
Developing Model of Auto Parts in Emerging Economies: Comparative Analysis of the International Competitiveness of Auto Parts in Mexico, Brazil and India from 1990 to 2014.

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Abstract: The aim of this study is to consider “How is the international competitiveness of auto-parts in this progress of Auto-industry in Mexico, Brazil and India?” and “Is the correlation for developing economies between auto industry and its parts industry positive or negative?” The development model of auto parts in emerging economies is used to consider these research questions. There are two types of development paths: the “Leaped model” is where the correlation between the progress of the auto industry and the strength of international competitiveness of auto parts is positive, while the “Dilemma model” is where the correlation is negative. In order to express the international competitiveness of auto parts the “Global Competitiveness Index” (GCI) is calculated from trade statistics data extracted from UN Comtrade trade database. The analysis reveals that in Mexico and India the international competitiveness of auto parts seems to be improving in recent years while in Brazil it seems not to be improving. In addition the correlation of Mexico from 1996 until 2014 is positive and that of India from 2009 until 2014 is positive. Mexico and India might be fit the “Leaped model” in recent years. In the case of Brazil, both in the long term and in recent time the correlation shown is negative. Brazil might fit the “Dilemma model”. This study provides some initial fact findings, which could be further explored in the future. Why these facts occur could be explored by undertaking interviews with automobile manufacturers or auto parts manufacturers in those countries.

Keywords: The international competitiveness of auto parts, the development model of auto parts in emerging economies,

1. Introduction: Purpose and back ground of this research

It is important for emerging countries of automobile production that reconstruction of the value chain of auto parts for both production and R&D occurs. Without accurate auto parts being designed well automobiles might fail to meet expectations of shape, performance and durability. Without good auto parts manufacturers with the ability to produce trial products of auto parts as designer's ideas are explored in R&D in time, they might face difficulty in enhancing ideas to improve new types of automobile or to complete a design in short time (e.g. Fujimoto 2013, Baba 2013). This study will discuss the transition of international competitiveness of auto parts in Mexico, Brazil and India between 1990 and 2014 based on the developing model of auto parts (Baba 2015a).

The discussion seeks to address two research questions: "How is the international competitiveness of Auto-parts in this progress of Auto-industry in Mexico, Brazil and India?" and "Is the correlation for developing economies between Auto-industry and Auto-parts industry positive or negative?"

Mexico, Brazil and India are countries of emerging auto industry. The production of automobiles in 2014, Mexico was 3,368,010 (7th in the world), Brazil was 3,146,386 (8th), India was 3, 844,857 (6th). In 2000, Mexico was 1,935,527 (9th), Brazil was 1,681,517 (12th), and India was 801,360 (15th) (OICA).

2. The developing model of auto parts in emerging economies

The development model of international competitiveness of auto parts in emerging economies, suggested by the author, is shown in Fig1. The horizontal axis is time that is alternative valuable of the growth of auto industry. The vertical axis is the international competitiveness of auto parts which can be weak or strong. Two types of paths of international competitiveness of auto-parts are suggested as representing how the auto industry has been developing. At the first stage the international competitiveness of auto-parts is considered to be quite weak in developing countries. Then gradually the international competitiveness had been increasing. When this goes smoothly and the tendency of the direction of competitiveness of auto parts goes upwards this can be called, the "Leaped Development Model" or "Fortitude" type as shown in Fig 1. In this type, the correlation between the time and competitiveness of auto parts is positive. If the automobile industry were compared to the outside of a human body, the auto parts industry could be considered to be the muscle or internal organs. The progress of the automobile industry shows appearance of a strong body and the progress of the auto parts industry shows strong muscle and good health. In this type, the more the appearance becomes stronger, the more the muscle and internal organs become stronger. It can be considered to be the 'fortitude'

type. The other type, can be called the “Development Dilemma Model” or “Paper tiger” type. In this type as the automobile industry grows, the competitiveness of auto parts decreases. The correlation between time and competitiveness of auto parts is negative. In order to produce automobiles of good quality at the same level as the world standard, they should import auto parts of good quality. In this type, the more the appearance becomes stronger, the more the muscle and internal organs become weaker. The paper tiger appears strong on the outside, but inside there is no muscle or internal organs, only air.

Development model of auto-parts in emerging economies

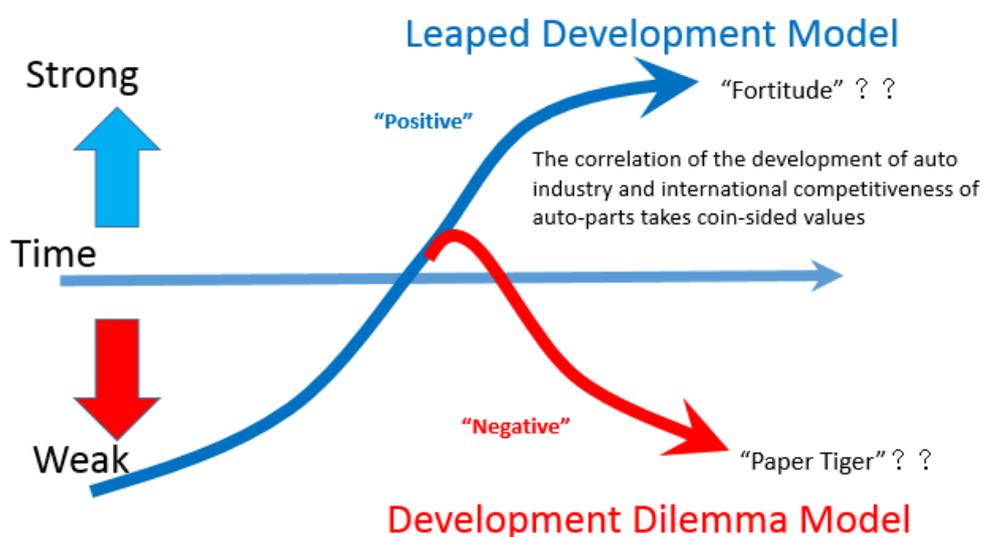


Fig 1. Development model of auto parts in emerging economies

3. Analysis: Method and Data

The variable used to verify this model is the “Global Competitiveness Index” (GCI) which indicates the international competitiveness of auto parts. The GCI is the same as the Trade specialization coefficient. The term “GCI” is used because it is thought to be more suitable to express the international competitiveness (Baba 2015b). The formula of GCI is as follows. $GCI = (Export - Import) / (Export + Import)$. The GCI ranges from -1 to 1, with values close to 1 indicating strong international competitiveness and close to -1 indicating weak international competitiveness. These GCI values are categorized from “very weak” to “very strong” as shown in table 1. The trade statistics are extracted from the data base of UN Comtrade.

Analyzing GCI, the author uses trade statistics of HS (Harmonized Commodity Description and Coding System, date). The model was verified and tested using HS8708 which is representative of auto-parts and includes items such as bumpers, seat belts, body

parts, brakes, gear boxes, driving-axles, wheels, suspensions, radiators, exhaust pipes, clutches, steering wheels, airbags and other miscellaneous auto parts. The countries are Mexico, Brazil, and India. Korea is used as a reference because the Korean automobile industry is well known as being successful in developing the quality of automobile and the progress of auto parts industry between 1980s and today.

Table 1. International Competitiveness of each GCI values

Value of GCI	International competitiveness	Situation of import / export
Over 0.75	Very Strong	Most of the applicable items are for export, and there are very few imports.
0.50 ~ 0.74	Strong	Many of the applicable items are for export, and there are few imports.
0.10 ~ 0.49	Slightly Strong	There are comparatively more exports.
-0.09 ~ 0.09	Moderate	Exports and imports are almost the same.
-0.10 ~ -0.49	Slightly Weak	There are comparatively more imports.
-0.50 ~ -0.74	Weak	Many of the applicable items are imports, and there are few exports.
Below -0.75	Very Weak	Most of the applicable items are for import, and there are very few exports.

4. Results

The results are shown in Fig 2. The GCI of Korean auto parts was -0.37 (slightly weak) in 1992 and increased to become 0.75 (very strong) in 2014. In the long term from 1992 until 2014, the correlation between the progress of automobile industry and the international competitiveness of auto parts is positive. The slope of Korean regression line is 0.053 in which X is the year and Y is the GCI. The development of Korean auto parts can thus be categorized as the “Leaped model”.

The GCI of Mexican auto parts was 0.30 (slightly strong) in 1992 and decreased to -0.34 (slightly weak) in 1996. In this term, the slope of Mexican regression line is -0.18. The correlation was negative. At that moment, Mexico was thought to fall into the “Dilemma model”. After that, the GCI of Mexico has gradually increased to 0.00 (moderate) in 2014. From 1996 until 2014, the slope of Mexican approximate line was 0.02. The correlation is positive. Though Mexico had fallen into the “Dilemma model”, recently it is can be considered to have changed to the “Leaped model”.

The GCI of Indian auto parts was -0.21 (slightly weak) in 1992. Then it increased to become 0.20 (slightly strong) in 2001. After the middle of 2000’s it reduced to -0.29 (slightly weak) in 2009. This might have been caused by the Lehman shock. After 2009, it had a tendency to increase and the GCI became 0.05 (moderate) in 2014. The slope of Indian regression line from 1992 to 2014 is 0.01 and from 1992 until 2001 it is 0.03. From 2006 until 2009 it is -0.15 and from 2009 until 2014, it is 0.07 and the correlation is positive.

Though it is difficult to categorize the Indian case, it might be categorized as the “Leaped model” from the long term view.

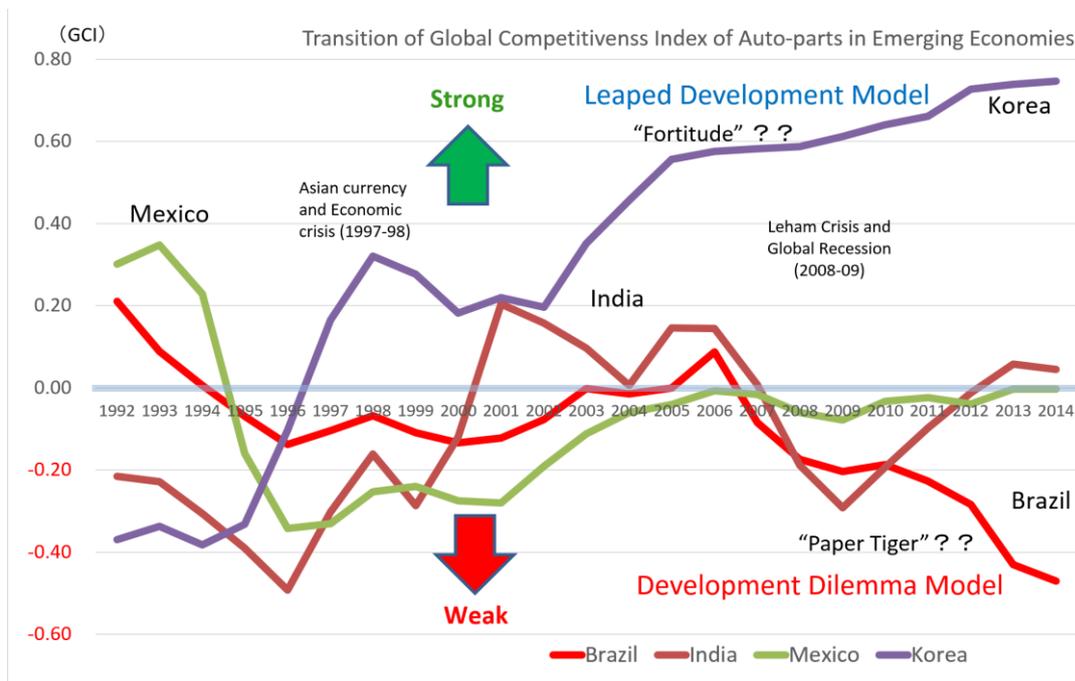


Fig 2. Transition of GCI of Auto parts in India, Mexico, Brazil and Korea

The GCI of Brazilian auto parts was 0.21 (slightly strong) as of 1992. Then it reduced to -0.14 (slightly weak) in 1996. Though until 2006 it had gradually increased to 0.09 (moderate), it turned downwards to -0.47 (slightly week) in 2014. In the long term from 1992 until 2014 the slope of the Brazilian regression line is -0.02 and the correlation is negative. Recently from 2006 until 2014 the slope is -0.06 and the correlation is negative. It seems that the growth pattern of the Brazilian auto parts competitiveness fitted the “dilemma model” both in recent short term and also long term.

The analysis for research question two “Is correlation for developing economies between auto industry and its parts industry is positive or negative?” can be summarized as follows. The Korean correlation between the progresses of auto industry and international competitiveness of auto parts is positive from 1992 until 2014, Korea is obviously fitted to “leaped model.” The correlation of Mexico from 1996 until 2014 is positive and that of India from 2009 until 2014 is positive. Mexico and India might fit the “leaped model” in recent years. In the case of Brazil, both in long term and in recent times the correlation is negative and thus Brazil might be considered to fit the “dilemma model”.

5. The change of competitiveness of each auto parts

In order to observe more detail the change of international competitiveness between 1990 and 2014 in each auto parts is analyzed and shown in table 2. The image of results is shown in fig 3. Dark grey means that there are more than five items in that category. Light grey means there are more than three but less than five items in that category. White means there are less than 3 items in that category.

It is obvious that the tendency of international competitiveness of Mexican and Indian auto parts became stronger from 1990 to 2014. The international competitiveness of Brazilian auto parts became weaker between 1990 and 2014.

Table 2. HS codes of each auto parts and the difficulty of technology learning

HS Codes	items	Technology*
4011	Tires	Eay → Difficult
401110	Of passenger cars	-
401120	Of buses or lorries	-
401110+20	Tires for automobiles	-
6813	Friction Material	Difficult
7320	Springs	Moderate
8407	Gasoline Engines	Difficult
8408	Diesel Engines	Difficult
8409	Engine Parts	Difficult
8415	Air Conditioners	Easy
841520	Of automobiles	-
8511	Ignitions/Starters	Easy
8512	Lights/Wipers	Easy
8527	Radios	Easy
8706	Chassis	Moderate
8707	Bodies	Moderate
8708	General auto parts	

HS Codes	items	Technology*
870810	Bumpers	Moderate
870821	Seat Belts	Easy
870829	Body Parts	Moderate
870830	Brakes	Easy
870840	Gear Boxes	Difficult
870850	Driving Axles	Difficult
870870	Wheels	Moderate
870880	Suspensions	Moderate
870891	Radiators	Easy
870892	Exhaust Pipes	Easy
870893	Clutches	Moderate
870894	Steering Wheels	Moderate
870895	Airbags	Easy
870899	Others	

* "Technology" means the defficulty of technology transfer or technology leaning.

GCI	Below - 0.75	-0.50~ - 0.74	-0.10~ - 0.49	-0.09~ 0.09	0.10~ 0.49	0.50~ 0.74	Over 0.75
International Competitiveness	Very Weak	Weak	Slightly Weak	Moderate	Slightly Strong	Strong	Very Strong
Mexico (1990)							
Mexico (2014)							
Brazil (1990)							
Brazil (2014)							
India (1990)							
India (2014)							

Fig 3 Image of Transition of international competitiveness of Auto parts in Mexico, Brazil and India between 1990 and 2014

6. Which auto parts became stronger and weaker?

6.1 Mexico

Table 3 shows international competitiveness of each auto parts in 1990 and in 2014. In 2014, Strong auto parts which include the category of “very strong” and “strong” of Mexico is seat belts. Seat belts are categorized to the group of rather easy to learn technology as shown in table 2. In the developing stage, auto parts are categorized in the group of easy to learn are thought to be easy to raise international competitiveness. From this point of view, this strong positioning of seat belts in Mexico is an acceptable result. Now, many auto parts including difficult type of parts, categorize more than moderate. Only Chassis and tires remain in the weak category. Though there still remains some auto parts categorized below rather weak in Mexico, the international competitiveness of Mexican auto parts today has obviously improved compared to that of 1990.

6.2 Brazil

Table 3 shows that in 1992 many auto parts including difficult type as shown in table 2, were categorized more than moderate. In Brazil, the policy of nationalization of producing automobiles was practiced (Baba 2015). Though they produced automobiles in Brazil, technology trend was behind the trend in world technology at that time. In 2000’s many automobile manufactures invested in new lines or newly arriving in Brazil such as Hyundai in the context of the economic development of BRICs. As new type of cars are

assembled in Brazil, they need new types of auto parts. Though the existing auto parts manufacturers have wanted to learn new technologies, they have suffered from “Brazilian cost” which means the high production cost peculiar in Brazil and high lending interest in order to buy new machines according to my field study in Brazil 2015. Though Hyundai is famous for importing many parts from Korea, other automobile manufacturers also import auto parts from other countries such as Japan, China, Korea, Thailand, German, USA or France. At the same time because of the cost and quality and economic downturn of Argentina which is major country of Mercosur, and major auto parts importer from Brazil, Brazilian auto parts manufacturers have suffered from increased exporting. Now in 2014 as shown in table 3, many auto parts are categorized below slightly weak. Though Brazil is practicing “Brazil’s Inovar-auto Incentive Program” from 2012 in order to grow domestic automobile industry, it seems not to have affected Brazilian auto parts industry as well.

Table 3. The international competitiveness of each auto parts in Mexico, Brazil and India, 1990 and 2014

GCI	Below -0.75	-0.50~-0.74	-0.10~-0.49	-0.09~-0.09	0.10~0.49	0.50~0.74	Over 0.75
International Competitiveness	Very Weak	Weak	Slightly Weak	Moderate	Slightly Strong	Strong	Very Strong
Mexico (1990)	Lights/Wipers, Seat Belts, Gear Boxes,	Tires, Friction Material, Diesel Engines, Ignitions/Starters, Wheels, Suspensions, Clutches,	Engine Parts, Exhaust Pipes, Steering Wheels, Others,	Radiators,	Springs, Bodies, Bumpers, Body Parts, Driving-Axles,	-	Gasoline Engines, Chassis,
Mexico (2014)	Chassis,	Tires,	Friction Material, Diesel Engines, Gear Boxes, Suspensions, Radiators, Exhaust Pipes, Clutches,	Springs, Engine Parts, Ignitions/Starters, Bumpers, Body Parts, Brakes, Wheels, Steering Wheels,	Gasoline Engines, Air Conditioners, Lights/Wipers, Bodies, Driving-Axles, Airbags, Others,	Seat Belts,	-
Brazil (1990)	Seat Belts,	-	Springs, Ignitions/Starters, Gear Boxes, Radiators,	-	Driving-Axles, Friction Material, Engine Parts, Body Parts, Exhaust Pipes, Clutches, Steering Wheels, Others,	Tires, Gasoline Engines, Diesel Engines, Lights/Wipers,	Chassis, Bodies, Bumpers, Wheels, Suspensions,
Brazil (2014)	-	Diesel Engines, Body Parts, Gear Boxes, Exhaust Pipes, Steering Wheels, Airbags,	Springs, Gasoline Engines, Air Conditioners, Ignitions/Starters, Lights/Wipers, Bumpers, Seat Belts, Brakes, Driving-Axles, Wheels, Suspensions, Radiators, Others,	Tires, Engine Parts, Clutches,	Friction Material,	Bodies,	Chassis,
India (1990)	Bumpers, Seat Belts, Exhaust Pipes, Steering Wheels,	Friction Material, Ignitions/Starters, Driving-Axles,	Springs, Engine Parts, Body Parts, Gear Boxes, Clutches, Others,	-	Gasoline Engines, Suspensions,	Lights/Wipers, Bodies, Wheels, Radiators,	Tires, Diesel Engines, Chassis,
India (2014)	Air Conditioners, Airbags,	Bodies, Body Parts, Steering Wheels,	Springs, Diesel Engines, Lights/Wipers, Gear Boxes, Wheels, Exhaust Pipes, Clutches,	Ignitions/Starters, Seat Belts, Brakes, Driving-Axles,	Tires, Friction Material, Gasoline Engines, Engine Parts, Suspensions, Radiators, Others,	Bumpers,	Chassis,

Note: Not in 1990 (Air Conditioners, Brakes, Airbag)

6.3 India

India has a long history of producing automobiles, practicing automobile nationalization policy until early 1990's from 1940s (Baba 2011). In 1990 many auto parts such as diesel engines, chassis, bodies, gasoline engines, and suspensions are categorized more than slightly strong. Though they could produce many auto parts in India in 1990, the technologies were behind the world trend at that time. As the Indian economy developed, many automobile manufacturers invested in new lines to produce new type of cars. At the first stage in those new lines, though auto manufactures should import many auto parts of new good quality, gradually domestic auto parts manufactures or newly coming foreign auto parts manufactures have been able to supply new type of auto parts. Historically, India treated auto parts manufacturers and SMEs very well. They could borrow money at a premium interest rate, especially for SMEs. India is practicing their "Automotive mission plan 2006-2016" in order to grow the automobile and auto parts industry. Though it is not going exactly according to plan, it seems to achieve an effect to some extent. As shown in table 3, though many auto parts were categorized below slightly weak in 1990, it has shifted to the range from slightly weak to slightly strong.

7. Conclusion

This paper has considered two research questions, "How is the international competitiveness of auto-parts in this progress of Auto-industry in Mexico, Brazil and India?" and "Is correlation for developing economies between auto industry and its parts industry is positive or negative?"

The answer to the latter question is shown in "4. Results". The Korean correlation between the progress of the automobile industry and international competitiveness of auto parts is positive from 1992 until 2014 and Korea obviously fits the "leaped model." The correlation of Mexico from 1996 until 2014 is positive and that of India from 2009 until 2014 is positive. Mexico and India might be fit the "leaped model" recently. In the case of Brazil, both in the long term and in recent time the correlation shown is negative. Brazil might fit the "dilemma model".

The answer to the former research question of "How is the international competitiveness of auto-parts in this progress of Auto-industry in Mexico, Brazil and India?" is in "5. The change of competitiveness of each auto parts" and "6. What auto parts did they become stronger and weaker?" In Mexico and India the international competitiveness of auto parts seems to be successfully improving recently while in Brazil it seems not to be improving.

This study provides some initial findings, which could be further explored in the

future. Why these facts occur could be explored by undertaking interviews with automobile manufacturers or auto parts manufacturers in those countries. It would also be helpful to explore and verify the relationship between the Investment policy and progress of auto parts manufacturers using empirical method such as TFP of auto industry.

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