conditions, this study virtually simplified a situation. In the beginning, a country underdeveloped in industries concerning certain goods should import all goods from abroad. At this time, the country has no choice but to import such goods. In such situations, the GCI value is -1. Some countries may establish such industries that are underdeveloped in other countries. Consequently, these countries domestically procure manufactured goods and reduce imports. As the industry grows, the countries may start exporting these goods. In this phase, the GCI value gradually increases from -1. In the initial stages, such a country may be categorised as an import-oriented type; in later stages, it may be categorised as a rather import-oriented type.

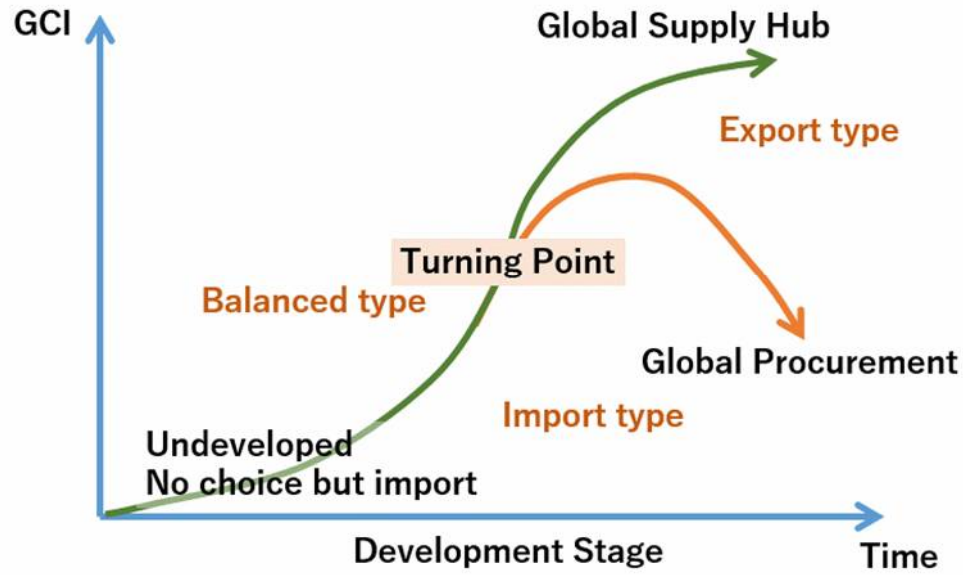

Figure 1. Behaviour Model of the GVC.
Source: Author

As the industry grows, the country may be categorised as a balanced type. Here, the import and export of these goods are approximately the same. This is the time of a turning point for such a country. The strategic decisions made by a country affect future directivity. In cases where a country decides to develop a particular industry and increase its exports, the GVC type of that country shifts to a rather export-oriented or an export-oriented type. In this case, the country can become a global supply hub of manufactured goods. In another case, the country may allocate the recourses to the production of other goods rather than importing those goods owing to reduced costs. The country may focus

on high value–added series production domestically and may import lower value–added series into their market. Occasionally, the country may decide to transfer the technology or a factory producing such goods overseas. This results in the reduction of the GCI value. In this case, the country can be categorised as a global procurement type. Of course, this may also happen in balanced-type countries.

4.2 Possibility to change the rank to achieve high global shares

Generally, we are prone to believe that the present situation continues. When strong competitors occupy high shares, we are prone to think it is rare to exceed Gulliver. Here, this study verified the possibility of increasing a country's rank to the top in the GVC of new tyres. The case of increasing the exports of a country to be transformed into a global supply hub was considered. This study focused on the country's rank of the supply GVC from 2012 to 2022.

Table 20 shows a change in the country's rank in the tyre supply GVC for motor cars. In 2022, the global share of the top 5, top 10, and top 20 countries was 39.7%, 58.4%, and 84.5%, respectively. The top 5 countries in 2022, that is, China, Germany, Thailand, South Korea, and Japan, had the same ranks in 2019. Based on this result, the author thought that it is difficult to cross the Gulliver.

Table 20. Change in the country's rank in the tyre supply GVC for motor cars

	2022	2019	2012
China	1	1	1
Germany	2	2	2
Thailand	3	3	7
South Korea	4	4	4
Japan	5	5	3
Romania	6	11	16
Poland	7	9	11
Hungary	8	12	12
Netherlands	9	6	8
Mexico	10	15	19
Portugal	15	16	15
Belgium	20	22	20
Brazil	25	28	25

Source: Calculated by the author

When the viewpoint in the 10-year term was evaluated, another scenario can be

observed. Thailand was 3rd in 2022, raising her position from 7th in 2012. Several countries demonstrated a raise in their global ranks. Romania was 6th in 2022, raising from 16th in 2012. Poland raised its rank from 11th to 7th in 2022. Hungary raised its rank from 12th to 8th in 2022. Mexico raised its rank from 19th to 10th in 2022. Thailand reached the top 3, and Romania, Poland, Hungary, and Mexico reached the top 10.

Table 21 presents the change in the country's rank in the tyre supply GVC for large commercial vehicles. The top 5 countries in 2022 were China, Thailand, the USA, Germany, and Japan. The ranks of these countries were exactly the same as those in 2019. In the 10-year period, Thailand raised its rank from 7th to 2nd in 2022. Furthermore, Vietnam raised its rank to 6th from 25th in 2022. Poland raised its rank to 10th from 11th in 2022. Thailand raised its rank again, as shown in the tyre supply GVC for motor cars. Vietnam significantly raised its rank from 2012 to 2022.

Based on the data presented here, countries may increase their rank from a lower rank overtime

Table 21. Change in the country's rank in the tyre supply GVC for large commercial vehicles

	2022	2019	2012
China	1	1	1
Thailand	2	2	7
USA	3	3	2
Germany	4	4	5
Japan	5	5	3
Viet Nam	6	18	25
Slovakia	7	6	9
South Korea	8	7	4
Canada	9	8	6
Poland	10	10	11
Brazil	15	16	14
Belgium	20	20	18
Brazil	15	16	14

Source: Calculated by the author

4.3 Factors influencing the increase in international competitiveness

Several factors must be considered when a country aims to become a global supply hub. First, manufacturers should have the ability to produce competitive tyres. In general, the factors of competitive tyres include the price, quality, durability, supply ability,

dependability, and balance. Second, manufacturers should have the capacity to produce large volumes of tyres to satisfy the large global demand, indicating the need for a large investment. This study assessed whether Brazil can satisfy the factors required to become a global supply hub.

4.3.1 GVC route and potential market

(1) Tyres for motor cars

In 2022, Brazil imported and exported 549 million and 522 US dollars (USD) worth of new tyres for motor cars. Brazil primarily imported from China (66%), Vietnam (5%), India (3%), and Indonesia (2%). Figure 2 shows the export partners of new tyres for motor cars from Brazil in 2022. As shown in Figure 2, Brazil exported almost half the volume to the USA (45%) and the remaining to Latin American countries such as Argentina (18%), Mexico (12%), and Colombia (5%).

Brazil imported primarily from Asian countries and exported to USA and Latin American countries.

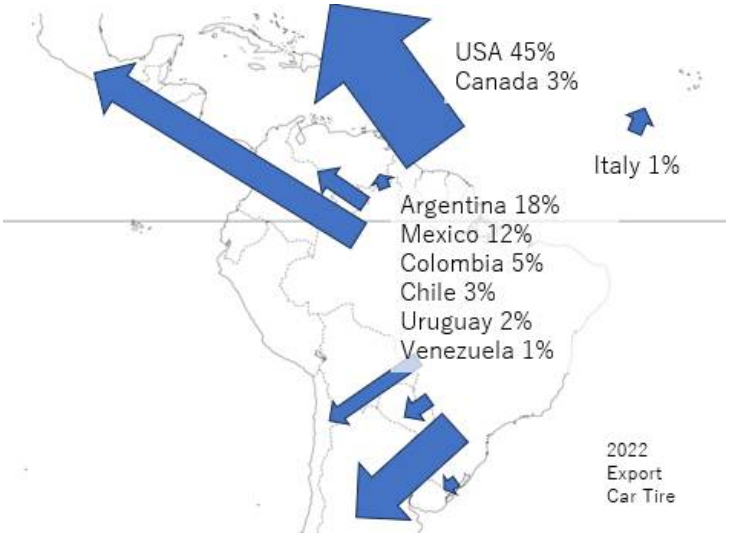

Figure 2. Export of new tyres for motor cars from Brazil in 2022.
Source: Author

(2) Tyres for large commercial vehicles

In 2022, Brazil imported and exported 593 and 485 million USD worth of new tyres for large commercial vehicles, respectively, Brazil primarily imported from Asian countries such as Vietnam (29%), China (21%), India (16%), Malaysia (14%), Japan (6%), and Thailand (3%). Figure 3 shows the export partners of Brazil for new tyres for large

commercial vehicles in 2022. As shown in Figure 3, Brazil exported more than 60% of new tyres to Latin American countries such as Argentina (24%), Mexico (15%), Colombia (9%), Chile (5%), Uruguay (2%), Peru (2%), and Ecuador (1%). Brazil also exported to the USA (31%), similar to the export rates of new tyres for motor cars.

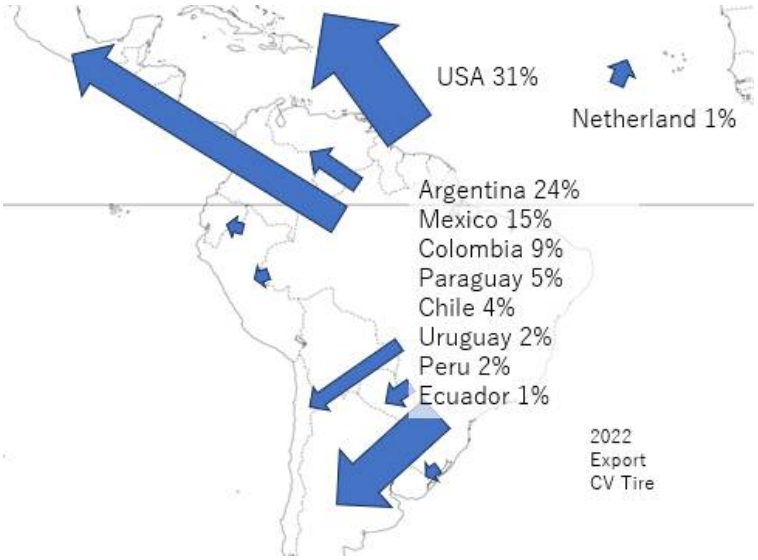

Figure 3. Export of new tyres for large commercial vehicles from Brazil in 2022.
Source: Author

(3) Changes in Brazil's import and export rates

For cars and commercial vehicles, the behaviour of import and export rates of Brazil are similar. Brazil imported from Asian countries and exported to the USA and Latin America. It appears that Brazil imported from far-away countries that are almost on the other side of the globe, such as China, Vietnam, India, or Indonesia. Although a definitive explanation for this long-distance tyre import is not known, a similar scenario can be observed in terms of the export of other automobile parts. said the major reason is the cost, as it was cheaper to import than manufacturing the product domestically. Based on this, when Brazilian tyres become more efficient than those manufactured by Asian countries, these countries may import tyres from Brazil, resulting in a long-distance import.

(4) Potential market

Many countries exported tyres to Brazil. This means that there is potential for developing a new tyre market worth 1.14 billion USD in Brazil. Furthermore, 2.3 million units of new cars were produced in 2023, reaching a global 9th rank. As of 2021, 46 million units of automobiles were used in Brazil. This indicates a large demand for tyres in Brazil.

The agriculture industry of Brazil is highly efficient., along with a flourishing mining industry. Brazil has a vast territory and several miles of road. Therefore, the long-distance transportation of commodities and working personnel is highly usual in Brazil.

There are several segments, grade, type, and price in terms of tyre demand in Brazil. Manufacturers, distributors, users, and the government may choose to import or use domestically fabricate tyres. In any case, there exists a large, world-class tyre demand in Brazil.

4.3.2 Players, humans, and technology

(1) Tyre manufacturers in Brazil

This study considered that tyre manufacturers in Brazil have a potential ability to satisfy the factors mentioned above. There are several competitive tyre manufacturers worldwide. In 2021, the global top 5 tyre manufacturers and their market share are as follows: Michelin (14.8%), Bridgestone (12.5%), Goodyear (8.4%), Continental (6.8%), and Sumitomo Rubber (4.1%). All these companies are global manufacturers. The headquarter of Michelin is in France since 1863. Bridgestone is in Japan since 1830. Good Year is in the USA since 1898. Continental is in Germany since 1871. Sumitomo Rubber is in Japan. Dunlop of the UK started tyre production in Japan in 1909, and this is origin of Sumitomo Rubber.

All these top 5 companies already produce tyres in Brazil. Michelin have produced tyres since 1927 in Brazil. Bridgestone bought Firestone in 1988. Firestone started tyre production in Brazil in 1939. Goodyear established the Americana plant in Brazil in 1971. Continental established a tyre factory in Brazil in 2006. Sumitomo Rubber started their tyre production in Brazil in 2013.

These global manufacturers already have the potential to produce good-quality products and supply channels. An important research subject is to conduct an additional investment such as the market growth, policy merit, and future potential profit of these companies.

(2) Labor potential in Brazil

When tyre manufactures wish to increase investment to expand the production, they need a certain number of skilled labourers. The population of Brazil in 2022 was 215 million, the 7th largest in the world. The education regarding industry is good in Brazil. There are several universities with engineering departments and technical training facilities such as SENAI. It is not difficult to hire human resources needed for a new investment. When companies wish to become a supply hub, the R&D facilities are also

important. There exists a tyre R&D facility in Brazil: the South America Proving Ground of Bridgestone. They have 10 development-centres in the world: China, Italy, Thailand, Indonesia, Japan, the USA (Ohio and Texas), Mexico, and Brazil. This indicates that this company sees a potential in Brazil. When manufacturers set up or expand their R&D facilities, they need human resources with higher education compared with those required at production sites. There are many graduate schools of engineering in Brazil, which have the ability to provide human resources with higher education in Brazil.

(3) Possibility of domestic mould procurement

To produce tyres, moulds are absolutely necessary. When only commercial production is considered, the domestic supply of moulds is not necessary. Once new moulds are developed, we can use them for several years with a proper maintenance. As we consider developing new tyre products based on changes in the demand, the ability to domestically supply good-quality moulds becomes important. Currently, to the best of the author's knowledge, Brazil mainly imports moulds for tyre moulding.

Delicate and advanced technologies are needed to produce moulds of good quality. Furthermore, a large investment is needed to fabricate good-quality tyre moulds. Only facilities are insufficient. There is also a need for highly skilled human resources. Is it possible to set up a domestic supply system of tyre moulds in Brazil? Several studies have been investigated the scope of mould industry in Brazil (Baba, 2021; Baba, 2018). There are good mould industrial clusters in Brazil such as Joinville, Caxias do Sul and Sao Paulo. Brazil has sufficient technical knowledge to set up a new production site for tyre moulds in Brazil. There is a need for suitable technologies for making tyre moulds. In general, it is difficult to find a suitable provider for technologies or for an investment. In the case of Brazil, global tyre OEMs already exist and deal with tyre mould manufacturers, having in-house tyre mould productive sections. If tyre OEMs consider it is reasonable to procure tyre moulds domestically, then they should be powerful allies. To start the production of tyre moulds domestically, there are some issues to be considered, such as the profitability of mould manufacturers, quality, competitive price comparing imports, and competitive delivery time.

(4) Industrial policy

It is important for a country to express a clear political direction for making strategic decisions in the private sector. Suitable supports strongly push their positive decision. Generally speaking, there is a good demand in Brazil but Brazil's 'cost issue (Brazil Cost)' prevents domestic procurement. There are measures to support them. To

reduce the initial investment cost, reducing the tariff for manufacturers when they adapt to the national direction can be considered. Redacting the income tax for a fixed period when they invest more than a certain amount will be also effective. A policy of reducing the tariff would be effective for manufacturers producing strategic products with competitive prices. There are many effective methods that the government could consider to increase the result of ROTA2030.

5. Conclusion

In this study, the scope of the tyre business in Brazil was considered based on the survey of the GVC. From the GVC analysis, the following conclusions were drawn:

According to the total GVC analysis of car tyres, the ranks of Brazil are as follows: 24th in 2022, 26th in 2019, and 23rd in 2012. Regarding the tyres for large commercial vehicles, the ranks are 16th in 2022, 18th in 2019, and 14th in 2012. The results indicate that Brazil is in the turning point to decide whether to be an export-type, import-type or a balanced-type country.

In the case where Brazil aims be an export-type country and become a global tyre supply hub, this study focussed on the supply side of the GVC. In the supply GVC, the ranks of Brazil are 25th in 2022, 28th in 2019, and 25th in 2012. Those for large commercial vehicles are 15th in 2022, 16th in 2019, and 14th in 2012. The ranks of supply GVC are as similar to those of the total GVC. The global share of Brazil in car tyre export was 1.2% in 2012 and that for commercial vehicles was 1.7%. As a global tyre supplier, Brazil does not have a significant presence at present. According to the further analysis of the supply chain, the author found that Brazil is a regional tyre supplier for Latin America and the USA.

The study considered the possibility of Brazil having a higher presence as a global tyre supplier. Regarding the possibility to raise the global rank to the top, according to the analysis of recent behaviour of other countries, the author found that it is possible. In the case of the rank of car tyre suppliers, Thailand raised its rank from 7th in 2012 to 3rd in 2022. Romania raised its rank from 16th in 2012 to 6th in 2022. Mexico raised its rank from 19th in 2012 to 10th in 2022. Regarding the ranks of tyre supply for commercial vehicles, Thailand raised its rank from 7th in 2012 to 2nd in 2022, and Vietnam raised it from 25th in 2012 to 6th in 2022. The author found that Brazil can raise its rank to be within top 10. Furthermore, being within the top 5 is quite possible if the tyre industry in Brazil develops well and if the manufactured products obtain a favourable global competitiveness.

Finally, this study considered the requirements to develop the Brazilian tyre industry. Regarding potential domestic tyre market, Brazil already has a good demand.

Global tyre manufacturers are already present in Brazil, with some companies already establishing R&D facilities. Brazil's human resources and potential technologies are good. Although Brazil imports moulds for tyre production, it is possible to increase the number of domestic suppliers. The main obstacle disrupting the global competitiveness is the high-cost factor. With good support from the government and efforts from the private sector, the author believes it is possible to overcome this issue. Brazil has a good potential to become a world-class tyre supplier.

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