

EE 489: Seminar in Industrial Economics

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“Steel Industry and The Study of Steel Price”

Abstract: Steel industry serves as the country's basic industry and an essential supporter to downstream industry such as construction industry, automobile and real estate sector. Steel industry's growth in Thailand has been in line with the country economic, the brisk expansion of construction industry and real estate sector. Since the global crude steel having fluctuate from 80 million for nearly three decade from the early 1970s; as reported by Iron and Steel Institute of Thailand (ISIT) Steel Statistical Yearbook, and the World largest and second largest steel firms are transnational restructuring, this phenomena cause change in steel production from the early 1970s. Particularly steel production in Asia has shown a significant rise and in 2005 Asia's share of World crude steel reached over 50%. However, Thailand consumption in steel has been stagnated even there is a growth in compound annual growth rate (CAGR). Thai is because Thailand still relies on import of both semi-finished and finished steel products due to lack of raw material and upstream industry. At the end, I hope that with updated variables it will emphasize that Thai Steel price experience a decreasing trend while other countries do not. Or otherwise, if it does it should be revealed in this paper.

Keywords: Steel Industry, Price, Thailand, Government Intervention

Steel Industry and The Study of Steel Price in Thailand

Literature Review:

A comparative analysis of production systems of various integrated iron and steel companies in East Asia shows that the investment for construction and upgrading of production system is the driving force that improves competitiveness of iron and steel in East Asia. In addition, Nozomu (2012) writes extensively that most of steel companies including in Thailand has faced with international competition and system evolution. This study based on a generation model of production systems treats all the countries in East Asia equally homogenous. Leiberman and Kang (2008) compared the productivity of Japanese companied with POSCO and USX , the largest producers in South Korea and the United States. The study shows that the high productivity in East Asia was partly due to over investment in capital equipment. This reveals that maintaining a consistent standard from embodied technology of the capital equipment is needed condition for companies with high capital intensity to remain at international competition.

For the development of steel industry, the domestic market is very important. This is due to high transportation cost therefore a large-scale market is necessary for the existence of large companies. Nozomu(2012) shows that there is huge demand in China, Japan and South Korea, in contrast, the demand is very small in Thailand. This disparity reflects a difference in the scale of automobile production (Nozomu; 2012) and downstream industries such as construction, machinery and industrial, appliance and packaging (ISIT; 2012).

To be the front-runners of system evolution, companies have to maintain long-term relationship with major customers such as automobile assemblers and shipbuilders (Baba and Taki (1997), Kipping (1998)). Some of these companies conducted joint product development programs with their customers (Nakoka and Usuda (2002: 214-223), Kawabata (1995: 71-80)). Companies that are aggressive about foreign direct investment have different key focuses for example Japanese companies focus on the benefit from same level of technology and management implemented in all production units especially in rolling and surface-treating processes (Kawata (2005: 151-158)). While joint venture abroad is considered one way to overcome the problems with limited supplies, they are risky as they involved huge capital investment (Nozomu; 2012). Some studies shows that the to be a leader in Global market some companies such as POSCO made a huge capital investment in R&D (Abe (2008) and Tanaka (2008)).

One of the major explanation of the study suggests that companies can evolve after they have adopted new technologies and upgrading production system in its own way such as through R&D in the case of Baosteel or through alliance with other industries (Nozomu; (2012)). Since China is the largest steel making economy in the World, the study shows that Chinese company called Baosteel Group has equipped the technology transferred from the West German and established an integrated production system for flat products then became a supplier position in automobile steel market (Nozomu (2012)). However in the case of Thailand, Thailand has to import high grade sheets from Japan because there are no reliable local suppliers (Kawata (2005: 151-158) (2008:276-286)).

For cooperate growth through cross-border mergers and acquisitions (M&A), different companies have different purposes for example Japanese companies tend to

focus on internal growth and domestic mergers because they are keen to maintain the level of technology and management for high-grade steel in all of their steel work while some other companies may use this as a tactic when internal growth and domestic mergers are stressed (Nozomu (2012)).

From the perspective of system evolution, one major concern is environmental impacts and solutions (Rungnapa et al 2010, Athiwatr et al 2010, Chatana et al 2010, Thumrongrut et al 2010 [2010]).

Introduction:

Steel industry serves as the country's basic industry and an essential supporter to downstream industry such as construction industry, automobile and real estate sector. Steel industry's growth in Thailand has been in line with the country economic, the brisk expansion of construction industry and real estate sector. Since the global crude steel having fluctuate from 80 million for nearly three decade from the early 1970s¹; as reported by Iron and Steel Institute of Thailand (ISIT) Steel Statistical Yearbook, and the World largest and second largest steel firms are transnational restructuring, this phenomena cause change in steel production from the early 1970s. Particularly steel production in Asia has shown a significant rise and in 2005 Asia's share of World crude steel reached over 50%².

However, Thailand consumption in steel has been stagnated even there is a

¹ Statistics in this paper are from International Iron and Steel Institute (IISI), Steel Statistical Yearbook (various issues), unless otherwise indicated.

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growth in compound annual growth rate (CAGR)³. This is because Thailand still relies on import of both semi-finished and finished steel products due to lack of raw material and upstream industry. The data from Iron and Steel Institute of Thailand (ISIT) analysis and Thai Customs has shown that China is a leader in semi market, while Japan is a leader in finished steel market². Therefore Thai's steel prices have to depend on these countries' economies².

In this paper, China is chosen as it plays an importance role in global steel market therefore is used in determining Thai steel price since it is where Thailand imports crude steel. However, for the simplicity of the study Baosteel Company, a state own iron and steel company and is the second-largest crude steel producer in the World⁴. This makes it possible to acquire the data. Moreover, the reason this paper focuses on China because the quantity imported from China has increased overtime (2005-2012)⁴, therefore, the increase in China steel and iron ore price has significant impact on Thai steel industry. From the Iron and Steel Institution of Thailand data and Trade Map data, it has shown that there is significant growth in import (figure 1). Furthermore, it is reported that cost of production of Thai company is higher than Chinese companies about 15-20%⁵. This suggests that Thailand has low self-supply supply capacity for crude steel, which is account for 47% of total steel consumption⁶.

³~~The year over year growth~~ rate of an investment over specifies period.

⁴ Several studies point to the same conclusion
<http://www.fas.org/sgp/crs/row/R41421.pdf> ,
<http://www.scmp.com/topics/baosteel-group>

⁵ see SCB Economics Intelligent center (EIC) based on Bloomberg data

⁶ Statistics in this paper are from International Iron and Steel Institute (IISI), Steel Statistical Yearbook (various issues), unless otherwise indicated

However, China's increasing steel market share has negative effect on domestic Thai producer⁷.

This paper highlights steel industry in Thailand and seeks to analyze the features and factors that will affect steel price in Thailand on the supply-side. In doing so, it aims to study the relationship steel prices. For internal factor (in-firm factors), the main focus variables are cost of raw material, transportation cost, operation cost, and profit. And from each variable, quantitative research method is used to analyze deep in detail. For external factor (outside-firm factors such as law, economics condition, stage of economy, government), the main focus is China, broadly speaking; the steel price function is the same therefore China should face the same increasing trend cost as Thailand does (figure 2) but how can possibly China's steel price keeps increasing (figure 3) overtime while Thailand does not⁷. However, there is an impact from change in supply side from other major players in the World market which this paper does not take into account for simplicity such as USX (the United States-owned company) POSCO (Korea-owned company), TATA (Indian-owned company)⁸.

The next section will analyze cost of material, transportation cost, operation cost, and profit on how they affect steel price and subset data from each variable respectively. The third section will discuss on the methodology and its result and

1. www.onestockhome.com and Statistics in this paper are from International Iron and Steel Institute (IISI), Steel Statistical Yearbook (various issues), unless otherwise indicated and China Trade Summary www.ustr.gov/sites/default/files/uploads/reports/2009/NTE/asset_upload_file868_15464.pdf

⁸ see Comparative Analysis of Intergrated Iron and Steel Companies in East Asia

implication. The Fourth section will focus on further research. The fifth section is policy suggestion, which will provide policy guidance for future Thai steel industry. And the last section is conclusion remark.

Methodology

Under my assumption, I will study significant variables that affect steel price in Thailand. Since there is no exact number or exact data from each variable available, I will use significant data, which is the subset of that variable to indicate the trend. The methodology used is quantitative research method however, if it does not give result or answer the objective of this paper, I will use quantitative and qualitative research method together for deeper research.

Assumption: $Y = A + X_1 + X_2 + X_3 + E$

-Where Y = price of steel

- A = Constant term in this case it is referred to profit

- X_1 = Cost of raw material

- X_2 = Transportation Cost

- X_3 = Operation Cost

- E = Error term

| Variables | Name of Variables | Expected Effect on Y |
|-----------|----------------------|----------------------|
| A | Profit | + or - |
| X1 | Cost of raw material | + |

| | | |
|----|---------------------|--------|
| X2 | Transportation Cost | + |
| X3 | Operation Cost | + |
| E | Error term | + or - |

Data and Variable

The dependent variable will be steel price and its data figures are collected from Bloomberg, WTO, Coaster Freight Index, custom and from ISIT (Iron and Steel Institution of Thailand). And the main focus independent variables are cost of material, transportation cost, operation cost. For each independent variable, there will be subset data. For cost of raw material and transportation cost, integrating previous knowledge from existing economics papers on crude steel and mining papers respectively is used to explained the trend of these two independent variables. The statistical data used is obtained from analysis of Australia Reserve Bank on China and Mining Investment to explain the trend of raw material price. Also there is average price from OPEC crude oil price available in time-series data (1960-2014) indicating the trend of transportation cost. For operation cost, the minimum wage and purchasing power statistical data is used because steel manufacturers have got processes and management, which relies mostly on labor. From sources of collecting data, there should be sufficient to indicate the trend of each independent variable since they hold high creditability. However, in this study profit is assumed to be a constant term or standard rate according to market theory where profit is zero.

I. Cost of Raw Material

For Thai steel industry, raw material is the major steel cost of production since this cost fluctuates all the time. Due to the fact that Thailand has not

yet developed an up-stream steel industry⁹, it is necessary to import most of raw material from abroad.

Scrap and Iron Ore are the major inputs to steel making and price of them increase overtime because¹⁰ (figure 4 and 5)

- a) Export increases as Dollars weaken and Chinese demand booms (Structural change).
- b) Poor scrap generation and low scrap inventory (cyclical event).
- c) Bad weather which hampers scrap and scrap collection (minor factor).
- d) Availability of iron ore (minor factor).

When the manufacturers realize that the price of raw material decreases and there is a tendency that the price will increase in the near future and if the manufacturers have sufficient capital, they will buy a big quantity of raw material in order to reduce the risk on the increasing price in the future.

II. Transportation Cost

Transportation cost of steel industry is considered one of the performance measurement of the entrepreneur. The result of economics paper, Economics Factors Influencing Logistics Cost of Thai Steel Industry, shows that the transportation cost in steel industry is according to the principle of supply chain and logistics management theory and also relies on other economics factors such as oil price. Additionally, supply chain

⁹ See The Iron and Steel Industry in Asia: Development and Restructuring :

<http://www.ide.go.jp/English/Publish/Download/Dp/pdf/210.pdf>

¹⁰ See Economics Factors Influencing Logistics Cost of Thai Steel Industry:

http://www.iaeng.org/publication/WCECS2009/WCECS2009_pp1203-1209.pdf

and logistics management (SCM)¹¹ is the “systematic coordination of the tradition business and the tactics across the business functions within a particular company and across business within supply chain, for the purpose of improving the long term performance of the individual companies and the supply chain as a whole”. Through the multi-regression model based on economics paper EVIEW is used as a tool to determined and analyze for parameters selection into the logistics cost model. Transportation cost depends on the amount of warehouse, diesel price and the number of labor⁸.

a) **The amount of warehouse:** Warehouse acts as linking activity between seller of raw material and steel manufacturers or between manufacturers and consumers. Since raw material or finished steel products are kept at the warehouse to wait for further deliveries, locations of the warehouse of the steel products are mostly in the same location as the production for future transportation. As we can see there is more interaction between firm and others or firm and consumers at local level rather than offshore or off-district. Hence, the further distance of the warehouse will add up more transportation cost. In reality, firms will not bare the transportation cost and will pass that to consumer based on the distance. This results in relatively low comparative advantage for firms in Thai steel industry as consumers can choose firms that are able to minimize the transportation cost. To be comparative advantage, some firms have more than one warehouse

¹¹ see http://en.wikipedia.org/wiki/Supply_chain_management#cite_note-Definition-2 and Mentzer, John T., William DeWitt, James S. Keebler, Soonhoong Min, Nancy W. Nix, Carlo D. Smith, & Zach G. Zacharia (2001): Defining Supply Chain Management. Journal of Business Logistics, Vol. 22, No. 2, pp. 1–25.

or rent free space from other firms.

- b) **Diesel price:** diesel price has positive relationship with crude oil price.

OPEC crude oil price is defined by OPEC (reference) basket. This basket is an average price of petroleum produced by OPEC member. The statistical data has shown an increasing trend from 1960 to 2014¹².

- c) **The number of labor:** labor considered as the derived demand¹³ or the demand for factor that is used to produce final product. Based on economics paper, labor is used as part of handling activity through creating the circulation of product. In steel industry, labor will help smooth the production process throughout supply chain and is required to specialize in using machine such as lifting machine, crane or other special tools for product delivery. Due to economics theory, profit maximization firms¹⁴ aim to achieve optimal point of production through minimizing cost. Generally, all costs are related to each and have impact on output quantities subject to short run and long run. In short run, U-shaped average cost (AVC) is variable cost typically labor cost per unit of output. $SRAVC = wL/Q$ where w is wage, L is quantity labor used and Q is quantity of output produced. Assuming Q is fixed, the result of minimum wage policy¹⁵ increases the average variable cost in Thai steel industry since firm incurs more cost (figure 6). Extensively, the higher the value of delivered product, the more labors are needed both in delivery and handling materials.

¹²See <http://www.statista.com/statistics/262858/change-in-pec-crude-oil-prices-since-1960/>

¹³see http://en.wikipedia.org/wiki/Derived_demand

¹⁴See http://en.wikipedia.org/wiki/Profit_maximization

¹⁵CEIE, TMB analysis

III. Operation Cost

Steel industry have got processes and product management which rely mostly on staff and labor

- a) Customer response management: One economics paper based on Thai steel industry has found that Thai steel manufacturers have organized customer services in order to response to customers 'needs. This mean is used as a marketing tool to promote the repurchase⁸. This is due to the fact that most of manufacturers have no direct contact between manufacturers and consumers. However, this activity requires small number of staff, however operation cost incurs through sample delivery activity in order to promote sale and consumer satisfaction.
- b) Reverse logistics activities: in the purchase there is a document specified the quality of the steel if the actual product's quality does not match with the specified document, manufacturer firm has to get responsibility to replace and get the product back. These activities include the return of products and sending back of products, collection of containers for reuse and recycle

etc⁸. IV. Profit

In this paper, profit is assumed to have either positive or negative to the steel prices. According to market theory in competitive market¹⁶ where there is zero profit, this explains why profit is assumed to be fixed. For profit to be negative relationship with steel price, there is a case when firms and manufacturer firms decide to reduce their own profit margin and not to increase their prices while production cost increase to maintain

¹⁶ see http://en.wikipedia.org/wiki/Perfect_competition

consumer relationship and maintain quantity sold. On the other hand, profit can have positive relationship with steel price due to economics theory that profit will attract new firm and increase supply resulting in increase in steel price.

Result and Implication

After conducting the quantitative research, with no biased, the data set has shown that there is the positive relationship between each dependent variable to price of Steel since each subset of the dependent variables has indicated **the increasing trend** while in reality the steel price decreases whereas it increases in China therefore Thai manufacturers get less and less profit margin while¹⁷ China manufacturers get more and more (figure 7). However, there should be the same for China as these dependent variables are significant in explaining independent variable or steel price in both countries. Since the result does not give any meaningful result, there should be qualitative factors to explain the difference in price such as government support since the data from ISIT has shown that Chinese government encourage its steel industry competitiveness through effective government support. As the result of this, China steel industry has benefit from localization and economies of scale through government policy that makes China have strong influence in steel market. Localization: the research has shown that there is sufficient demand help smooth the production process in China both from downstream production and government support. Economies of scale: Bao Steel is the obvious example steel company that is owned by state and become the World second largest crude steel production due to the fact that Bao Steel has benefits from economies of scale. As the result of this,

¹⁷ See Economics Policy and the Growth of Local Manufacturers in Thailand :

China holds dominance power in the World steel market since it can produce in large quantities at the relatively lower average cost comparing with the rest of the world¹⁸.

Government support in this case include research and development, new technology support, government guarantee, institutional support such as law, and public good such as road, high way and communication support, etc. This suggests that future of Thai steel industry can be rebound through the role of government intervention¹⁷.

In addition, with regard to sectorial policies, once Thai government has tried to promote the development of selected industries. To promote automotive industry, the ministry of industry set up the Automobile Development Committee in 1969¹⁷. At the beginning of the 1980s, the government established a petrochemical industry and integrated steel industry in order to support automotive industry. However, for steel industry government's actions have not been effective, nor been carried out with clear development purpose. Comparing with the governments of other East Asia nations, which have actively tried to intervene in the market deliberately in steel industry, the role of government in Thailand is minimal in term of industrial policy¹⁸. It may be concluded that the framework of conservative policy, the private sector has to expand their investment, in line with the increasing demands of the domestics market in order to survive. In response to the country's integration into the world economy nowadays, Thai manufacturers must strengthen their competitiveness from their own effort.

¹⁸ See Comperative Analysis of Intergrated Iron and Steel Companies in East Asia:

https://www.academia.edu/5937338/A_Comparative_Analysis_of_Integrated_Iron_and_Steel_Companies_in_East_Asia, The Lessons of East Asia, Thailand: The Institutional and Political Underpinnings of Growth, World Bank : http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/1993/10/01/000009265_3970128110053/Rendered/PDF/multi0page.pdf

Further Research

To improve the result to be close to reality, robustness and more credibility, the further investigation can be listed as follow. First, there should be the regression analysis to see the effect of Automobile Development Committee in 1969 before and after since this committee indirectly favors steel industry by integrating steel industry in order to support automobile industry. Since this paper focus mainly on supply side and leave the demand side constant, the study should also focus on demand side of the industry as well as the data from World Bank shows that there is a swing in World GDP. Third, The main focus in this paper is China however, the result would be more accurate if Thailand is compared with the countries that share same characteristics of economy, market size, culture of government and the stage of the economy since every economy has its own unique characteristics derived from its originate, to elaborate this, Thailand originates from Sakdina system while China from communism. Fourth, the steel price function in methodology should assign weights on each variable since each variable has different effect on the independent variable (Y). Finally, the data should be adjusted to real term to be more accurate.

Policy Guidance

If you accept the result that Thailand experience the decreasing trend in price while others experience the opposite price direction and agree that government intervention will favor steel industry. Then government should support the domestic production capacity to help them meet the efficiency point through government project and strong downstream industry (automotive, construction, real estate, etc). Furthermore, Capital investment and technological upgrading may be the key to built the competitiveness from the inside then the industry can be able to growth from their

own effort from manufactures to steel firms. Government can prevent the price fluctuation from outside country since we rely on international trade through exchange rate as this will help maintain stable raw material price for upstream production. As the result of this steel firms or agents will be able to survive and downstream industry will benefit from lower steel price. In addition, many studies about steel industry have been carried out over the past decade and most of them aimed to improve the performance of the industry requiring the role of government intervention. In order to support and develop logistics system, Thai steel industry has potential of developing logistics and supply chain system strived for cost and time reduction in supply chain. Following is the important guideline:

- a) Reducing non-value added activities: This will increase effectiveness in firms' performance including production process throughout supply chain, fully utilized capacities etc.
- b) Planning effective transportation: Infrastructure provision such as road, ship, railroad and highway that help smooth the delivery process in term of time and distance.
- c) Increasing the effectiveness of production demand in relevant to the need of customer and transportation plan: This requires the support from downstream industries such as real estate, construction, automotive industry etc.
- d) Developing the information technology system to link and exchange information inside organization and outside organizations; between firms and manufacturers, firms and firms, firms and consumers and firms and government.
- e) Research and Development and technology upgrading: this will help steel industry in the long term and also technology upgrading will help to increase

production capacity. Moreover, based on economics paper it shows that USX (the United States-owned company) POSCO (Korea-owned company), TATA (Indian-owned company) or Bao Steel (China State-owned company) are able to grow because high capital injection at the beginning and also benefit from their technology upgrading¹⁹.

Conclusion Remark

Extensively beyond the result and implication, there is no doubt that the Thai state has an important role in economic development in Thailand. But overall trade and development policies have not always been indispensable in explaining Thailand's economics success. The government has never tried to control the allocation of credit and foreign exchange, as has been the case in China or other East Asian nations. The experience of Thailand's development shows that macroeconomics management and infrastructure investments are the most essential factor undertaken by government. Conservative fiscal and monetary policies and infrastructural provisions have made it possible for private sector to grow.

But keep in mind that this study still need specific indicators on the dependent variable and minimize the error term in the equation. The qualitative and quantitative analysis in this study seem to be simple and there are more qualitative factors beyond government intervention therefore we need more advance model for further study. However, there is nothing that will hold constance in the same time and in reality there are uncertainties occur that will affect steel industry (confidence of investors, season, macroeconomic factor such as exchange rate, political, etc.) so the

¹⁹ See Comperative Analysis of Intergrated Iron and Steel Companies in East

Asia:

[https://www.academia.edu/5937338/A Comparative Analysis of Integrated Iron and Steel Companies in East Asia](https://www.academia.edu/5937338/A_Comparative_Analysis_of_Integrated_Iron_and_Steel_Companies_in_East_Asia)

result and data must be profoundly regard to the actual circumstance. So to be able bring growth in steel industry, government should promote the industry and must not copy other success country or company as a model but they should develop their own strategy from nation own resources in their hand like human capital development and innovation.

Appendix:

Figure 1

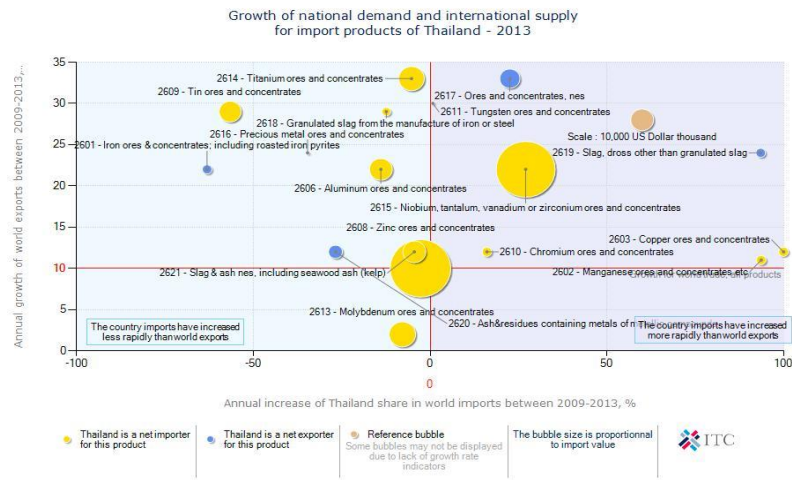


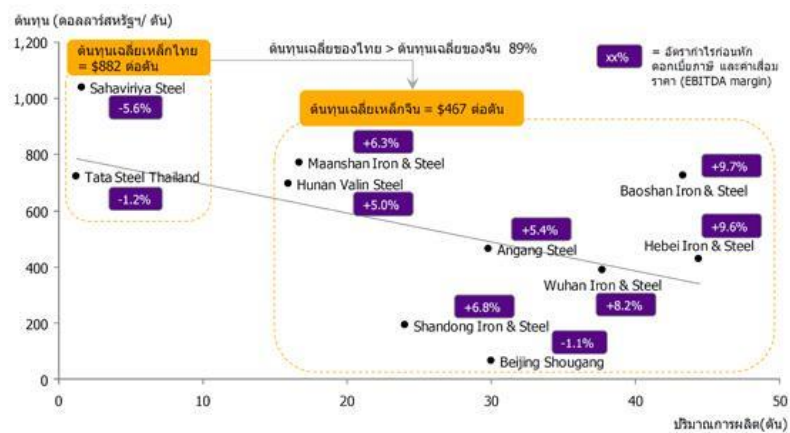
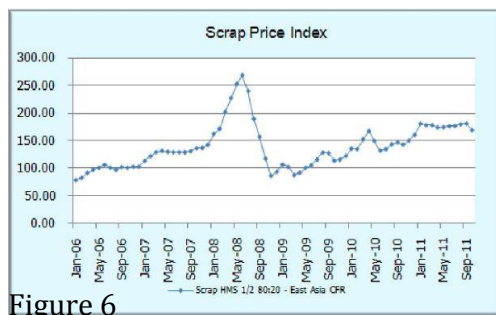
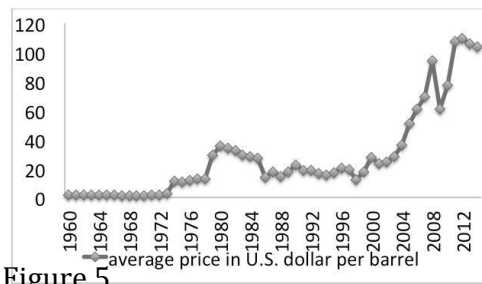
Figure 2



Figure 3



Figure 4



ที่มา: การวิเคราะห์โดย SCB EIC จากข้อมูลของ Bloomberg

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