THE APPLICATION OF TECHNICAL COMPARATIVE ADVANTAGE INDEX TO OBSERVE THE FUTURE EFFECT OF PASSENGER CAR TIRES MANDATORY STANDARD IN INDONESIA

THESIS

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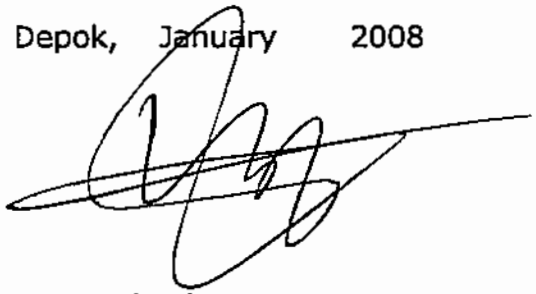

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FOREWORD

International trade may give benefits and threats to the countries. The global competition is very tough that every country will try to survive in the competition. Some will try to gain benefits from the consumer unawareness. Therefore the standardization is important in the global market. The standardization may give certain effects to the industry and to the market. This thesis will try to offer a tool to predict the future effect of the mandatory standard implementation to the domestic industry. Hopefully this thesis would be useful and inspiring for other people.

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I. INTRODUCTION

One way to enhance the welfare of the world is by doing the International Trade. The external trade is very important to expand the market for the product of the domestic industries. By expanding the market, the international trade will enhance the efficiency of industry so that the industry can reach closer to the economies of scale. If the industry can enhance the efficiency, then the cost of production will be lower and the price of the products will be cheaper, therefore the welfare of the society in a nation will increase.

Despite of the benefits gained, external trade may also give negative effect. The international trade may cause injury to the domestic industry if the domestic industry cannot compete with the imported product. If the domestic industry cannot produce with lower cost, then the price of the domestic product will be high and it may not be able to compete with the imported products if the imported products have lower price, this is because the consumer would choose the lower price product rather than the more expensive product. This may happen if the products are relatively homogenous.

However, the products that are being traded are not completely homogenous and there are difference between one products and another. Consumers have some considerations in choosing the product to buy. Therefore price is not the only factor that may determine the competitiveness of a product.

One of the factors beside price that may determine the competitiveness of a product is the quality. The consumers nowadays are very concern about the quality of a product especially if the quality concerns the safety of the consumers. Assuming that the products are traded with equal price, the consumers would choose the product with higher quality rather than the lower quality product. The consumers may consider that the quality is important for their safety or just for

their satisfaction due to the higher utility they will get by consuming the product.

One way to ensure the quality of the distributed products is by regulating the standardization for the quality of products. Many countries are applying the standard for the quality of product to ensure that the products that are distributed in their nation have good quality. The qualities that are being standardized by the countries may be intended to ensure the safety of the consumers or to ensure the utility that will be obtained by the consumers by consuming the products. The reassurance of the quality may increase the competitiveness of the product and it may increase the trade of the product.

However, the cost that must be expensed by the industry to comply with the quality standard is not small. Some research and improvement in the production process is necessary in order that the product may comply with the quality standard and this will cost a lot of investment. Beside the production process, there must be quality control to ensure the products are consistently produced with high quality. The quality control may be done in a testing laboratory and this may increase the cost significantly as well.

The increase of cost due to the standardization may cause injuries to the industry. The increase of cost will increase the price of the product and therefore it will reduce the sale of the product, especially if the price elasticity to quantity demanded is high.

Despite the purpose to protect the domestic consumer, many countries are applying the quality standard as trade barriers to protect the domestic industries. Although the quality standard regulation may increase the competitiveness of the domestic product, it may restrict the imported products that do not comply with the quality standard to enter the domestic market. It is intended to deter the low quality products entering the domestic market because the low quality products do not have to expense high cost to increase the quality of the product and to ensure the quality by investing in quality control

division. The absence of these costs will cause the low quality product having the lower price, and the consumers that lack the information about the quality would rather to buy the low quality product rather than the higher quality domestic products. This may endanger the consumers and will harm the domestic industry. Due to the objectives of the World Trade Organization in reducing tariff barriers, many countries are trying to put the non-tariff barriers to protect their domestic industry.

However, the implementation of the mandatory standard may give opposite impact to the domestic industry. Sometimes the foreign industries can apply the technology to meet the requirements of the standard with higher efficiency than the domestic industry. If that is the case then the quality standard regulation is not significant to protect the domestic industry and it may only become a burden for the domestic industry to spend more money in investment and quality control to keep the product comply with the quality standard. Therefore the objective of the mandatory standard to protect the domestic industry may not be accomplished.

It is very important to foresee the potential effect of the mandatory standard to the performance of the domestic industry before the mandatory standard is being implemented. If the mandatory standard has the potential to enhance the performance of the domestic industry, then the mandatory standard is liable to be implemented. But if the mandatory standard has the potential to harm the domestic industry, then the mandatory standard should not be implemented if there is any other solution. And if the mandatory standard is necessary to be implemented due to the consumer protection, then the government must anticipate its potential to harm the domestic industry. The potential effect is very crucial to be predicted before the implementation of the mandatory standard.

How is the potential effect of the mandatory standard implementation to the performance of the domestic industry? Does the mandatory

standard have the potential to enhance the performance of domestic industry or will it harm the performance of domestic industry? This Thesis will try to analyze the potential effect of the quality standard in enhancing the export value.

1.1. Research Objectives

The objectives of the research are :

1. To analyze the potential effect of the passenger car tires Mandatory Standardization to the performance of the domestic industry.
2. To introduce the formula to measure potential effect of the mandatory standard implementation to the performance of the domestic industry.

1.2. Research Methodology

The research will analyze the potential effect of the mandatory standardization to the performance of domestic industry. The research will introduce a new approach to analyze the potential effect of the mandatory standard implementation; the new approach is the Technical Comparative Advantage Index (TCAI).

To see the potential effect of the mandatory standard implementation, the technical competitiveness of the industry is very crucial. The technical competitiveness that is fundamental for the analysis is the capability of the industry to apply the technology to meet the requirements of the standard with high efficiency. TCAI will compare the market share of the industry of each country as the parameter of the technical competitiveness comparison between the exporter and the importer countries. Further explanation of the new approach can be seen in the next chapter.

The research will also test the liability of the new approach by applying the Technical Comparative Advantage in analyzing the

case of the implementation of the mandatory standard for the tires industry. The liability test is consist of two kind of test, they are the partial test and the general test. In partial test, after the measurement of the Technical Comparative Advantage, the value of the Technical Comparative Advantage will be checked for consistency with two parameters which are the market share of industry of Country J in the domestic market and the market share of domestic industry in the market in Country J. In general test, the TCAI value will be checked for consistency with the market share of domestic industry in the world market and the market share of domestic industry in the domestic market. The change of Market share is used as parameters rather than the change of production because the market share will represent the competitiveness of the domestic industry compare to the world industry. The growth of production may be caused by the growth of the production of the complementary product, for instance the growth of car production will also push the growth of tires production because in producing a car, tires are needed.

1.3. Research Coverage

The research will analyze the potential effect of mandatory standard implementation due to the application of the Standar Nasional Indonesia (SNI) for the tires industry. The data that is going to be used are the data before and after the implementation of the SNI. Since the mandatory SNI for tires industry was prevailed according to the ministerial decree that was signed in 2004, the standard should be fully implemented on 2005. Therefore, the data that is used is from the year of 2004 and the 2006. The data covers the production, export and import value of Indonesia and other countries from which Indonesia import the tires with significant values.

II. THEORETICAL BACKGROUND

The expansion of market through the international trade is mainly to enlarge the market therefore it will enable the producer to reach efficiency that can be explained through the economies of scale concept. Efficiency is one of the most important factors that determine the competitiveness of the producers. High level of competition will encourage all producers to reach the efficiency in order to survive in the industry.

Economies of scale will increase the welfare of the society because through economies of scale, the lower cost of production occurs due to the efficiency and the consumer will be able to receive the lower price.

The Ricardian model explains that due to the limitation of production factors, the countries will tend to produce the product that they can produce more efficient than other countries. The Heckscher-Ohlin model explains that countries will have the tendency to produce the products that require the factor of production the countries endowed with. The Ricardian model assumes that there is a technology differences among countries while the Heckscher-Ohlin model assumes that the level of technology is equal among the countries. These concepts will encourage the countries to do specialization of production, and specialization of production will allow the products to be produced with the lowest cost.

The specialization of production will be able to be achieved if the free trade can be implemented without any barriers therefore it will push the inefficient countries out of certain industry and enter other industry that they may do better without putting unnecessary competition. The free trade will let the most efficient countries to produce the certain products and it will increase the welfare of the international society due to the lower price of the products, regardless to the opportunistic behavior of countries to apply the monopoly price due to the increasing market power after specialization.

The existence of trade barriers will reduce the possibility of product specialization because the inefficient countries will try to compete the more efficient countries by securing the domestic market. This unnecessary competition will make the domestic consumer pay higher price than they are supposed to and it will reduce the welfare of the nation.

Therefore it is very important to ensure the existence of technical barriers to trade is really to guarantee the safety of the domestic consumers.

Revealed Comparative Advantage is a method to analyze the trade data. The Revealed Comparative Advantage measures the competitiveness of a country. Before the Revealed Comparative Advantage was introduced by Balassa in 1965, there was an empirical literature of Revealed Comparative Advantage by Liesner in 1958. The proposed simple measure of Revealed Comparative Advantage by Liesner is as following[1] :

$$RCA_1 = X_{ij} / X_{nj}$$

Where X represents the exports, i represents a country, j represents the commodity and n is a set of countries.

An advanced measure of Revealed Comparative Advantage was later on presented by Balassa (1965) and then this measure is widely accepted. The measure of Revealed Comparative Advantage by Balassa is as following :

$$RCA_2 = (X_{ij} / X_{it}) / (X_{nj} / X_{nt}) = (X_{ij} / X_{nj}) / (X_{it} / X_{nt})$$

Where X represents the exports, i represents a country, j represents the commodity t represents a set of commodities and n represents a set of countries. The Revealed Comparative Advantage method is the background theory that inspire the concept of Technical Comparative Advantage Index.

[1] Utkulu and Seymen 2004. Liesner measured the comparative advantage of the UK with the Common Market as the comparator.

III. THE CONCEPT OF THE TECHNICAL COMPARATIVE ADVANTAGE INDEX

This Thesis will try to analyze the parameter that may determine the effect of the implementation of mandatory standard to the performance of the domestic industry. This thesis will introduce a new approach to examine the liability of the implementation of the mandatory standard in enhancing the performance of the domestic industry.

There are many factors that may determine the impact of the mandatory standard implementation to the performance of the domestic industry such as the capability of the domestic industry to apply the technology, the capability to reach efficiency in applying the technology, the resource abundance of a country, logistic efficiency, etc. These factors are the technical specification related competitiveness of the domestic industry. If the domestic industry have high capability in applying the technology required by the standard with high efficiency, the implementation of the mandatory standard will be beneficial to the domestic industry, which will allow the domestic industry to expand their market and increase the market share.

Nevertheless, it is very difficult to measure the capability of the industry to apply the technology with high efficiency. Analyzing the capability of every firm in the industry will be very costly and it will take time. However, we can still measure the capability of the firms by generalizing the subject of analysis into the technical competitiveness of the industry.

3.1 Technical Competitiveness

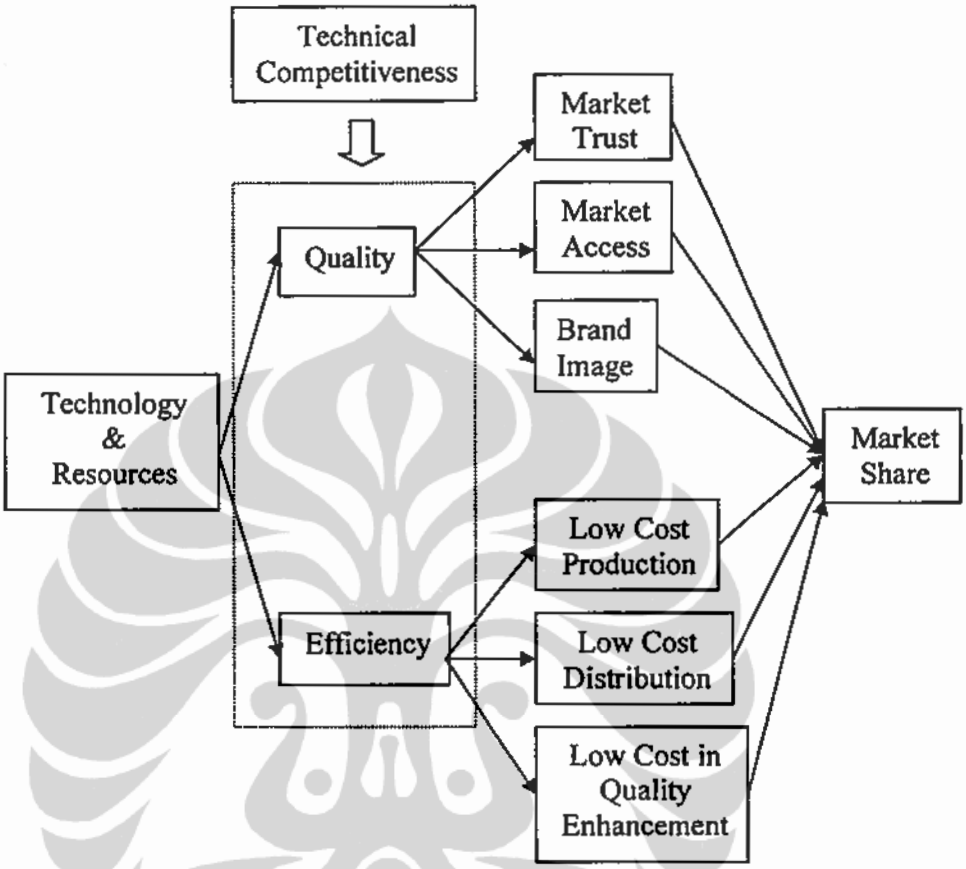
Technical competitiveness is the competitiveness of the industry in producing the product in terms of efficiency and the quality of the product. There are many factors that can determine the technical competitiveness such as technology, resource

abundance, strategic competitiveness, large domestic market, logistic efficiency, etc. The technical competitiveness is much related to the technology level of the country and the resource abundance, the technology allows the industry to produce with high efficiency and for that reason the technology may reduce the cost of production. Moreover, the technology will allow the industry to increase the quality of the product. Meanwhile the resource abundance will allow the industry to produce the product with lower cost for the material. For some products, the material resource may also determine the quality of the product.

Higher technical competitiveness means the industry has higher efficiency and quality. As mentioned before, the efficiency may be caused by the technology or the resource abundance. But those two variables may also increase the quality of the product. The resource abundance cause the product become cheaper. Often the quality enhancement require more resource for material as marginal cost for the product, the resource abundance will reduce the increase of marginal cost of the product. The research that is needed to increase the quality will enhance the technology level of the industry, and the cost for the research can be very high. Higher level of technology will reduce the cost for research to increase the quality in order to comply the mandatory standard because the gap of technology is less and the research needed to meet the quality requirements is also less.

Lower technical competitiveness means the efficiency and quality of the product of the industry is lower. The level of technology and the resource abundance is also lower and the quality enhancement will give higher burden to the industry because the large gap of technology to meet the requirements will require more expensive research and also because of the more expensive material due to the less abundance of resource.

Figure 1. Technical competitiveness and market share



The quality will allow the industry to gain trust over their product from the market, it will also allow the industry to penetrate the market which has already put mandatory standard as the technical barrier to trade. The quality will also allow the industry to obtain the good brand image that increases the loyalty of the consumers.

The efficiency will allow the industry to produce the products with low cost so that it will reduce the price which may increase the demand from the consumer. The technology may also influence the efficiency in the distribution system by allowing the industry to have the efficient and durable packaging, efficient storing system and facilities, reducing the size and weight of the product without reducing the functional purpose, and other distribution system. The technology will also allow the industry

to obtain the quality enhancement with lower cost because with the level of technology that is already high, the industry will not have to put relatively high investment to reach the level of technology required to meet the quality requirements. And also the technology of the country will allow the high quality supporting material for the product to be able to be produced domestically, and also industry do not have to import the foreign experts or to buy the technology from other countries.

Resources are also the determinant factors for the technical competitiveness. Resources abundances will lower the production cost and then increase the market share. The Heckscher-Ohlin theory also shows that the market share will indicate the abundance of resources that are required to produce certain product. Quality enhancement will also require resources and the country that have the abundant resources will be able to have lower increase of price due to the technology enhancement.

The research and installment for technology enhancement are fixed costs, therefore the industry with high market share will be able to distribute the cost enhancement to the large number of production. For that reason the industry with higher market share will have less price increase for their products than the products of other countries industry due to the quality enhancement. This economies of scale effect will influence the general implication of the Technical Comparative Advantage index.

The industry that has higher production than the competitor is not necessarily means that the industry reaches closer to the economies of scale than it's competitor. The economies of scale is highly depend on the cost structure. The high fixed cost of the industry with high capacity will require high quantity to produce in order to reach the economies of scale.

Figure 2. Economies of scale for Higher Fixed Cost And Higher Production Capacity

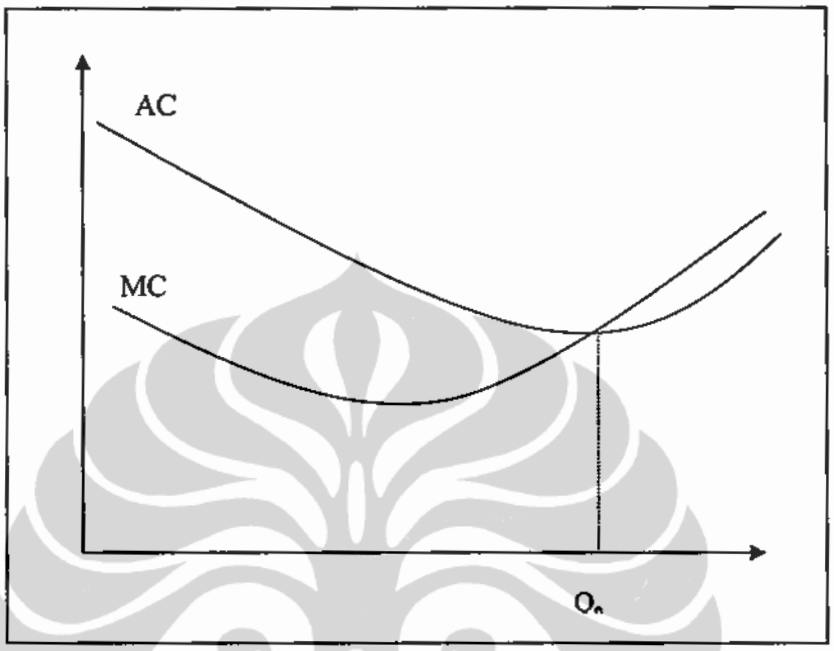
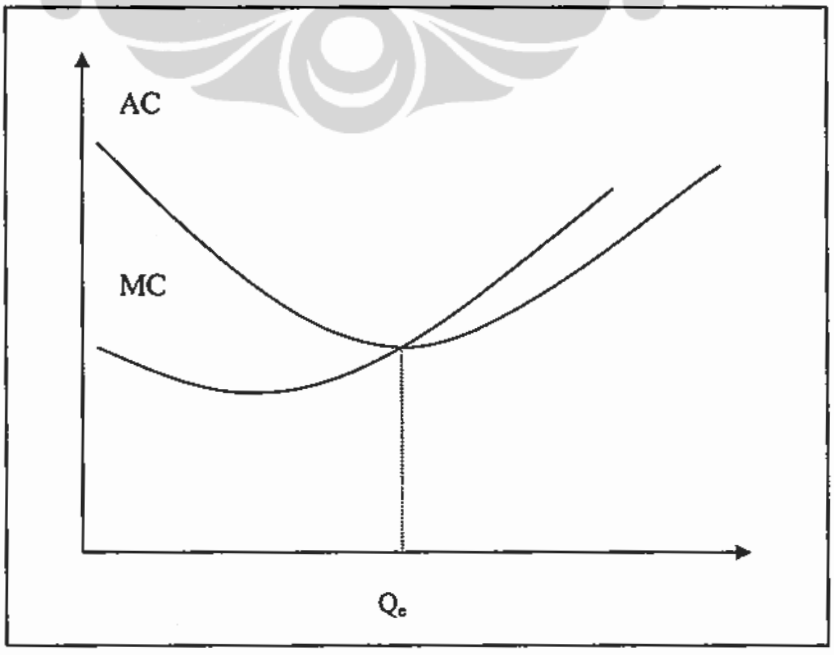


Figure 3. Economies of scale for Lower Fixed Cost And Lower Production Capacity



3.2. Technical Comparative Advantage Index

In order to predict the effect of the mandatory standard to the performance of the domestic industry, the parameter that can be used is the competitiveness of the domestic product related to the technical specification. The competitiveness related to the technical specification can be measured by using the Technical Comparative Advantage Index (TCAI). TCAI is the measurement of technical competitiveness of the domestic industry compare to the countries that export the products to the domestic market. To understand the calculation of TCAI, it is very important to learn about the Technical Comparative Advantage (TCA) first.

Technical Comparative Advantage (TCA) is the measurement of technical competitiveness of the domestic industry compare to a certain industry in a foreign country that export the product to the domestic market. The difference between TCAI and TCA is that the TCAI is a measurement in comparison to some countries that export the product to the domestic market, while TCA is a measurement in comparison to a certain country that export the product to the domestic market.

TCA value can be obtained by putting into account the market share of each country in a certain industry. The market share value is used to measure the technical competitiveness because the technical competitiveness is mainly determined by the technology and resources of the country. The technology will determine the quality and the efficiency of the industry, the technology will allow the industry to enhance the quality of their product and also to enhance it with low cost.

We can see the TCA formula below with country i is the domestic and country j is the foreign.

$$TCA_j = \frac{S_i + S_{ij} + S_{iw}}{S_j + S_{ji} + S_{jw}}$$

S_i = The market share of the domestic industry of country i in the domestic market.

The calculation for S_i is as following :

$$S_i = \frac{P_i - E_i}{P_i - E_i + M_i}$$

S_{ij} = The market share of the domestic industry of country i in the market in country j.

The calculation for S_{ij} is as following :

$$S_{ij} = \frac{E_{ij}}{P_j - E_j + M_j}$$

S_{iw} = The market share of the domestic industry of country i in the world market.

The calculation for S_{iw} is as following :

$$S_{iw} = \frac{E_i}{C_w - (P_i - E_i + M_i)}$$

S_j = The market share of the industry of country j in the market of country j.

The calculation for S_j is as following :

$$S_j = \frac{P_j - E_j}{P_j - E_j + M_j}$$

S_{ji} = The market share of the industry of country j in the domestic market of country i .

The calculation for S_{ji} is as following :

$$S_{ji} = \frac{E_{ji}}{P_i - E_i + M_i}$$

S_{jw} = The market share of the industry of country j in the world market.

The calculation for S_{jw} is as following :

$$S_{jw} = \frac{E_j}{C_w - (P_j - E_j + M_j)}$$

P_i = domestic production of tires in country i

E_i = export of tires to the world by country i

M_i = import of tires from the world by country i

E_{ij} = export of tires from country i to country j

P_j = production of tires in country j

E_j = export of tires from country j to the world

M_j = import of tires from the world by country j

C_w = consumption of tires in the world

E_{ji} = export of tires from country j to country i

In the TCA formula, S_i and S_j comparison is important to see the capability of the domestic industry of each country (i and j) to compete in their own market against the competitor from other countries. The S_i and S_j comparison may reflect the competitiveness of the industries. However, there are some other considerations to analyze the technical competitiveness comparison.

It is important to put into consideration the possibility that the compared country (country j) has already implement the mandatory standard that is similar or even have the higher requirement for the products that are distributed in their market. That is why the formula put S_{ij} and S_{jj} into account. If the compared foreign country (country j) has already implement the standard, it will influence the market share of the domestic industry in that foreign market (S_{ij}). The high quality of the imported products due to the standard implementation in country j will also influence the market share of the industry of country j in the domestic market of country i. That is why the S_{ij} and S_{jj} are important to be put into the formula.

Some other issues are important to be put into consideration, the first is the possibility that the standard has already been implemented in other countries (world) and the second is the issue of the different logistic cost of each country to take their products to the other markets in foreign countries.

The first issue is the implementation of the standard in other countries, if country n has already implement the standard while country j has not, than the industry of country n will have more opportunity to obtain market share in country i which also implement the standard requirements. This will influence the market share of country j in country i and will distort the comparison of technical competitiveness between the industries in country i and country j.

The second issue is the difference in logistic cost, if country j is closer to country i compare to country n, then country j will have lower logistic cost than country n in carrying their product to the domestic market of country i. Thus, country j will have more opportunity to obtain market share in country i compare to the opportunity of country n.

Those issues will influence the market share of country j in the market of country i and therefore will create bias in the measurement of the technical comparative advantage. These are the reasons why S_{iw} and S_{jw} are put into the formula. The comparison between S_{iw} and S_{jw} will console the distortion of logistic cost and the standard implementation in other countries.

In analyzing the potential effect of the mandatory standard implementation, it is important to consider the specification of requirements of the standard. Countries in the world usually implement the standard with the requirements that are according to the international standard. The international standard is believed as the reasonable requirements to protect the consumer rights and safety. Therefore, by comprising the S_{iw} and S_{jw} the requirements of the standard will also be consolidated in the formula.

Every country has different tariff and market access that may influence the export to a country. In relation to the logistic cost and market access such as tariff it is important to put those variable into account. This is also the reason of putting the S_{iw} and S_{jw} in the formula to consolidate those variables.

It is important to measure the TCA before we can calculate the TCAI. TCA is the component in calculating the TCAI. TCAI is the average value of the TCAs.

$$TCAI_n = \frac{\sum_{j=1}^{n} TCA_j}{n}$$

The number of countries (n) to be put into account is limited to some of the largest exporters to the domestic market. The countries that is put into account are the countries from which the domestic country (country i) imports significant value of the product in a period of time.

The value of TCA shows the comparison of the technical competitiveness between the domestic industry and the industry of a country that export the certain product to the domestic market. If the value of TCA with comparison of country j is higher than 1, that means the domestic industry is technically more competitive than the industry of country j. The mandatory standard implementation will deter the low quality product from country j and allow the domestic industry to obtain higher domestic market. The higher domestic market will increase the efficiency of the domestic industry due to the economies of scale. If the large market share obtained by the domestic industry is because of the low cost but low quality product, then the implementation of the mandatory standard will encourage the domestic industry to take the rational action by increasing the quality. The reason for this rational actions are :

- The large market share will allow the increase of price of domestic product due to the quality enhancement to be lower than the price increase of product from country j because of the economies of scale.
- The large market share indicates that the domestic industry already has the distribution system that supports the large market. The industry in country j will have to set up the distribution system if they want to capture the market, and this will increase the price of the product from country j.

- The consumers are familiar with the domestic product, this is a benefit for the domestic industry because the competitor from industry in country will have to do promotion to obtain the market share, this will increase the price of the product from country j.

If the large market share is because of higher quality of domestic product, the foreign industry (country j) will need higher investment to reach the level of technology required to meet the quality requirements, this will increase the price of the product from country j and therefore will reduce the demand for the country j's product. The mandatory standard will also increase the market trust from the market in country j on the domestic product, this will increase the sale of the domestic product in the market in country j.

If the value of TCA with comparison of country j is lower than 1 that means the domestic industry is technically less competitive compare to the industry of country j. If the large market share obtained by country j is because of the higher quality of the product then country i, then the domestic industry (country i) will need higher investment than country j to reach the level of technology required to meet the quality requirements, this will increase the price of the domestic product higher. If the large market share obtained by country j is because of it's efficiency, then increase of cost due to the implementation of mandatory standard will be burden to both country, and the country with higher efficiency will be able to push the production cost. The other scenario is if the large market share obtained by country j is because of the low cost but low quality product, the implementation of mandatory standard may reduce the performance of industry of country j although the TCA value is lower than 1. In this condition, the rational action that must be taken by country j is to increase the quality of their product. The reasons for this rational action are :

- Country j will have to increase the quality of their product because of the economies of scale. The large market share will allow the investment to increase the quality to be distributed to the large sales, and the increase the price of product from country j will be lower than the increase of the price of country i after the implementation of mandatory standard.
- The other reason is because the large market share indicates that country j already has the distribution system that will support the large market share, this is a benefit because the domestic industry will have to set up the distribution system if the domestic industry want to increase the sales due to the implementation of mandatory standard and this will increase the price of the product from the domestic industry.
- Another reason for the industry of country j to increase the quality is because the large market share indicates that the consumers are familiar with the product of country j, this is a benefit because the domestic industry will have to do promotion in order to obtain the market due to the implementation of the mandatory standard.

If the value of TCA with comparison of country j is equal to 1, that means the technical competitiveness of domestic industry is relatively equal the industry of country j.

The value of TCA may vary from one exporter country to the other exporter country. If the value of TCA from country j is higher than the value of TCA from country B, that means the domestic industry is technically more competitive compare to country j than to country B.

The value of TCA will have the partial implication which explain the change of performance of domestic industry and the industry of competitor country in domestic market. However the

partial implication may also be influenced by the general implication of TCAI.

The partial implication of the TCA value to the potential effect of the mandatory standard implementation to the domestic industry can be seen from table 1.

Table 1. The Potential Effect of the Mandatory Standard for each TCA value

TCA value	Partial Implication
>1	The domestic industry have higher technical competitiveness than the comparing country, and the mandatory standard will give less burden to the domestic industry compare to the comparing country, therefore it will have the tendency to increase the performance of domestic industry compare to the competitor's industry
<1	The domestic industry have lower technical competitiveness than the comparing country, and the mandatory standard will give less burden to the comparing country compare to the domestic industry, therefore it will have the tendency to decrease the performance of domestic industry compare to the competitor's industry
=1	The domestic industry have relatively equal technical competitiveness to the comparing country, and the mandatory standard will give relatively the same burden to the industries in both country

The value of TCAI will indicate the technical competitiveness comparison between the domestic countries and the foreign

countries from which the domestic country import the products. The comparison value will also indicate the readiness of the domestic industry to play in the market that is implemented with mandatory standard. Therefore the TCAI value will indicate the capability of the domestic industry to survive or even to expand their market in a mandatory standard implemented market. Furthermore, the value of TCAI will indicate the potential effect of the mandatory standard implementation in increasing or harming the performance of the domestic industry.

If the TCAI value is higher than 1, that means the domestic industry has higher technical competitiveness than the rival countries. The value indicates that the domestic product has higher efficiency, quality, or other supporting factor compare to the rival product from foreign industry. The economies of scale effect will also take part in the efficiency of domestic industry. The domestic industry will have the opportunity to expand its market due to the implementation of the mandatory standard. Therefore the mandatory standard implementation has the potential to increase the performance of the domestic industry. This is because the mandatory standard will deter the low quality product to enter the domestic market, so that the domestic industry can obtain the higher domestic market. The low quality product is usually produced with low cost because of the low quality material and the absence of quality control. The mandatory standard will also increase the performance of the domestic industry because it will increase the market trust on the domestic product so that it may increase the demand from the market. The higher the value of TCAI, the mandatory standard implementation has more potential to increase the performance.

If the TCAI value is less than 1, that means the domestic industry is vulnerable to the implementation of mandatory standard. The mandatory standard implementation will have the

tendency to increase the production cost of domestic industry and will increase the price that will reduce the consumer's demand for the domestic product and turn to the foreign product that produce the qualified product with lower cost. Therefore if the TCAI value is less than 1, the implementation of mandatory standard has the potential to harm the performance of the domestic industry.

If the TCAI value is equal than 1, that means the implementation of mandatory standard will have the tendency not to give significant effect to the domestic industry. This is because the capability to apply the technology and also the increase of cost to meet the requirement of the standard is equal between the domestic industry and the foreign industry.

Table 2. The Potential Effect of the Mandatory Standard for each TCAI value

TCAI value	General Implication
>1	Increase the performance of domestic industry
<1	Decrease the performance of domestic industry
=1	Do not give any significant effect

The general implication explains the effect of the economies of scale, technology, and resource abundance to the general performance of domestic industry. It is different to the partial implication that explain only the effect of the comparison of technology gap, comparison of resource abundance specialization of every country, difference of logistic efficiency, etc. the partial implication relation of performance between the domestic industry and the industry To each competitor country. Therefore the general implication may give effect to the partial

implication because economies of scale concerns the total sales of the domestic industry.

There are simultaneous implications between the TCAI value and the TCA value. The TCA value will form the TCAI value but the general implication of the TCAI value may also give effect on TCA's partial implication.

3.3. The Weakness of Technical Comparative Advantage Index

The Technical Comparative Advantage Index model has some weakness :

- Irrational Behavior

  The Technical Comparative Advantage Index model cannot cover the case where the industry does not want to increase the quality to comply the mandatory standard. If the large market share is because of the low cost but low quality product, then if the industry do not increase their quality to meet the requirements, the mandatory standard will cause the industry will loose the market and this is the contrary to the model above.

- Cateris Paribus

  The liability for this model is assuming some variables to be constant. The examples of the variables are : exchange rate, interest rate, import tariff, the rise of oil price, etc.

- The Availability of the Data

  The data that is used in calculating the TCAI is very difficult to be obtained, some companies will not give the required data for the reason of competition. Moreover, the availability of the data, in some cases the market share cannot represent the fact, and this may be caused by illegal activities in trade.

IV. THE IMPLEMENTATION OF THE TECHNICAL COMPARATIVE ADVANTAGE INDEX ON INDONESIAN PASSENGER CAR TIRES INDUSTRY

The tires industry that is mentioned in this paper is the industry of tires for 4 wheel vehicle. The Harmonized System code for the product is 401110.

4.1. Indonesian Tires Industry Profile

Indonesian tires industry is now mainly consist of 14 tires producers that are joined in the association of Indonesian tires producers (APBI).

Tabel 3. Indonesian Tires Producers

No	Producers	Location of Factory	Capacity (thousands of units)	
			4 wheel vehicle Tires	2 wheel vehicle Tires
1	PT. Intirub	Jakarta	864	-
2	PT. Goodyear Indonesia	Bogor	3.120	-
3	PT. Bridgestone Tire Indonesia	Bekasi	12.000	-
4	PT. Gajah Tunggal	Tangerang	12.700	11.695
5	PT. Mega Safe Tyre Industry	Semarang	2.150	750
6	PT. Industri Karet Deli	Medan	8.387	3.636
7	PT. Ariga Mira Rubber Works	Tangerang	-	255
8	PT. Sumi Rubber Indonesia	Cikampek	3.605	3.653
9	PT. Elang Perdana	Bogor	2.000	-
10	PT. Hung-A Indonesia	Bekasi	-	1.500
11	PT. Suryaraya Rubberindo Industries	Bogor	-	5,500
12	PT. Banteng Pratama	Bogor	-	500
13	PT. United King Land	Tangerang	-	270
14	PT. Multistrada Arah Sarana	Bekasi	4.500	
	TOTAL		49.326	27.758

Source : Indonesian Ministry of Industry

Most of the tires producer is located in Java island particularly in west java. The largest production capacity for 4 wheel vehicle tires is belong to PT. Gajah Tunggal and PT. Bridgestone Tire Indonesia with the production capacity up to 12.700.000 units per year and 12.000.000 units per year.

PT. Goodyear Indonesia is the first tire producer in Indonesia and now there are 850 labor working PT. Goodyear Indonesia.

Some of the domestic tires producers are the foreign capital firm. PT. Bridgestone Tire Indonesia and PT. Sumi Rubber Indonesia are the Japanese capital firm while PT. Goodyear Indonesia is American capital firm. USA and Japan also have standard for tires products that had already been applied before the Implementation of mandatory standard for tires in Indonesia, therefore some of the domestic tires producers produce the tires based on the standard requirement in their countries.

However the capacities of the domestic producers are not entirely utilized. The utilization of the capacity of tires for 4 wheel vehicle are as the following table :

Table 4. Utilization of Indonesian 4 Wheel Vehicle Tires Industry Capacity

No	Producers	Capacity (000 units)	Production Realization (000 units)		
			2003	2004	2005
1	PT. Intirub	864	495	517	483
2	PT. Goodyear Indonesia	3.120	2.072	2.448	2.395
3	PT. Bridgestone Tire Indonesia	12.000	8.844	10.236	11.720
4	PT. Gajah Tunggal	12,700	10.047	10.675	11.470
5	PT. Mega Safe Tyre Industry	2.150	1.567	1.429	1.226
6	PT. Industri Karet Deli	8.387	617	723	951
7	PT. Sumi Rubber Indonesia	3.605	5.710	7.974	11.259
8	PT. Elang Perdana	2.000	769	1.366	1.806
9	PT. Multistrada Arah Sarana	4.500	-	-	-
	Total	49.326	30.076	35.371	41.310
	Utilization (%)		79	96	84

Source : Indonesian Ministry of Industry

The utilization of the production capacity for the 4 wheel vehicle tires increased very optimal in 2004 from 79 % to 96 %. This increase may be caused by the expectation of the increase in sale of domestic tires related to the decree which is signed in 2004 for the implementation of the mandatory standard for tires

and the decree should be prevailed in 2005, but then in 2005 the utilization of the production capacity decreased to 84.

Indonesian tires industry supplies not only the domestic market but also the foreign market. The domestic sales of Indonesian producers for 4 wheel vehicle tires are as following tables :

Table 5.The Domestic Sales and the Market Concentration Of Domestic 4 Wheel Vehicle Tires Producers in 2006

Producers	Domestic Sales (Tons)	Domestic Market Share %
PT. Bridgestone Tires Indonesia	58,338	34.7
PT. Gajah Tunggal TBK	45,987	27.3
PT. Sumi Rubber Indonesia	15,396	9.1
PT. Goodyear Indonesia	11,071	6.6
PT. Elang Perdana Industri	5,391	3.2
PT. Industri karet Deli	5,308	3.2
PT. Mega Safe Tyre Industry	902	0.5
PT. Intirub	590	0.4
IMPORT	25,293	
TOTAL	167,686	
CR4		**77.7%**

Source : Indonesian Tires producer Association (APBI)

In 2006 the market share for 4 wheel vehicle tires was dominated by several domestic producers. The market concentration (CR4) based on 4 producers that have the highest market share reached 77.7%. This showed that the competition level in the industry is still low.

According to the Indonesian Tires Producers Association, the export of domestic tires has been having the stable increase in the last 8 years from year 1997 to 2005. This increase may be caused by the increase of the car production in the world so that it increases the market for the tires industry world wide.

Indonesia is exporting tires to some countries like United States, Japan, England, United Arab Emirates, Philippines, etc. In 2005 Indonesia[2] is the 19th biggest exporter of tires in the world, Indonesian export of tires represents 1 % of the world's export for tires.

Indonesia is also the importers of tires; the countries that Indonesia imports the tires from are Singapore, Japan, China, United States, France, Korea, Thailand, etc.

The domestic tires industry is using some types of rubbers and carbon black in producing the tires. The composition of the materials can be seen in the next table.

Table 6. Material Composition in Tires Production

Material	HS Code	Composition (%)	Source of Material
Natural Rubber	4001.10. 4001.21. 4001.22	25	Domestic
Synthetic Rubber	4002.11. 4002.20.	24	Domestic /imported
Carbon Black	2803.00.10	14	Domestic /imported
Nylon Tire Cord	5902.10. 5902.20.	5	Domestic /imported
Bead Wire	7247.10.22	5	Domestic
RPO	2707.99.10	5	Domestic
Rubber Chemical : Zinc Oxide Stearic Acid Calcium Carbonat	 2817.00.10 2915.70.20 2836.50.90	5	 Domestic Domestic Domestic
Total		100	

Source : Indonesian Ministry of Industry

Indonesian government is implementing the mandatory standard for tires product. This was proposed by the Indonesian Tires Producer Association in 2003. The mandatory standard for the tires was separated into five kind of standard for five kinds of tires which are for tires for passenger car, tires for Truck and

[2] Trademap

Bus, tires for light truck, tires for motorcycles, and inner tube tires. The ministerial decrees for the implementation of the five mandatory standards are signed in September 2004 and they should have prevailed in 2005 but the effective implementation was on march 2006[3].

4.2. The Technical Comparative Advantage Index for Indonesian Passenger Car Tires Industry

The mandatory standard for the tires for passenger cars is based on the decree which was signed in September 2004 and should be prevailed in 2005. Although the prevailing of the decree was fully effective in march 2006, there might be some effect took place to the industry in 2005. Therefore to measure potential effect of the mandatory standard, the data in 2004 will be used.

The Indonesian tires market is supplied by both the domestic tires and imported tires. The countries that the domestic market import the tires (HS. 401110) from in 2004 are consist of more than 19 countries but the significant imports are from 6 countries. The list of countries that the domestic market was importing from is shown in the appendix 1. In this liability test, the selections for the significant imports are the imports which the quantities are more than 200 tons. These countries will be used to measure the Technical Comparative Advantage value of Indonesian Passenger Car Tires Industry. But due to the unavailability of some data, Philippines will not be used in the liability test. And since there is no passenger car tires industry in Singapore, it is impossible to measure the industry competitiveness between Singapore and Indonesia. Therefore Philippines and Singapore will be detached from the calculation. These make the number of countries to be used for the liability test are only five.

[3] This information was taken from the 2005 annual report of Indonesian Tires Producers Association (APBI).

The next table will show the countries that are chosen for the measurement of the Technical Comparative Advantage. The table also shows the quantity of import and the value of import in 2004.

Table 7. The Countries That The Domestic Market Import From Significantly in 2004

Exporters	Imported Quantity (Tons)	Imported Quantity[4] (Units)	Imported value ($1000)
Japan	3,641	334,972	11,818
China	1,128	103,776	649
Thailand	807	74,244	2,045
Malaysia	652	59,984	1,031
Singapore*	577	53,084	1,785
Philippines*	318	29,256	656
Rep. of Korea	286	26,312	408

Source : www.Trademap.org
*) will be detached from calculation

The countries in table 6 will be used as the comparing countries in calculating the Technical Comparative Advantage Index for Indonesian Passenger Car Tires Industry. But due to the unavailability of the data from Philippines and the inexistence of the tires industry in Singapore, the 2 countries will be detached from the calculation of Indonesian TCAI. According to the table, The largest import in 2004 for tires for passenger car is from Japan (3,641 tons) and then followed by China (1,128 tons), Thailand (807 tons), Malaysia (652 tons), Singapore (577 tons), Philippines (318 tons), and Republic of Korea (286 tons).

[4] The quantity data is an estimated value. The data obtained from www.trademap.org is in tons therefore to convert it into quantity of units, the conversion uses the comparison of Japanese export according to IRSG (units) and the trademap (tons). This comparison is obtained by comparing the export from Japan in 2002 to 2005 that is acquired from IRSG and the Japanese export in 2002 to 2005 that is acquired from trademap. The average of the value obtained is 92 unit/tons.

Indonesia also export the tires for passenger car to each of the countries. The list of the countries that Indonesian tires industry export to in 2004 are shown in the appendix 2. The exports in 2004 from Indonesia to each of the countries that are selected for the Technical Comparative Advantage measurement are shown in the next table.

Table 8. The Export of Indonesian Tires (401110) To Each of the Exporter Countries in 2004

Importers	Exported Quantity (Tons)	Exported Quantity (Units)	Exported value ($1000)
Japan	46,657	4,292,444	90,854
China	252	23,184	944
Thailand	5,195	477,940	11,817
Malaysia	7,799	717,508	13,323
Singapore*	3,301	303,692	6,632
Philippines*	6,452	593,584	9,005
Rep. of Korea	1,872	172,224	3,466

Source : www.Trademap.org
*) will be detached from model

The domestic production data that is used to calculate the TCA value is the 2004 domestic production of passenger car. The domestic production of passenger car tires in 2004 and 2006 can be seen in the following table :

Table 9. The Domestic Production and Total Export of Indonesian Tires

Year	Domestic Production	Total Export
2004	24,227,000 unit tires	18,895,000 unit tires
2006	25,984,000 unit tires	21,396,000 unit tires

Source : APBI Annual Report 2004

The production of each country in 2004 are as following:

Table 10. Total Production of Passenger Car Tires of Each Countries in 2004

Countries	Units of Production
Japan	132,390,000
China	66,060,000
Thailand	11,260,000
Malaysia	7,590,000
Korea	61,170,000

The world consumption data that is used in this model is taken from the Michelin fact book 2004-2007 and from the Michelin annual report.

Table 11. The World Tire Market By Product Type (2004)

Type of Tires	Share of Sales
Passenger Car-light Truck	51%
Truck	32,4%
Earth Mover	6,7%
2-Wheel	5,9%
Agricultural	3,4%
Aircraft	0,6%

Source : Michelin annual Report 2004

The Michelin annual report and Michelin fact book put passenger car and light truck in the same market segmentation. This may be caused by the substitution function between the tires for the two types of vehicle.

Table 12. The World Consumption

	Passenger Car	
2004	994,000,000	unit tires
2006	1,114,000,000	unit tires

Source : Michelin fact book

The calculation of TCAI for Indonesian passenger car tires industry will begin from the calculation of TCA for Japan, China, Thailand, Malaysia, and Republic of Korea.

4.2.1 The Calculation of Technical Comparative Advantage (TCA)

The TCA value for domestic tires industry to the tires industry in Japan in 2004 is :

$$TCA_{Japan} = \frac{S_{Ind} + S_{Ind\text{-}japan} + S_{Ind\text{-}world}}{S_{japan} + S_{japan\text{-}Ind} + S_{japan\text{-}world}}$$

$$S_{Ind} = \frac{P_{Ind} - E_{Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{24,227,000 - 18,895,000}{24,227,000 - 18,895,000 + 735,908}$$

$$= \frac{5,332,000}{6,607,908}$$

$$= 0.879$$

$$S_{Ind\text{-}Japan} = \frac{E_{Ind-japan}}{P_{japan} - E_{japan} + M_{japan}}$$

$$= \frac{4,292,444}{132,390,000 - 52,586,004 + 13,196,204} = 0.046$$

$$S_{Ind\text{-}world} = \frac{E_{Ind}}{C_{world} - (P_{Ind} - E_{Ind} + M_{Ind})}$$

$$= \frac{18,895,000}{994,000,000 - (6,607,908)}$$

$$= \mathbf{0.0191}$$

$$S_{Japan} = \frac{P_{japan} - E_{japan}}{P_{japan} - E_{japan} + M_{japan}}$$

$$= \frac{132,390,000 - 52,586,004}{132,390,000 - 52,586,004 + 13,196,204}$$

$$= \frac{79,803,996}{93,000,200}$$

$$= \mathbf{0.858}$$

$$S_{Japan\text{-}Ind} = \frac{E_{japan-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{334,972}{24,227,000 - 18,895,000 + 735,908}$$

$$= \mathbf{0.055}$$

$$S_{Japan\text{-}world} = \frac{E_{japan}}{C_{world} - (P_{japan} - E_{japan} + M_{japan})}$$

$$= \frac{52,586,004}{994,000,000 - (93,000,200)}$$

$$= \mathbf{0.058}$$

$$TCA_{Japan} = \frac{0.879 + 0.046 + 0.0191}{0.858 + 0.055 + 0.058} = \mathbf{0.972}$$

The TCA value for domestic tires industry to the tires industry in China is :

$$TCA_{Chin} = \frac{S_{Ind} + S_{Ind\text{-}Chin} + S_{Ind\text{-}world}}{S_{Chin} + S_{Chin\text{-}Ind} + S_{Chin\text{-}world}}$$

$$S_{Ind\text{-}Chin} = \frac{E_{Ind-Chin}}{P_{Chin} - E_{Chin} + M_{Chin}}$$

$$= \frac{23{,}184}{66{,}060{,}000 - 20{,}884{,}552 + 1{,}267{,}668} = \mathbf{0.0005}$$

$$S_{Chin} = \frac{P_{Chin} - E_{Chin}}{P_{Chin} - E_{Chin} + M_{Chin}}$$

$$= \frac{66{,}060{,}000 - 20{,}884{,}552}{66{,}060{,}000 - 20{,}884{,}552 + 1{,}267{,}668}$$

$$= \frac{45{,}175{,}448}{46{,}443{,}116}$$

$$= \mathbf{0.973}$$

$$S_{Chin\text{-}Ind} = \frac{E_{Chin-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{103{,}776}{24{,}227{,}000 - 18{,}895{,}000 + 735{,}908} = \mathbf{0.017}$$

$$S_{Chin\text{-}world} = \frac{E_{Chin}}{C_{world} - (P_{Chin} - E_{Chin} + M_{Chin})}$$

$$= \frac{20{,}884{,}552}{994{,}000{,}000 - (46{,}443{,}116)}$$

$$= \mathbf{0.022}$$

$$TCA_{Chin} = \frac{0.879 + 0.0005 + 0.019}{0.973 + 0.017 + 0.022} = \mathbf{0.888}$$

The TCA value for domestic tires industry to the tires industry in Thailand is :

$$TCA_{Thai} = \frac{S_{Ind} + S_{Ind\text{-}Thai} + S_{Ind\text{-}world}}{S_{Thai} + S_{Thai\text{-}Ind} + S_{Thai\text{-}world}}$$

$$S_{Ind\text{-}Thai} = \frac{E_{Ind-Thai}}{P_{Thai} - E_{Thai} + M_{Thai}}$$

$$= \frac{477{,}940}{11{,}260{,}000 - 5{,}634{,}448 + 1{,}164{,}076} = \mathbf{0.070}$$

$$S_{Thai} = \frac{P_{Thai} - E_{Thai}}{P_{Thai} - E_{Thai} + M_{Thai}}$$

$$= \frac{11{,}260{,}000 - 5{,}634{,}448}{11{,}260{,}000 - 5{,}634{,}448 + 1{,}164{,}076}$$

$$= \frac{5{,}625{,}552}{6{,}789{,}628}$$

$$= \mathbf{0.829}$$

$$S_{Thai\text{-}Ind} = \frac{E_{Thai-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{74{,}244}{24{,}227{,}000 - 18{,}895{,}000 + 735{,}908} = \mathbf{0.012}$$

$$S_{Thai\text{-}world} = \frac{E_{Thai}}{C_{world} - (P_{Thai} - E_{Thai} + M_{Thai})}$$

$$= \frac{5{,}634{,}448}{994{,}000{,}000 - (6{,}789{,}628)}$$

$$= \mathbf{0.006}$$

$$TCA_{Thai} = \frac{0.879 + 0.070 + 0.019}{0.829 + 0.012 + 0.006} = \mathbf{1.143}$$

The TCA value for domestic tires industry to the tires industry in Malaysia is :

$$TCA_{Mal} = \frac{S_{Ind} + S_{Ind\text{-}Mal} + S_{Ind\text{-}world}}{S_{Mal} + S_{Mal\text{-}Ind} + S_{Mal\text{-}world}}$$

$$S_{Ind\text{-}Mal} = \frac{E_{Ind-Mal}}{P_{Mal} - E_{Mal} + M_{Mal}}$$

$$= \frac{717{,}508}{7{,}590{,}000 - 216{,}844 + 287{,}684} = \mathbf{0.094}$$

$$S_{Mal} = \frac{P_{Mal} - E_{Mal}}{P_{Mal} - E_{Mal} + M_{Mal}}$$

$$= \frac{7{,}590{,}000 - 216{,}844}{7{,}590{,}000 - 216{,}844 + 287{,}684}$$

$$= \frac{7{,}373{,}156}{7{,}660{,}840}$$

$$= \mathbf{0.962}$$

$$S_{Mal\text{-}Ind} = \frac{E_{Mal-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{59{,}984}{24{,}227{,}000 - 18{,}895{,}000 + 735{,}908} = \mathbf{0.010}$$

$$S_{Mal\text{-}world} = \frac{E_{Mal}}{C_{world} - (P_{Mal} - E_{Mal} + M_{Mal})}$$

$$= \frac{216{,}844}{994{,}000{,}000 - (7{,}660{,}840)}$$

$$= \mathbf{0.0002}$$

$$TCA_{Mal} = \frac{0.879 + 0.094 + 0.019}{0.962 + 0.010 + 0.0002} = \mathbf{1.020}$$

The TCA value for domestic tires industry to the tires industry in Republic of Korea is :

$$TCA_{Kor} = \frac{S_{Ind} + S_{Ind\text{-}Kor} + S_{Ind\text{-}world}}{S_{Kor} + S_{Kor\text{-}Ind} + S_{Kor\text{-}world}}$$

$$S_{Ind\text{-}Kor} = \frac{E_{Ind-Kor}}{P_{Kor} - E_{Kor} + M_{Kor}}$$

$$= \frac{172{,}224}{61{,}170{,}000 - 31{,}663{,}640 + 3{,}798{,}864} = \mathbf{0.005}$$

$$S_{Kor} = \frac{P_{Kor} - E_{Kor}}{P_{Kor} - E_{Kor} + M_{Kor}}$$

$$= \frac{61{,}170{,}000 - 31{,}663{,}640}{61{,}170{,}000 - 31{,}663{,}640 + 3{,}798{,}864}$$

$$= \frac{29{,}506{,}360}{33{,}305{,}224}$$

$$= \mathbf{0.886}$$

$$S_{Kor\text{-}Ind} = \frac{E_{Kor-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{26{,}312}{24{,}227{,}000 - 18{,}895{,}000 + 735{,}908} \approx \mathbf{0.004}$$

$$S_{Kor\text{-}world} = \frac{E_{Kor}}{C_{world} - (P_{Kor} - E_{Kor} + M_{Kor})}$$

$$= \frac{31{,}663{,}640}{994{,}000{,}000 - (33{,}305{,}224)}$$

$$= \mathbf{0.033}$$

$$TCA_{Kor} = \frac{0.879 + 0.005 + 0.019}{0.886 + 0.004 + 0.033} = \mathbf{0.978}$$

4.2.2 The calculation of Technical Comparative Advantage Index (TCAI)

The TCAI value for the Indonesian passenger car tires Industry is :

$$TCAI_n = \frac{\sum_{j=1}^{n} TCA_j}{n}$$

$$TCAI_5 = \frac{TCA_{Jap} + TCA_{Chin} + TCA_{Thai} + TCA_{Mal} + TCA_{Kor}}{5}$$

$$TCAI_5 = \frac{0.972 + 0.888 + 1.143 + 1.020 + 0.978}{5}$$

$$TCAI_5 = \mathbf{1.0002}$$

The calculation result of the TCAI value for Indonesian passenger car tires industry is 1.0002.

V. THE ANALYSIS OF TECHNICAL COMPARATIVE ADVANTAGE INDEX FOR INDONESIAN PASSENGER CAR TIRES INDUSTRY

The Technical Comparative Advantage Index (TCAI) value will have implication on the effect of implementation of the mandatory standard to the performance of Indonesian passenger car tires industry. If the TCAI value is higher than 1 then the implementation of the mandatory standard will have the tendency to give positive effect to the domestic industry. On the contrary, if the TCAI value is less than 1 then the mandatory standardization will have the tendency to give negative effect to the domestic industry.

5.1 The Analysis of the Technical Comparative Advantage Index

The TCAI value for Indonesian passenger car tires industry is 1.002. This means the technical competitiveness of the Indonesian passenger car tires industry is relatively higher than the technical competitiveness of the competitor countries in general.

The implementation of the mandatory standard will give relatively lower burden to the domestic industry compare to the industry of competitor countries. This is because the domestic industry has relatively higher quality or efficiency than the average of competitors.

Higher quality means fewer gaps between the technologies of the domestic industry to the required technology for standard requirements. It will allow the domestic industry to minimize the cost for standard compliance because to comply the mandatory standard, the Indonesian passenger car tires industry will require less research to meet the requirements for quality standard. Higher quality can also indicate that most of the Indonesian passenger car producer has already comply the standard requirements even before the mandatory standard was

implemented, in this condition the implementation of mandatory standard will not give significant burden to the domestic industry.

Higher efficiency means that the Indonesian passenger car tires industry can produce the products with lower cost than the industries of competitor countries. There can be many factors that influence the efficiency such as technology and resource abundance.

The technology of passenger car tires industry in Indonesia is quite high because there are many multinational corporation that produce passenger car tires in Indonesia. Those multinational corporations have high technology in producing tires and are the biggest tires producers in the world.

The resource abundance can be the raw material, land, human resources, etc. Indonesia is rich of these resources and this may be the key factor for the high technical competitiveness of Indonesian passenger car tires industry. Quality enhancement sometimes requires an increase in material utilization, which will be the marginal cost for production. The abundance of resources allows the industry to obtain cheaper materials so that the implementation of mandatory standard will give fewer burdens to the country that has abundant resources. The quality enhancement will allow the Indonesian passenger car tires industry to have small increase in marginal cost since there are lots of raw materials for passenger car tires production in Indonesia.

The large domestic market can also be an advantage for Indonesian passenger car tires industry. The domestic market is very important because the distribution to the domestic market does not require high cost compare to the foreign market. The large domestic market allows Indonesian passenger car tires industry to produce with lower price because of the economies

of scale. This reason is also the benefactor of the technical competitiveness of Indonesian passenger car tires industry.

5.2 The Analysis of the Technical Comparative Advantage

The Technical Comparative Advantage value indicates the technical competitiveness of domestic industry compare to the foreign industry.

Some countries may have high market share but produce low quality product, this condition will cause the TCA value for that rival country become lower than 1. The high market share is obtained because the industries reduce the production cost by reducing the quality of the product. In this condition, the model assume that the country will act rationally by enhance the quality of it's product concerning the implementation of mandatory standard in the domestic market. This action called rational because without the enhancement of the product's quality, the rival country will lose it's market share in domestic market and the country will also lose some efficiency due to the decrease of sales which will create more gap for the country to reach economies of scale.

- TCA_{japan}

The Technical Comparative Advantage value for the domestic tires industry compare to the passenger car tires industry in Japan is 0.972. The TCA_{japan} value means that if the other factors are constant, then the implementation of mandatory standard will benefit the Japanese passenger car tires industry rather than the domestic industry. The TCA_{japan} value indicated that the Japanese passenger car tires industry is technically more competitive than the Indonesian passenger car tires industry.

The implication of the TCA_{japan} value is the implementation of mandatory standard will decrease the performance of the

domestic industry. The parameters for the performance will be the market share of the Japanese passenger car tires industry in the domestic market, and the market share of Indonesian passenger car tires industry in the Japanese market.

However, the partial implication of the TCA_{japan} value is not always consistent, there is also the general implication of TCAI that might explain the change of performance of both industry. Since the general implication of TCAI is contradictory to the partial implication of TCA_{japan} then the dominant implication will explain the fact.

- TCA_{china}

The Technical Comparative Advantage value for the domestic tires industry compare to the passenger car tires industry in China is 0.888. The TCA_{china} value indicates that the Chinese passenger car tires industry had higher technical competitiveness compare to the Indonesian passenger car tires industry. It also indicates that the implementation of mandatory standard in Indonesian market will decrease the performance of Indonesian passenger car tires industry.

Many of the Chinese passenger car tires are produced with low quality and some are below the mandatory standard. If Chinese passenger car tires industry do not enhance the quality of it's product, then the implementation of mandatory standard will decrease the market share of Chinese industry in domestic market for passenger car tires. The Chinese industry will also lose some of their efficiency because the sales will be further from the economies of scale.

- $TCA_{thailand}$

The Technical Comparative Advantage value for the domestic tires industry compare to the passenger car tires industry in Thailand is 1.143. The value indicates the supremacy of Indonesian passenger car tires industry's technical

competitiveness over the Thailand Passenger car tires industry. The implication of this TCA value is that the implementation of mandatory standard will increase the performance of domestic industry. The mandatory standard will enhance the market share of domestic passenger car tires industry in Korean market. The implementation will also decrease the market share of Korea in domestic market.

However there is preferential tariff agreement among the ASEAN countries, this may disrupt the implication of the TCA value. The low tariff may give competitiveness to the Korean passenger car tires compare to the tires from countries outside ASEAN.

- $TCA_{malaysia}$

The Technical Comparative Advantage value for the domestic tires industry compare to the passenger car tires industry in Malaysia is 1.020. The implication of the TCA value is that the implementation of mandatory standard will increase the performance of domestic industry by boosting the market share of domestic passenger car tires industry in Malaysian market. The standard regulation will also decrease the market share of Malaysian industry in domestic market. However the same as Thailand, Malaysia is one of the ASEAN country that bound to the preferential tariff agreement, and this may disrupt the consistency of the partial implication of TCA value.

- TCA_{korea}

The Technical Comparative Advantage value for the domestic tires industry compare to the passenger car tires industry in Republic of Korea is 0.978 which has the implication that the implementation of mandatory standard will decrease the performance of domestic industry and increase the market share of Korean passenger car tires industry in domestic market.

VI. THE LIABILITY TEST FOR THE TECHNICAL COMPARATIVE ADVANTAGE INDEX OF INDONESIAN PASSENGER CAR TIRES INDUSTRY

The effect of the implementation of the mandatory standard in tires industry can be analyzed by reviewing the performance of the industry in 2006. Therefore to test the liability of the Technical Comparative Advantage Index for Indonesian Passenger Car Tires Industry, the data in 2006 will be used.

The 2006 trade data is also taken from the Trademap web site, but the data is obtained in tons, it is necessary to convert it into units of product. the conversion will use the same conversion unit as the 2004 trade data.

Table 13. Total Export and Import of Competitor Countries to the World In 2006

Countries	Export		Import	
	Tons	Units	Tons	Units
Japan	675,102	62,109,384	184,880	17,008,960
China	531,278	48,877,576	24,728	2,274,976
Thailand	104,199	9,586,308	20,016	1,841,472
Malaysia	18,950	1,743,400	24,304	2,235,968
Rep of Korea	406,203	37,370,676	58,146	5,349,432

Source : Trademap

The total export of passenger car tires of the competitor countries increased from 2004 to 2006, so as the total import. This increase might be caused by the increasing demand for passenger car tires in the whole world.

Table 14. Indonesian Export and Import With Competitor Countries In 2006

Countries	Indonesian Export		Indonesian Import	
	Tons	Units	Tons	Units
Japan	65,466	6,022,872	1,871	172,132
China	11	1,012	628	57,776
Thailand	6,357	584,844	846	77,832
Malaysia	9,388	863,696	660	60,720
Rep of Korea	2,037	187,404	679	62,468

Source : Trademap

Indonesian export of passenger car tires to each competitor country increase from 2004 to 2006, except to China. Indonesian import from Japan and China decreased from 2004 to 2006, but the import of passenger car tires from Thailand, Malaysia and Republic of Korea increased from 2004 to 2006.

The liability test consists of two kind of test, those are the General Test and the partial

6.1 General Test for TCAI value

The liability test for TCAI value for domestic passenger car tires industry will be done by checking the implication of the TCAI value to the performance of domestic industry. The general implication is the effect of the economies of scale, technology and resource abundance. The parameter that is used in this general test are the change of market share of Indonesian passenger car tires industry in the world market and the market share of Indonesian passenger car tires industry in domestic market.

The TCAI value for Indonesian passenger car tires industry is 1.0002 which will generate two predictions that the

implementation of mandatory standard will increase the market share of domestic industry in world market and the market share of domestic industry in domestic market. The implication of TCAI will be rejected if the market share of domestic industry in the world market decreases or if the market share of domestic industry in the domestic market decreases.

The market share of domestic passenger car tires industry in the world market in 2004 is 0.0191 and the market share of the industry in the domestic market in 2004 is 0.879.

The market share of domestic passenger car tires industry in the world market in 2006 is:

$$S_{Ind\text{-}world} = \frac{E_{Ind}}{C_{world} - (P_{Ind} - E_{Ind} + M_{Ind})}$$

$$S_{Ind\text{-}world} = \frac{21,396,000}{1,114,000,000 - (25,984,000 - 21,396,000 + 603,244)}$$

$$S_{Ind\text{-}world} = \mathbf{0.0193}$$

The market share of domestic passenger car tires industry in the domestic market in 2006 is:

$$S_{Ind} = \frac{P_{Ind} - E_{Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$S_{Ind} = \frac{25,984,000 - 21,396,000}{25,984,000 - 21,396,000 + 603,244}$$

$$S_{Ind} = \mathbf{0.884}$$

The calculations above shows that the market share of Indonesian passenger car tires industry in the world market increased from 0.0191 in 2004 to 0.0193 in 2006. The increase was 0.0002 and it approves the first prediction that states the implementation of mandatory standard would increase the

market share of domestic passenger car tires industry in the world market.

There was also an increase in the market share of Indonesian passenger car tires industry in the domestic market. It increased from 0.879 in 2004 to 0.884 in 2006. The increase was 0.005 and it approves the second prediction that states the implementation of mandatory standard would increase the market share of domestic passenger car industry in the domestic market. The hypotheses that are accepted in this general test is 100%.

6.2 Partial Test for TCA values

The liability test for TCA value for the domestic passenger car tires industry compare to the passenger car tires industry in each country will be done by comparing the consistency of the implication of TCA value to the performance of domestic passenger car tires industry according to table 1. There are two parameters to be used in measuring the performance of domestic passenger car tires industry concerning each TCA value, the first is the change of market share of passenger car tires industry of each competitor country in the domestic market between 2004 and 2006 and the second parameter is the change of market share of domestic passenger car tires industry in the market in each competitor country between 2004 and 2006.

There can be two implications that may explain the parameters that are going to be used in partial test, they are the partial implication and the general implication. This is because the partial implication is the effect of the comparison of technology gap, comparison of resource abundance specialization, and other comparison factors; meanwhile the general implication is affected by the economies of scale that concerns whole sales of

domestic industry. Therefore the result of the partial test may become the result of general implication of TCAI value and the partial implication of TCA value. The largest effect will determine the dominance of each implication to the performance of domestic industry.

The liability test for each competitor country:

- Japan

  The TCA_{Japan} value is 0.972 and this generates two hypotheses that the implementation of mandatory standard will increase the market share of Japan in domestic market and decrease the market share of domestic passenger car tires industry in Japan market.

  The market share of Japan in domestic market for passenger car tires in 2004 is 0.055 and the market share of domestic passenger car tire industry in Japan market in 2004 is 0.046.

  The market share of Japan in domestic market for passenger car tires industry in 2006 is:

$$S_{Japan\text{-}Ind} = \frac{E_{japan-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{172{,}132}{25{,}984{,}000 - 21{,}396{,}000 + 603{,}244}$$

$$= \mathbf{0.033}$$

  The market share of domestic passenger car tires industry in Japan market in 2006 is:

$$S_{Ind\text{-}Japan} = \frac{E_{Ind-japan}}{P_{japan} - E_{japan} + M_{japan}}$$

$$= \frac{6,022,872}{134,590,000 - 62,109,384 + 17,008,960}$$

$$= 0.067$$

In this TCA_{japan} partial test, the market share of Japan in domestic market decreased from 0.055 in 2004 to 0.033 in 2006. This fact enforce the rejection of the first prediction that stated the mandatory standard implementation will decrease the market share of Japan industry in domestic market.

The market share of domestic industry in Japan market increased from 0.046 in 2004 to 0.067 in 2006. This fact also enforce the rejection of the second prediction that stated that the implementation of mandatory standard will reduce the market share of domestic industry in Japan market.

The rejections of these two hypotheses were probably caused by the dominance of the economies of scale, technology and resource abundance. The general implication of TCAI might be the dominant implication in the passenger car tires trade relation between Indonesia and Japan. The economies of scale increase the technical competitiveness of Indonesian passenger car tires industry compare to the Japanese passenger car tires industry.

Although the production of Japanese passenger car tires industry in 2006 (P_{japan}=134,590,000 unit tires) was higher than the Indonesian industry ($P_{Indonesia}$=25,984,000 unit tires), this was not necessarily means that the Japanese passenger car tires industry was closer to reach the economies of scale than the domestic passenger car tires industry. The economies of scale of an industry is highly depend on the cost structure. If the industry's fixed cost is

higher, then the quantity required to reach the economies of scale is also higher (picture 2 and 3).

The fixed cost in the passenger car tires industry may be the factory, the rubber plant, the technology of production, etc. Indonesia has a lot of resources, whether it is natural resources, land, human resources, etc. This resources may be the factors that enable the Indonesian passenger car tires industry to reach economies of scale faster than the Japanese Industry.

- China

  The TCA_{china} value is 0.888 and this generates two hypotheses that the implementation of mandatory standard will increase the market share of China in domestic market and decrease the market share of domestic passenger car tires industry in China market.

  The market share of China in domestic market for passenger car tires in 2004 is 0.017 and the market share of domestic passenger car tire industry in Chinese market in 2004 is 0.0005.

  The market share of China in domestic market for passenger car tires industry in 2006 is:

$$S_{Chin\text{-}Ind} = \frac{E_{Chin-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{57{,}776}{25{,}984{,}000 - 21{,}396{,}000 + 603{,}244}$$

$$= 0.011$$

The market share of domestic passenger car tires industry in Chinese market in 2006 is:

$$S_{Ind\text{-}Chin} = \frac{E_{Ind-Chin}}{P_{Chin} - E_{Chin} + M_{Chin}}$$

$$= \frac{1{,}012}{115{,}970{,}000 - 48{,}877{,}576 + 2{,}274{,}976}$$

$$= 0.000015$$

In this TCA_{china} partial test, the market share of Chinese industry decreased from 0.017 in 2004 to 0.011 in 2006, this fact defies the first prediction that stated that the Chinese market share will increase in domestic market of passenger car tires due to the implementation of mandatory standard. This is because the technical competitiveness of China compare to Indonesia in 2004 was caused of the low quality product that did not comply to the mandatory standard. The TCA model's weakness is that it cannot cover the case where the industries do not act rationally by keeping their market with trying to comply with the standard regulation. If the Chinese industries tried to comply with the mandatory standard, then they will not lose the market share and the efficiency from the economies of scale.

The market share of domestic passenger car tires industry in Chinese market decreased from 0.0005 in 2004 to 0.000015 in 2006. This fact approves the second prediction that stated that the market share of domestic industry will decrease due to the implementation of mandatory standard.

- Thailand

  The $TCA_{thailand}$ value is 1.143 and this generates two hypotheses that the implementation of mandatory standard will decrease the market share of Thailand in domestic market and increase the market share of domestic passenger car tires industry in Thailand market.

  The market share of Thailand in domestic market for passenger car tires in 2004 is 0.012 and the market share of domestic passenger car tire industry in Thailand market in 2004 is 0.070.

  The market share of Thailand in domestic market for passenger car tires industry in 2006 is:

$$S_{Thai\text{-}Ind} = \frac{E_{Thai-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{77,832}{25,984,000 - 21,396,000 + 603,244}$$

$$= 0.015$$

  The market share of domestic passenger car tires industry in Thailand market in 2006 is:

$$S_{Ind\text{-}Thai} = \frac{E_{Ind-Thai}}{P_{Thai} - E_{Thai} + M_{Thai}}$$

$$= \frac{584,844}{13,880,000 - 9,586,308 + 1,841,472}$$

$$= 0.095$$

  In this $TCA_{thailand}$ partial test, the market share of Thailand passenger car tires industry in domestic market increased from 0.012 in 2004 to 0.015 in 2006. This fact is contradictory to the first prediction that stated that the mandatory standard implementation will decrease the

market share of Thailand in domestic market. This fact might be caused by the increasing demand for passenger car tires in Indonesia is captured by the Thailand Industry rather than other countries because Indonesia and Thailand are having the trade agreement as the member of ASEAN about the common exceptional tariff. This exceptional tariff is an enhancing factor for Thailand's competitiveness.

The second prediction is likely to be excepted since the market share of domestic passenger car tires industry increased from 0.070 in 2004 to 0.095 in 2006. This fact approves the second prediction.

- Malaysia

The $TCA_{malaysia}$ value is 1.020 and this generates two hypotheses that the implementation of mandatory standard will decrease the market share of Malaysia in domestic market and increase the market share of domestic passenger car tires industry in Malaysian market.

The market share of Malaysia in domestic market for passenger car tires in 2004 is 0.010 and the market share of domestic passenger car tire industry in Malaysian market in 2004 is 0.094.

The market share of Malaysia in domestic market for passenger car tires industry in 2006 is:

$$S_{Mal\text{-}Ind} = \frac{E_{Mal-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{60{,}720}{25{,}984{,}000 - 21{,}396{,}000 + 603{,}244}$$

$$= 0.012$$

The market share of domestic passenger car tires industry in Malaysian market in 2006 is:

$$S_{Ind\text{-}Mal} = \frac{E_{Ind-Mal}}{P_{Mal} - E_{Mal} + M_{Mal}}$$

$$= \frac{863,696}{8,240,000 - 1,743,400 + 2,235,968}$$

$$= 0.099$$

In this $TCA_{malaysia}$ partial test, the market share of Thailand passenger car tires industry in domestic market increased from 0.010 in 2004 to 0.012 in 2006, this fact defies the first prediction. The reason for this contradictory fact is the same as in Thailand case. Indonesia and Malaysia are bound in common preferential tariff agreement in ASEAN. This preferential tariff is the enhancing factor for Malaysian competitiveness in obtaining the market share of Indonesian increasing demand.

The market share of Indonesian passenger car tires industry increased from 0.094 in 2004 to 0.099 in 2006. This fact approves the second prediction that stated that the implementation of mandatory standard will increase the market share of domestic passenger car tires industry.

- Republic of Korea

  The TCA_{korea} value is 0.978 and this generates two hypotheses that the implementation of mandatory standard will increase the market share of Korea in domestic market and decrease the market share of domestic passenger car tires industry in Korean market.

The market share of Korea in domestic market for passenger car tires in 2004 is 0.004 and the market share of domestic passenger car tire industry in Korean market in 2004 is 0.005.

The market share of Korea in domestic market for passenger car tires industry in 2006 is:

$$S_{Kor\text{-}Ind} = \frac{E_{Kor-Ind}}{P_{Ind} - E_{Ind} + M_{Ind}}$$

$$= \frac{62,468}{25,984,000 - 21,396,000 + 603,244}$$

$$= 0.012$$

The market share of domestic passenger car tires industry in Korean market in 2006 is:

$$S_{Ind\text{-}Kor} = \frac{E_{Ind-Kor}}{P_{Kor} - E_{Kor} + M_{Kor}}$$

$$= \frac{187,404}{65,230,000 - 37,370,676 + 5,349,432}$$

$$= 0.006$$

In this TCA_{korea} partial test, the market share of Korean passenger car tires industry increased from 0.004 in 2004 to 0.012 in 2006. This fact approves the first prediction which stated that the implementation of mandatory standard will increase the market share of Korean passenger car tires industry in the domestic market.

Contradictory to the second prediction which stated that the implementation of mandatory standard would decrease the market share of domestic industry in Korean market, the market share of domestic passenger car tires industry increased from 0.005 in 2004 to 0.006 in 2006. The reason for this fact may be the dominance of the general implication of TCAI. The general technical competitiveness effect such as economies of scale, resource abundance and technology might have increase the market share of domestic passenger car tires industry in Korean market.

VII. CONCLUSION

Ensuring the quality and safety of the products is the obligation of all producers. Many of the producers do not care about the safety or the quality of their product because of the tight competition in the market. Not only in domestic industry, there are also producers that do not want to ensure the quality of the product so that they do not have to raise the production cost. Sometimes the consumers cannot obtain the information about the quality or safety of a product, for instance in passenger car tires industry. The consumer of passenger car tires cannot detect whether the product they buy is having good quality or not. If the passenger car tires have poor quality, it may endanger the consumer. That is why it is important to put the regulation that will force the producers to enhance the quality and safety of their product.

The implementation of mandatory standard may ensure the safety of the consumers in utilizing the product. The regulation may deter the low quality products that usually have lower price from entering the Indonesia market. The regulation may also prevent the unfair competition by other countries that push the production cost by omitting the quality and safety of the products. Therefore the mandatory standard may subside some of the competitors from foreign country.

After the implementation of mandatory standard for passenger car tires industry, the general performance of Indonesian passenger car tires industry increased. The parameters of the general performance are the market share of Indonesian passenger car tires industry in the world market and the market share of Indonesian passenger car tires industry in the domestic market.

The market share of Indonesian passenger car tires industry in the world market increased from 0.0191 in 2004 to 0.0193 in 2006 after the implementation. While the market share of Indonesian passenger

car tires industry in the domestic market also increase from 0.879 in 2004 to 0.884 in 2006 after the implementation.

The market share of Japanese passenger tires industry in Indonesian market decreased after the implementation of mandatory standard from 0.055 in 2004 to 0.033 in 2006. The market share of Chinese passenger car tires industry in Indonesian market also decreased from 0.017 in 2004 to 0.0005 in 2006 after the implementation of standard requirement. Increasing market share of rival countries in Indonesian market after the implementation of mandatory standard obtained by Thailand, Malaysia and Republic of Korea. The market share of Thailand passenger car tires industry in Indonesian market increased from 0.012 in 2004 to 0.015 in 2006. The market share of Malaysian passenger car tires industry in Indonesian market increased from 0.01 in 2004 to 0.012 in 2006. And the market share of Korean passenger car tires industry in Indonesian market increased from 0.004 in 2004 to 0.012 in 2006.

Despite of the positive effects of the mandatory standard, the quality requirements may also become a burden to the domestic producers that find difficulties to comply the mandatory standard. Quality enhancement may require high investment for research or factory installments. The industry that cannot perform efficiency will be injured due to the implementation of mandatory standard for the reason that the cost increase can make the industry losing their customer because of the tight competition. That is why it is important for the government to predict the implication of the mandatory standard implementation so that the negative effect of the mandatory standard may be anticipated.

It is important for the government to obtain the tools to predict the implication of mandatory standard. Unfortunately there are no models that can forecast the effect of mandatory standard to the domestic industry. What can be done is to measure the competitiveness of the industry in producing the products. To measure the technical

competitiveness of an industry, this paper offers the tools called Technical Comparative Advantage Index (TCAI).

TCAI value is obtained by analyzing the multi dimensions of market share to measure the technical competitiveness of an industry. In this paper, the TCAI calculation uses the main competitors of the Indonesian passenger car tires industry from foreign countries. The main competitors are Japan, China, Thailand, Malaysia, Singapore, Philippines and Republic of Korea. Singapore and Philippines are not included in the TCAI calculation because Singapore do not have the tires industry so it is impossible to measure the competitiveness comparison between the Singapore's industry and the Indonesian passenger car tires industry. The data from Philippines cannot be obtained, that is why Philippines is not included from the TCAI calculation.

The TCAI value for Indonesian passenger car tires industry in 2004 is 1.0002, this value means that the technical competitiveness of the Indonesian passenger car tires industry is above the average of the technical competitiveness of the industries of competitor countries. The General Implication of the TCAI value is that the implementation of the mandatory standard will increase the performance of the domestic passenger car tires industry.

In calculating the TCAI value, there are also other value that is obtained. The value is Technical Comparative Advantage (TCA), It is the value of comparison between the market share dimensions of domestic passenger car tires industry and the market share dimensions of each competitors industry.

The TCA value for Japan's passenger car tires industry is 0.972. The partial implication of the TCA value is that the implementation of mandatory standard will increase the performance of Japan's passenger car tires industry in domestic market.

The TCA value for Chinese passenger car tires industry is 0.888. The partial implication of the TCA value is that the implementation of

mandatory standard will increase the performance of Chinese passenger car tires industry in domestic market.

The TCA value for Thailand's passenger car tires industry is 1.143. The partial implication of the TCA value is that the implementation of mandatory standard will decrease the performance of Thailand's passenger car tires industry in domestic market.

The TCA value for Malaysian passenger car tires industry is 1.020. The partial implication of the TCA value is that the implementation of mandatory standard will decrease the performance of Malaysian passenger car tires industry in domestic market.

The TCA value for Korean passenger car tires industry is 0.978. The partial implication of the TCA value is that the implementation of mandatory standard will increase the performance of Korean passenger car tires industry in domestic market.

There are also some liability tests for this model. There are two kind of liability test, the first is general test to measure the liability of the TCAI value in explaining the fact, and the second is partial test to measure the liability of each TCA value in explaining the fact.

From the general test of the technical comparative advantage Index for Indonesian passenger car tires industry, the parameters that consistent to the TCAI implication are only 100 %, the implication of TCAI is consistent to the facts.

From the partial test of the Technical Comparative Advantage, the parameters that consistent to the TCA implication are only 40%. There are many factors that may disrupt the liability of the TCA values. There can be the dominance of general implication of TCAI, or the existence of preferential tariff that may cause the trade diversions among ASEAN countries, macroeconomic factors, etc.

However, there are many disturbances in this liability test. The data that are obtained may not represent the actual fact, this may be caused by the illegal activities such as smuggling, or other disruptions.

This may also be one of the factor that cause the inconsistency of TCA implication and the facts.

The result of this analysis is that the TCAI is a good model to measure the potential effect of the implementation of mandatory standard to the performance of domestic industry. It is a reliable model that can be used by the government or the private sector to anticipate the effect of mandatory standard implementation. Although the implication of TCA value is not reliable enough because there are many factors that may disrupt the consistency, it is still reliable to be used to measure the vectors of force to change the performance of industry by assuming that all variables are constant.

There are still some limitations in this academic paper due to the data scarcity or the time limitation. The conclusion also only based on one industry, it is important to do further exploration and research that will strengthen the reliability of TCAI and TCA.

APPENDIX 1.

The List of Countries That the Domestic Market Imported Passenger Car Tires From

Exporters	Imported value 2006 in US$ thousand	Imported quantity 2006 (Tons)	Imported value 2004 in US$ thousand	Imported quantity 2004 (Tons)
World	18,562	6,557	19,253	7,999
Japan	5001	1,871	11,818	3,641
Malaysia	2,969	660	1,031	652
Thailand	2,676	846	2,045	807
Singapore	2,179	885	1,785	577
Canada	1,313	155		
United States of America	1,151	198	103	84
Republic of Korea	1,010	679	408	286
Taiwan, Province of China	699	447	231	170
China	555	628	649	1,128
Australia	290	28	19	2
Germany	191	31	206	61
United Kingdom	158	12	22	17
Philippines	104	36	656	318
Czech Republic	61	6	1	0
Switzerland	58	8		
Brazil	54	9	2	2
France	29	7	10	5
Venezuela	17	5	0	
Spain	14	5	81	19
Italy	12	7	5	4
Indonesia	5	1	0	
Turkey	3	1	4	1
Sri Lanka	0		0	
Democratic People's Republic of Korea	0		4	1
Luxembourg	0		0	
South Africa	0		4	4
Sweden	0		0	
United Arab Emirates	0		0	
Egypt	0		0	
Free Zones	0		164	217

Source : trademap.org

APPENDIX 2.

The List of Countries That the Domestic Passenger Car Tires Industry Exported To

Importers	Exported value 2006 in US$ thousand	Exported quantity 2006 (Tons)	Exported value 2004 in US$ thousand	Exported quantity 2004 (Tons)
World	632,580	251,949	394,729	194,603
Japan	167,425	65,466	90,854	46,657
USA	109,735	44,247	39,155	19,991
UAE	51,648	21,029	28,722	13,634
United Kingdom	36,779	13,627	31,528	13,583
Saudi Arabia	36,131	14,960	24,459	12,511
Malaysia	21,472	9,388	13,323	7,799
Egypt	19,434	8,349	15,145	8,113
Thailand	17,204	6,357	11,817	5,195
Belgium	16,518	5,911	9,180	4,054
Australia	12,576	4,630	12,207	5,266
Philippines	9,287	5,633	9,005	6,452
Italy	8,641	2,783	5,410	2,277
Singapore	7,363	3,101	6,632	3,301
Germany	5,555	1,968	4,393	2,011
Netherlands	5,427	1,678	4,827	1,782
Libya	5,391	2,119	2,391	1,130
Pakistan	5,162	2,119	2,696	1,338
Republic of Korea	4,957	2,037	3,466	1,872
New Zealand	4,507	1,619	3,850	1,512
Iran	4,363	1,795	3,444	1,666
Spain	3,926	1,326	4,158	1,789
Sweden	3,842	1,277	3,233	1,186
Sri Lanka	3,739	1,662	3,140	1,596
Papua New Guinea	3,728	1,517	2,490	1,305
Portugal	3,674	1,262	3,491	1,433
Taiwan	3,611	1,568	4,393	2,250
Nigeria	3,034	1,219	1,554	713
Viet Nam	2,962	1,098	1,504	747
Finland	2,727	1,041	2,390	952
France	2,563	917	2,654	1,115
Hong Kong	2,543	988	3,062	1,543
Jordan	2,524	1,183	1,906	1,071
Yemen	2,259	952	978	531
Bangladesh	2,244	963	1,851	992
Brazil	2,111	1,062	809	398
Syrian	2,002	868	2,234	1,148
South Africa	1,967	785	2,393	1,125
Jamaica	1,940	797	1,660	821
Norway	1,814	662	1,632	692
Canada	1,695	658	3,864	1,832

Source : trademap.org

APPENDIX 3.

Production of Passenger Car Tires by Countries (000,000 units)

Year	Japan	China	Taiwan	Korea	Malaysia	Thailand	Indonesia
2003	130.33	49.14	16.61	55.24	7.66	6.83	
2004	132.39	66.06	17.62	61.17	7.59	11.26	24.227
2005	134.81	92.46	19.91	65.66	7.36	12.62	
2006	134.59	115.97	19.71	65.23	8.24	13.88	25.984

Source : Indonesian Rubber Study Group

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