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The Vietnamese Iron and Steel Industry in Transition to a Market Economy —Attainments and Challenges—

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Abstract

The aim of this paper is to examine the attainments and challenges of the iron and steel industry in Viet Nam. The demand for steel in Viet Nam is increasing, with a focus on construction steel. While low-level industrialization is a restraining factor for the industry, the high steel intensity of the economic structure is a promotional factor. Steel production is increasing in line with domestic demand. Private and foreign-affiliated enterprises are the main players in the expansion of steel production. Market selection based on survival of the fittest is working well. In general, the transition to a market economy is showing considerable results in Viet Nam. However, the industry still faces some challenges. While the low operating ratio due to excess capacity is a by-product of market-oriented reform rather than governmental intervention, the poor performance and governmental support of state-owned enterprises show an insufficiency of reform.

Keywords: iron and steel industry, Viet Nam, transitional economy, excess capacity

1. Introduction

1.1 The Purpose of this Study

The purpose of this study is to examine the achievements and challenges of the Vietnamese iron and steel industry in transition to a market economy. In particular, it seeks to confirm whether import substitution, production expansion, and streamlining of production facilities has been promoted by the competitive pressures that result from market-oriented reforms. Such confirmation also means the inspection of any remaining

distortions to market competition by governmental interventions. Moreover, it tries to establish the particular characteristics of the organization of this industry.

1.2 The Vietnamese Iron and Steel industry and Market-Oriented Reform

1.2.1 The Start of Industry Studies in Japan-Vietnam Joint Research

We first present the analytical perspective through a review of previous studies, which are examined in parallel with an explanation of the industrial development process.

Until the first half of the 1990s, there was no academic research into the Vietnamese iron and steel industry in the English language, because the size of the industry was very small. The Japan-Viet Nam Joint Research project (JVJR, 1995-2001) on market-oriented reforms pointed to the issue of industrial development for the first time.[1]

There were three phases in JVJR. Through the course of the research phase, the conception that Viet Nam has to promote market-oriented reforms and industrialization under the condition of liberalization of international trade and investment became a common understanding in the project (Imaoka and Ohno [1995], Ohno [2000], Ohno and Kawabata eds. [2003]). In this process, the Viet Nam team demanded a policy that promoted the iron and steel industry through the creation of a large-scale integrated iron and steel complex. The Japanese team maintained a cautious attitude to this policy until the end of the third phase; their approach was based on changes in development policy and previous examples of steel industries in other developing economies.[2]

Before the Viet Nam project was undertaken, POSCO in South Korea[3], China Steel Corporation (CSC) in Taiwan[4], and Bao Steel in mainland China[5] were considered as successful examples of the promotion of the iron and steel industry in developing countries. All of these projects involved newly designed integrated iron and steel works and started in

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[1] The formal title of JVJR was "The economic development policy in the transition toward a market-oriented economy in the Socialist Republic of Viet Nam." It was based on an agreement made during the Japan-Viet Nam summit meeting in April 1995. It was classed as a joint research between Japan International Cooperation Agency (JICA) and the Ministry of Planning and Investment (MPI) of Viet Nam. It was frequently called the "Ishikawa Project" in tribute to Professor Shigeru Ishikawa, who was a chief director of joint research. For a retrospect of this research project, see chapter 5 of Ishikawa [2006].

[2] In this section, the author replicates the recognition of the Japanese team of JVJR phase 3, while researches that were published after JVJR are also referenced. In the author's opinion, the recognition by the Japanese team of JVJR of this policy is legitimated after carefully considering the latest research.

[3] On the construction of POSCO, see Mitsubishi Research Institute [1981], Park [1989], Juhn [1991], D'Costa [1994] [1999], Kojima and Watanabe [1983], Hogan [2001], Abe [2008a] [2008b], and Fujimoto [2009].

[4] On the construction of CSC, see Syu [1995] and Yukihito Sato [1999] [2008].

[5] On the construction of Bao Steel, see Meng [1994], Otsuka, Liu and Murakami [1998], a series of Wang's paper including Wang [1996] [2002a] [2002b], Li [2000] [2001], Inoue [2008], Sun [2005], and a series of Liu's papers including Liu [2003a] [2003b] [2005] [2011]. In JVJR, the Japanese team referred to Sugimoto [1998], an unpublished master's thesis.

1960s or 1970s. Moreover, the development of a major steel industry was considered to be a core element of industrialization or the upgrading of the industrial structure in each economy. Governmental initiative was also strong, with the active participation of state-owned enterprises (SOEs). Protection policies for import substitution were implemented. The researchers who investigated these successful cases generally expressed a degree of appreciation for the positive role of government.

Since the 1980s, however, these success stories have not been reproduced in South East Asia. From the 1970s to the first half of the 1980s, the governments of ASEAN economies adopted import substitution policies in capital-intensive industries. As part of these efforts, they tried to promote active investments by state-owned enterprises and to apply protective trade policies (Kitamura ed. [2007], Suehiro [2000] Chapter 6 and 7). However, this policy failed, because of the overinvestment compared with domestic market size; difficulties in obtaining funding under the world recession in the first half of the 1980s; and heavy burdens on governmental budgets (Kitamura [1997]). In Philippines, Indonesia, and Malaysia, the construction of large-scale integrated steel companies was promoted by SOEs. In Philippines and Malaysia, these projects collapsed. In Indonesia, Krakatau Steel installed a medium-sized integrated iron and steel complex, based on direct reduction technology; however, it suffered from long-term managerial inefficiency.[6] Success stories like POSCO and CSC were not replicated in South East Asia. After this experience, ASEAN governments withdrew from protectionist approaches. Instead, they introduced export-oriented policies on the premise of the liberalization of trade and investment. They introduced foreign direct investment by multinational enterprises and promoted exports based on the region's comparative advantages.[7]

Taking account of the previous cases, the Japanese team maintained a cautious attitude when the Vietnamese government proposed the immediate construction of a large-scale integrated iron and steel complex as a core element of industrialization.

However, the Japanese team accepted the modest efforts towards the promotion of the iron and steel industry. At first, Imaoka and Ohno [1999] found that exports of manufactured products led to major imports of parts and other capital goods to Viet Nam, because of its weak industrial base. This phenomenon was apparent in iron and steel, because these were materials required for machinery and the construction of houses and

[6] During the JVJR research, the real picture of Krakatau Steel could not be grasped by the participants due to the lack of studies reported in English or Japanese. The situation was revealed in Yuri Sato [2008].
[7] Regarding this change of industrialization model, see Ohno [2003] and Kimura [2004]. On steel industry policy, see Kawabata [2005], pp.81-83. World Bank [1993], which had become popular in the JVJR period, emphasized such open and export-oriented approaches, while making mention of the failure of the Heavy Industries Corporation of Malaysia Berhad (HICOM).

buildings. Steel represented the highest value among import inducement coefficients of production by industry in the period of 1989-95 (Imaoka and Ohno [1999], p.215). Taking account of this result, the Japanese team argued that a strategy of gradual creation of the steel industry was needed to fulfill the domestic demand for steel that would be induced by export-oriented industrialization (Japanese members of Trade and Industry Group [2001], Kawabata [2003], p.174, Kawabata [2005], p.174).[8]

1.2.2 Steel Industry Promotion Policy by the Vietnamese Government

In JVJR, the Vietnam Steel Corporation (VNS), a group of SOEs, or joint ventures between VNS and foreign companies, was assumed to be a business entity within the steel industry. The Japanese and Viet Nam teams of JVJR thought it was possible for VNS to make and carry out a reasonable development plan with modest protection that would not interfere with international economic integration. However, the Japanese team added that the participation of a foreign company was necessary to execute large-scale investment with state of the art technology (Japanese members of Trade and Industry Group [2001], p.3, Kawabata [2001], p.164).

VNS drafted a master plan for the development of the iron and steel industry, in which a gradual construction strategy was specified. Based on this plan, a cold-rolling company and a mini-mill with an electric arc furnace (EAF) were installed. This was in line with the recommendations of JVJR. However, the Vietnamese government changed its attitude in the mid-2000s. The decision-making process was not clear, but the commitment of the government to VNS's development plan weakened remarkably. Instead, the government welcomed the entry of foreign and private companies, including 100% foreign capital investments.

While this change was in line with progress to a market economy, it was accompanied by one insufficiency and one overshooting. The insufficiency was that the government did not adequately follow through on VNS's investment plan in the long products sector, in which many private companies subsequently emerged. The overshooting occurred when the central and local government issued licenses to large-scale projects by foreign investors without detailed examination. Some projects were very speculative, where promoters tried to get licenses and occupy possible industrial sites without concrete plans for the

[8] Some researchers paid attention to the backward linkage effect on steel from consuming industries in research on South Korea (Kojima and Watanabe [1983], Imaoka and Ohno [1985]). After the completion of JVJR, this approach attracted more attention in the search for opportunities for the iron and steel industry in developing economies under economic liberalization. See Hajime Sato [2014], pp.23, 24, 27, and the research cited.

construction of factories (Kawabata [2007]). Under these policy changes, steel production in Viet Nam nonetheless expanded.

After the completion of the JVJR project, an investigation of the Vietnamese steel industry was carried out by the NEU-JICA Joint Research (2001-2004) team that was the successor to the JVJR's Trade and Industry Group, the Vietnam Development Forum (2004-) that was a center of a joint project between the National Graduate Institute of Policy Studies (GRIPS) and the National Economics University (NEU), and a research group that was organized by the Institute of Developing Economies (IDE). In these three research groups, Nozomu Kawabata proposed the modification of industrial policy to fit the prevailing global market economy, because the growth of private and foreign companies had elevated the industry to a new stage (Kawabata [2005] [2007]). With regard to the long sector, he proposed competition on an equal footing between VNS and private companies. With regard to large-scale projects in the flat products sector, he emphasized that government should check the quality of projects even during the transition to a market economy (Kawabata [2005] [2007]). He also suggested the promotion of environmental regulations and trade liberalization with a rational sequence and at a steady speed. Around the same time, a member of Waseda University's Vietnam Research Institute investigated large-scale projects by foreign companies (Hokura [2010]).

In the 2010s, however, research on the Vietnamese iron and steel industry faded out. Only two papers were published in the Japanese language. One involved research on the business models of cold-rolling companies in Thailand and Viet Nam (Kawabata [2011]), while the other was an overview of the steel industry in ASEAN economies (Hokura [2014]). An investigation is now required into the market situation after the global financial crisis, focused on improvements in import substitution and the modernization of production systems in the industry.

A noteworthy fact is that the construction of a large-scale iron and steel complex by Formosa Ha Tinh Steel (FHS) is scheduled to start in 2016. FHS will greatly change the production structure of the Vietnamese iron and steel industry. A total review of the achievements of the industry will be beneficial before this major change and is necessary to reveal what kind of future will be possible for the industry—i.e., whether FHS will be a strong competitor or a business partner for the existing producers.

1.2.3 Vietnamese Iron and Steel Industry in ASEAN Economies

Iron and steel industries in ASEAN economies have shared the common challenge of finding a development path without large-scale integrated production systems. In 2000s, an

IDE research project investigated the real situations of Thailand, Malaysia, Indonesia, and Viet Nam (Hajime Sato ed. [2007][2008]). On the one hand, this research revealed how the peculiar social and economic conditions of each country defined the developmental path of its industry. On the other hand, based on the investigation of the Thai case, the research revealed common tendencies that were brought about by export-oriented development led by foreign investment (Kawabata [2008]). The tendencies are that the room to grow is provided by the backward linkage effect from exporting industries; and that early expansion of the demand for high-grade steel leads to segmentation of the steel market. Such segmentation was also observed in Viet Nam, while demand within the high-grade segment was very small (Kawabata [2007][2011]).

Though the Vietnamese steel industry is a latecomer even among ASEAN economies, it is growing rapidly. An analysis of its import-substitution path and production structures in comparison with other ASEAN economies is needed and provides the focus of this paper.

1.2.4 Market-Oriented Reform under Worldwide Excess Capacity

In the 2010s, the situation of excess capacity in the global iron and steel industry gained much attention. According to statistics from the OECD Steel Committee, the volume of global capacity reached 2.164 billion tons, while total demand of the world was 1.648 billion tons. The demand-supply gap was thus 516 million tons (OECD [2015], p.7). The capacity has increased since that estimation. The OECD indicates governmental intervention as a major cause; more specifically, excessive issuance of licenses, provision of subsidies for additional facilities, and the existence of outdated facilities are found to distort market functions (OECD [2015]). However, OECD does not identify these issues with any particular economies.

With regard to excess capacity, it is natural that China stands out, as it carries the most unutilized capacity in the world. However, other emerging economies like Viet Nam are also causing concern. In the prevailing situation of excess capacity, a rapid expansion is likely to be considered as anti-competitive behavior. Viet Nam in particular is questioned by other economies as to whether its current expansion is the fruit of a free market or represents continued governmental intervention, given that it is a transitional economy that still proclaims itself to be a socialist state.

Previous studies from JVJR to VDF tried to identify the most desirable policies for the industrialization of Viet Nam, while recognizing the reforms leading toward a market economy and international economic integration. Instead, what is now required is to check

whether the current policies are anti-competitive or market-distorting from the perspective of the world steel industry.

1.3 Perspective and Outline of this Study

1.3.1 Analytical Perspective

This study assesses the development of the iron and steel industry in Viet Nam, in particular to establish whether production and import substitution have progressed in line with market expansion; whether this expansion is the result of market-oriented reforms; and whether competition is used as a primary criterion of development.

First, domestic demand is analyzed and its nature is compared with that of other ASEAN economies. High importance is attached to the relationship by which domestic demand conditions the structure of production.

Next, capital investment and production are analyzed. On the one hand, we review the issue of whether modern technology that meets international standards has been adopted. On the other, the extent to which the technology chosen is adapted to domestic market needs is investigated. Such a dual approach is necessary, because even technology that is inferior from an international perspective could serve the Vietnamese market.

Moreover, when the technology and investments are investigated, not only the level at any given time must be assessed; chronic trends also weigh heavily. Small production scales and technology that is not state of the art do not necessarily lead to a low valuation. Instead, the issues to be emphasized are whether there is a tendency to modernize the technology to meet demand and whether companies that do not receive governmental subsidy tend to dominate the market. If the trend of the survival of the fittest is observed, we can say that market-oriented reform in Viet Nam is working in the iron and steel industry and is promoting industrial development.

In conjunction with the analysis of industrial organization, an assessment of governmental trade and industry policy is needed. The criteria include progress in the reform of SOEs, the growth of private and foreign companies, and interventions with exports and imports.

1.3.2 Structure of the Paper

In section 2, the expansion of the Vietnamese steel market is analyzed. In comparison with other ASEAN economies, the degree of expansion and the market mix of customers and products are evaluated. In Section 3, steel production and capital investment are analyzed. First, the types of customers and products that have featured in the promotion of

import substitution are investigated. Second, the kinds of enterprises that have promoted capital investments in the industry, and the types of technology they use, are revealed. The importance of the emergence of FHS is also emphasized. In section 4, the steel trade in Viet Nam is validated. The nature of the export and import of steel products is revealed. The main issues are whether the export drive intensified because of excess capacity or not and the extent to which the impact of import penetration was reinforced by excess capacity abroad. Concluding remarks are presented in section 5.

2. The Steel Market in Viet Nam

2.1 Growth of Domestic Demand

Figure 1 shows the changes of steel demand in ASEAN economies.[9] Demand in Viet Nam grew year by year in the first half of 2000s and surpassed 9 million tons in 2007. After that it showed an up-and-down trend, but reached its historical record at 11.769 million tons in 2013. Though the volume was at the bottom of the ASEAN 6 in 1990, it rose to third position behind Thailand and Indonesia in 2013.

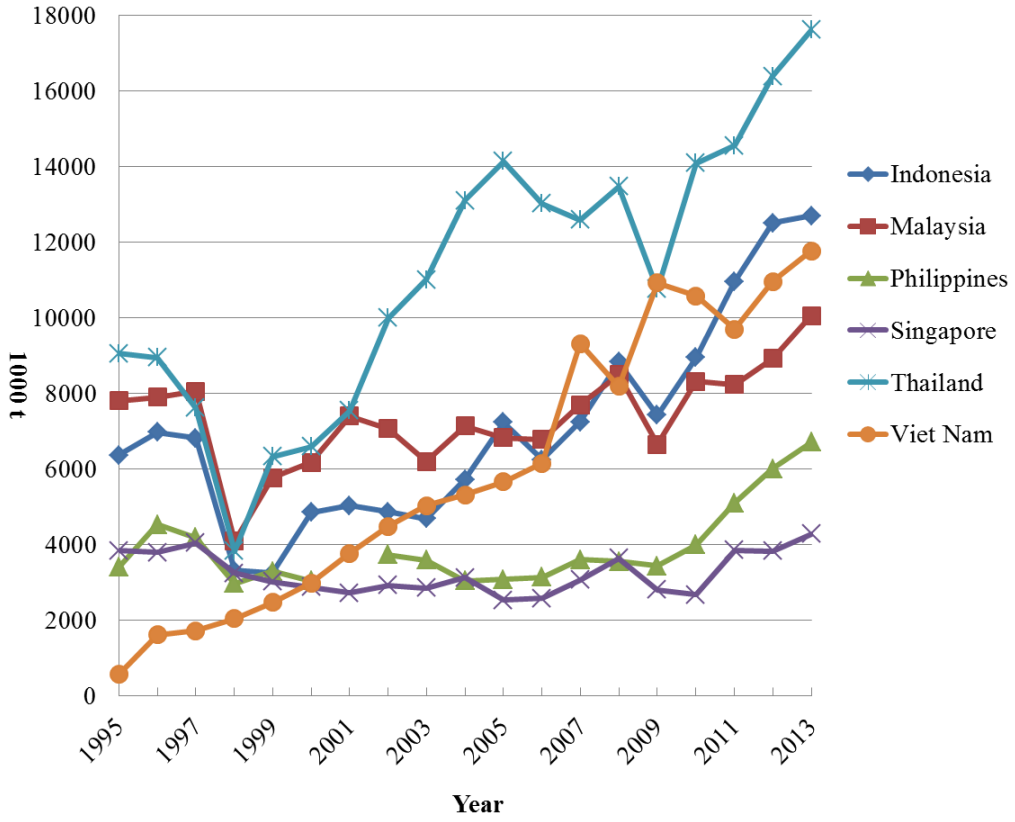
Total GDP in Viet Nam is ranked fifth and GDP per capita is at the bottom of the ASEAN 6 nations. Viet Nam's third position in steel demand reveals the high steel intensity (steel consumption per GDP) of the Vietnamese economy. The intensity in Viet Nam is 24.7 g/USD, the highest among the ASEAN 6, while Thailand is second at 17.9 g/USD.[10] This means that economic growth in Viet Nam relatively strongly induces steel demand.

[9] This paper frequently uses statistical data from the South East Asian Iron and Steel Institute (SEAISI). When figures for production, exports, imports, and consumption are noted without citation footnotes, all of these are cited or calculated from SEAISI [various years].

In this paper, apparent consumption in physical terms is considered to represent demand. Apparent consumption equals production plus imports minus exports. That is to say, apparent consumption represents a demand indicator that does not consider changes in inventory. Production methods in the iron and steel industry include multi-stage processes, like iron making, steel making, rolling, and surface treating. Rolling includes hot rolling and cold rolling. Tubing processes are added after steel production to make pipe and tube products. In such multi-stage processes, demand volume varies depending on the stage involved. In SEAISI statistics, apparent consumption is measured by production of hot-rolled products plus imports of total steel products minus exports of total steel products. In ASEAN economies, many companies make cold-rolled sheets from imported hot-rolled sheets, or make surface-treated products from imported cold-rolled products. For this reason, using hot-rolled products as a measure of production is better than using total steel products in order to avoid a duplicate count.

[10] GDP and GDP per capita are cited from World Bank database (http://data.worldbank.org/) (Retrieved April 28, 2015). Purchasing power parity in 2011 prices is used.

Figure 1. Changes in Steel Demand in ASEAN Economies



Source: Calculated by author from SEAISI [various years].

Changes in demand show a strong relationship with fluctuations in the macro economy, especially with regard to investment. The Viet Nam economy recorded a growth of 8-9% per annum from 2005 to 2007, in which time the investment boom occurred (CIEM [2013], p.44). Since the world financial crisis began in 2008, however, the growth rate has declined. Though the governmental stimulus policy temporarily lifted the economy, it turned to restrictive policies in 2010-11, because inflation occurred. The average growth rate of total investment in Viet Nam was 13.4% in 2002-2006, but this shrank to 8.3% in 2007-2011. In the latter period, the rate for each year showed sharp fluctuations at 27.0%, 7.8%, 11.4%, 7.8%, and -9.3%, respectively (CIEM [2013], pp.80-81). Such fluctuations in investment affected the apparent consumption of steel after a certain time lag.

2.2 The Composition of Domestic Steel Demand

2.2.1 Small Demand in Manufacturing

What are the features of the Vietnamese steel market in comparison with the other ASEAN economies? We will start with the demand by industry.

It is not easy to grasp the demand volume by industry. Such statistics are not available in ASEAN economies. The only investigation that was carried out over many countries is the annual review done by Japan Iron and Steel Federation (JISF) in cooperation with trading companies in each country. A review in 2012 that was contained in a report from the Ministry of Economy, Trade and Industry of Japan (METI [2014], p.7) found that steel demand in construction was as high as 65% in Viet Nam; it was 54% in Thailand, 38% in Malaysia, and 61% in Indonesia. Conversely, demand in manufacturing was as small as 3% in Viet Nam; it was 16% in Thailand, 14% in Malaysia, and 19% in Indonesia.

Let us estimate the concrete situation of demand in manufacturing, based on the production of steel-intensive products (Table 1).[11] In Viet Nam, the production volume of four-wheel (4W) vehicles and electrical home appliances is smaller than that of Thailand or Indonesia. In particular, the production of 4W vehicles is small at 44.7 thousand units in Viet Nam, while 2.4 million units are produced in Thailand and 1.1 million in Indonesia.

Estimation of steel demand for the production of 4W vehicles is achieved as follows: a value of 1.152 thousand kilograms is used, being the estimated steel use per sub-compact

Table 1. Production of automobile and electrical equipment in ASEAN economies

	Viet Nam	Thailan	Indonesia	Malaysia	Philippines	Japan
Four wheel vehicle(2012)	40,470	2,429,142	1,065,557	569,620	55,360	9,943,077
Motor cylcle(2012)	3,634,500	2,606,161	7,079,721	-	588,458	563,169
Refrigerator(2011)	(911,000)	6,505,000	2,857,000	422,000	301,000	2,006,995
Washing machine(2011)	(582,000)	5,872,000	729,000	312,000	645,000	2,292,249

Note: Refrigerator and washing machine in Viet Nam is the number in 2010.
Original Data: Japan Electrical Manufacturers' Association (JEMA) for refrigerator and washing machine in ASEAN economies. Ministry of Economy, Trade and Industry for those items in Japan.
Source: General Statistical Office of Vietnam (2014), p.505 for motor cycle in Viet Nam. Japan Automobile Manufacturers Association (JAME) for motor cycle in other economies. Matsuoka (2012) for electrical home appliance in ASEAN economies.
Website of JEMA in Japan (http://www.jema-net.or.jp/Japanese/data/data1.html) (Retrieved March 6, 2015).

[11] In manufacturing, the physical indicators of production volume of various products are available, while steel demand in a specific industry does not imply the use of specific steel products. For example, thick plate is used not only for shipbuilding, but also for construction; galvanized sheet is used not only for automobile bodies, but also for house roofs. For this reason, the steel demand of a particular manufacturing industry cannot be estimated by the kinds of steel products required. Instead, this demand can reasonably be estimated through the production level of manufactured products and the steel use per unit product.

car in Japan (Tamaki, Daegu, Hayashi, Matsudo, and Adachi [2009]), because this number is not available for Viet Nam.[12] By multiplying this by the number of units produced, demand from 4W vehicle production is obtained, this being 2.798 million tons in Thailand, 1.228 million tons in Indonesia, and only 47 thousand tons in Viet Nam. This represents differences of more than 2.3 million tons behind Thailand and more than 1 million tons behind Indonesia.

The production of motor cycles in Viet Nam is greater than in Thailand, while smaller than that in Indonesia. This is sure to lead to a steady demand for cold-rolled sheet and structural pipe. However, the steel use per motorcycle is much smaller than for 4W vehicles. A value of one tenth is a reasonable estimation.[13] Motor cycle production in Viet Nam is about 1 million units greater than in Thailand. However, the difference of steel use in motor cycle production is only equal to 100 thousand units of 4W vehicles. Such a slender superiority does not compensate for the inferiority in 4W vehicles, at about 2.3 million units.

2.2.2 The Central Role of Demand for Long Products in Construction

The next checkpoint is steel demand by product. Figure 2 shows the steel demand divided into long and flat/pipe products in ASEAN economies in 2011-2013. It is immediately obvious that Viet Nam has the largest demand for long products in ASEAN. In comparison, it is third in flat/pipe products, the same as the case for total demand. The share of long products in the domestic total is 52.9% (SEAISI [2014]); this is higher than Thailand and Indonesia, while lower than Malaysia.

In developing economies including Viet Nam, long steel products are consumed in construction,[14] while there are a variety of applications for flat/pipe products. Therefore, while Viet Nam's steel market has essentially expanded to the level of advanced ASEAN economies like Thailand and Indonesia, its demand depends heavily on construction.

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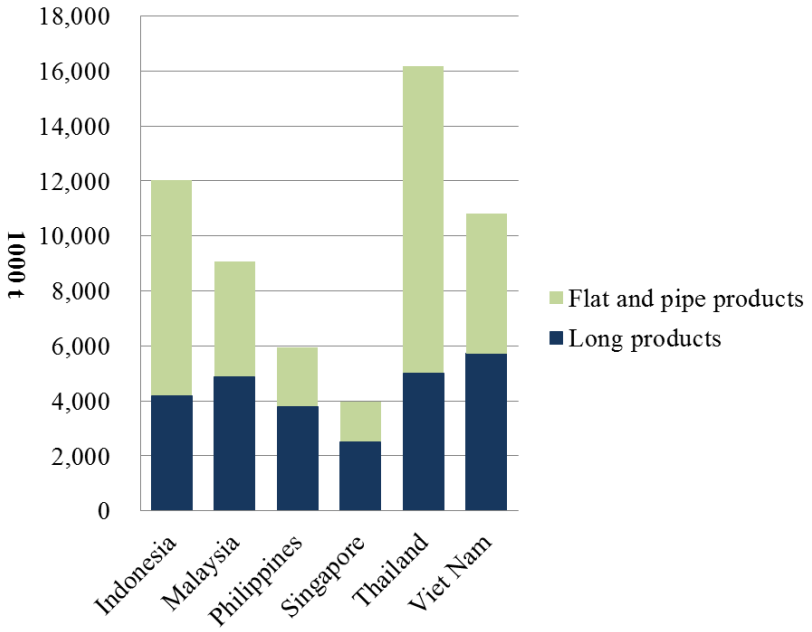
[12] Tamaki et al. [2009] found that steel use per car in Japan is 1633 kilograms in compact vehicles, 1152 kilograms in sub-compact cars, and 794 kilograms in light vehicles. As an experimental rule, this value is around 700-800 kilograms (Sugimoto [2007], p.49, Daily Steel News, January 29, 2015). The difference is due to the fact that Tamaki's group adopted the steel input required in production, while the experimental rule uses steel per unit in manufactured cars. The calculation by Tamaki's group includes scrap steel generated in the vehicle production process.

[13] The estimate is as follows: the total weight of a motorcycle is one tenth that of a sub-compact car, while the steel rate—the total weight of steel per unit—is equal between motor cycles and sub-compact cars.

[14] In SEAISI statistics, long products include rails and accessories, sheet pile, shape, bar, and wire rod. Among these, rail and accessories are used for railroads. The other four kinds of products are mostly used for construction in developing economies. In advanced economies, the rate of machine structural use of bar and wire rod becomes high. That is to say, steel demand from construction has strong ties with particular steel products. Meanwhile, there are no internationally recognized physical indicators of construction activity, in contrast with manufacturing. For that reason, analysis by product is reasonable for an investigation of steel demand in construction.

Figure 2. Demand for steel mill products by product in ASEAN economies (average in 2011-2013)



Source: Compiled from SEAISI [2014].

Table 2. Consumption of steel mill products by product in Viet Nam (average in 2011-2013)

	Consumption in SEAISI statistics	Estimate of final consumption	Share	Share in long products	Share in flat and pipe
Total		10,808	100.0%		
Sub total of long products		5,721	52.9%		
Sub total of flat and pipe products		5,087	47.1%		
Shape	248	248	2.3%	4.3%	
Bar and wire rod	5,458	5,458	50.5%	95.4%	
Other long products	15	15	0.1%	0.3%	
Hot rolled sheets and plates	4,929	2,366	21.9%		46.5%
Cold rolled sheets and strip	1,976	201	1.9%		4.0%
Surface treated sheets	1,751	1,751	16.2%		34.4%
Pipe ans tube	768	768	7.1%		15.1%

Unit: 1000t.
Source: SEAISI [2014].

Figure 2 shows the demand by product in detail. Bar and wire rod comprises 95.4% of long products. This suggests that construction of reinforced concrete structures provides the major use of long products. In Viet Nam, not only office buildings and condominiums, but modern detached houses are constructed with reinforced concrete. In one provisional

calculation, 7 tons of bar and wire rod are needed for a tri-level house of 180 square meters.[15]

2.2.3 Growing Demand for Flat and Pipe Products

Though the share of flat products and pipes in the total demand is smaller than that of long products, its growth rate is higher than that of long products. The growth rate of demand from 2005 to 2013 was 1.8 times in long products, but 2.4 times in flat and pipe products.

The rate of manufacturing use of flat and pipe products is in general higher than that of long products. In Viet Nam, however, this is not necessarily the case, as is suggested by the demand structure for flat products.

The leftmost column of Table 2 shows the average consumption by product in 2011-2013 in SEAISI statistics. However, this does not represent consumption of final products, because it includes the consumption required in subsequent production processes. Concretely, consumption of hot-rolled sheets and plates includes consumption as an input for cold rolling and tubing. Consumption of cold-rolled sheets and strip includes consumption as a host material for surface treating. When the consumption as final product is calculated, the result is 2.376 million tons of hot-rolled sheets and plates, only 201 thousand tons of cold-rolled sheets and strip, and 1.751 million tons of surface-treated sheets.[16] Hot-rolled and surface-treated products occupy the major share of the final demand for flat products in Viet Nam. Most cold-rolled sheets and strip are the host material for surface treating, rather than final product.

In general, cold-rolled sheets and strip are mainly used for manufacturing products like bodies of automobiles, home appliances, metallic barrels, etc. In contrast, surface-treated sheets are used both in construction and in manufacturing. Roofs and walls of factories, warehouses, and individual residences are examples of the former. Automobiles and home appliances represent the latter. In Viet Nam, demand for pre-painted sheets in construction is expanding, while the demand in manufacturing is small. With these points in mind, the small share of cold-rolled sheets and the large share of surface-treated sheets indicate that the consumption of flat products is concentrated in construction in Viet Nam.

[15] Interview with an executive of Kyoei Steel Vietnam (August 17, 2015).
[16] Some types of surface-treated sheet are made from thick-sized hot-rolled sheets. The share of such types of sheet is considered trivial here and is excluded from the calculation. Accurate values for the shares of such types of sheet are not available in any statistics.

3. Steel Production and Capital Investment

3.1 Improvements in and Limitations of Import Substitution

3.1.1 Separated Material Flows

From the perspective of the broad category of steel mill products, long products, flat products, and pipe/tube products are differentiated. Moreover, the manufacturing processes of iron and steel have many stages of production. The major classification of these processes is iron making, steel making, rolling, and surface treating like galvanizing and painting. Tubing processes are the next step in steel making or hot rolling or cold rolling; these processes vary, depending on the products.[17] There are three typical patterns of enterprises among iron and steel companies. The first is the *integrated producer* or *integrated mill*. These have iron making, steel making, and rolling processes in the same company. The major material is iron ore. In most cases, a blast furnace (BF) and a converter are used for iron making and steel making, respectively. The second is the *semi-integrated producer* or *mini mill*. This has only steel-making and rolling processes. The major material is steel scrap. EAFs are used for steel making. The third type includes re-rollers, surface-treating companies, pipe-fitters, etc. These companies do not have iron-making or steel-making processes; they have only downstream processes.

The material flow of the iron and steel industry in Viet Nam is shown in Figure 3. The flow is decoupled between the long, flat, and pipe sectors. In domestic production, the three flows are isolated from each other.[18] In the long sector, all three of the major processes are installed in Viet Nam. In the flat and pipe sector, however, there are no iron-making, steel-making, or hot-rolling processes within the country. Only cold-rolling, surface-treatment, and pipe-fitting processes are installed.

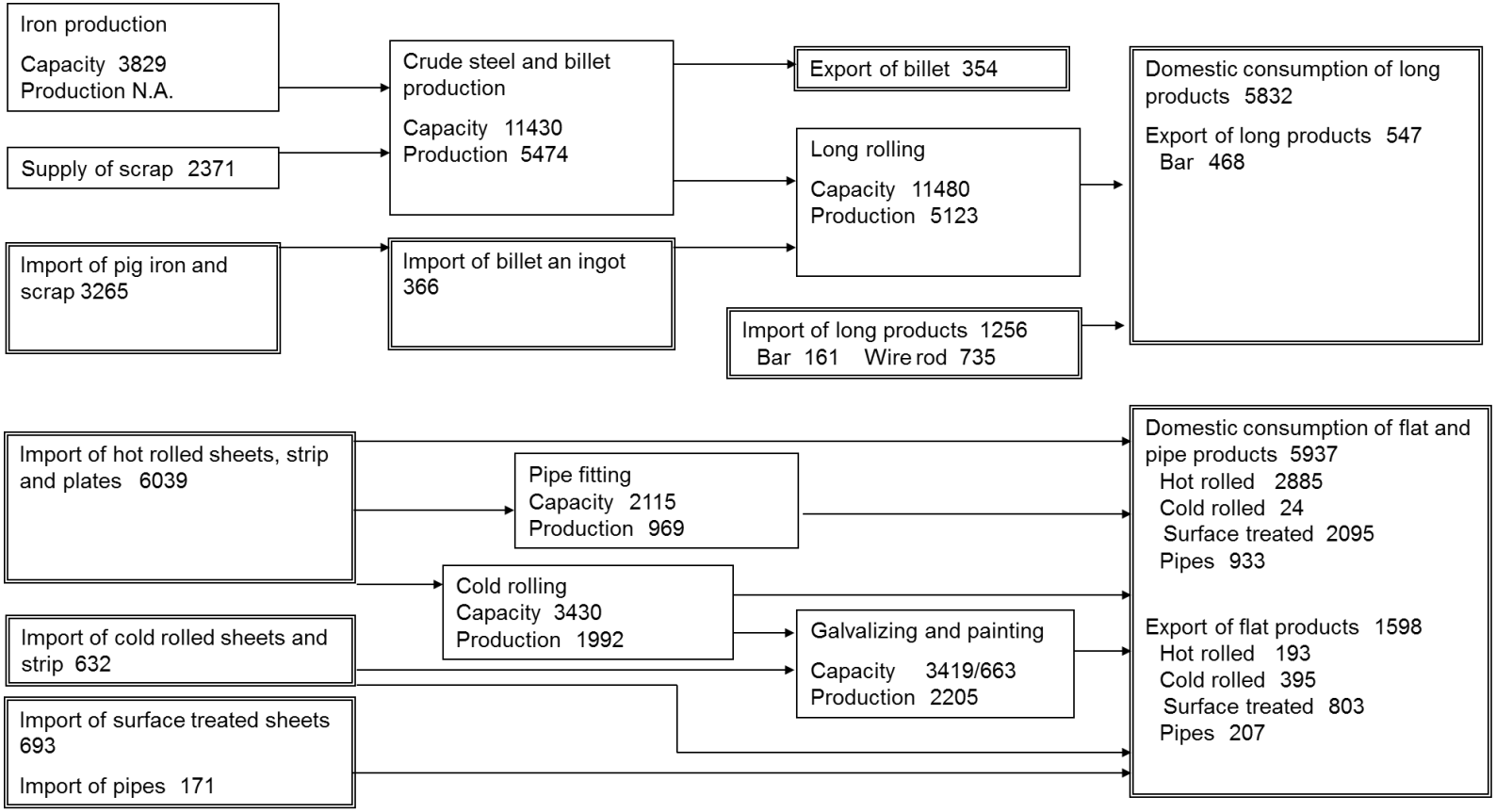
3.1.2 The Rise of the Self Sufficiency Rate in Crude Steel

The production expansion of crude steel is a major indicator of the development of an iron and steel industry. In Viet Nam, this is limited to the long sector in which crude steel is cast into billets as a semi-product; that is, crude steel production is almost equal to billet production.

[17] In Viet Nam, only welded pipe is made from hot-rolled sheets. Seamless pipe, which is made from billets by boring, is not manufactured.

[18] In a country in which hot-rolled sheets and plated products are made, the flat and pipe sectors share the hot-rolling process. In a country in which integrated mills make all kinds of products, the three sectors share iron-making and steel-making processes.

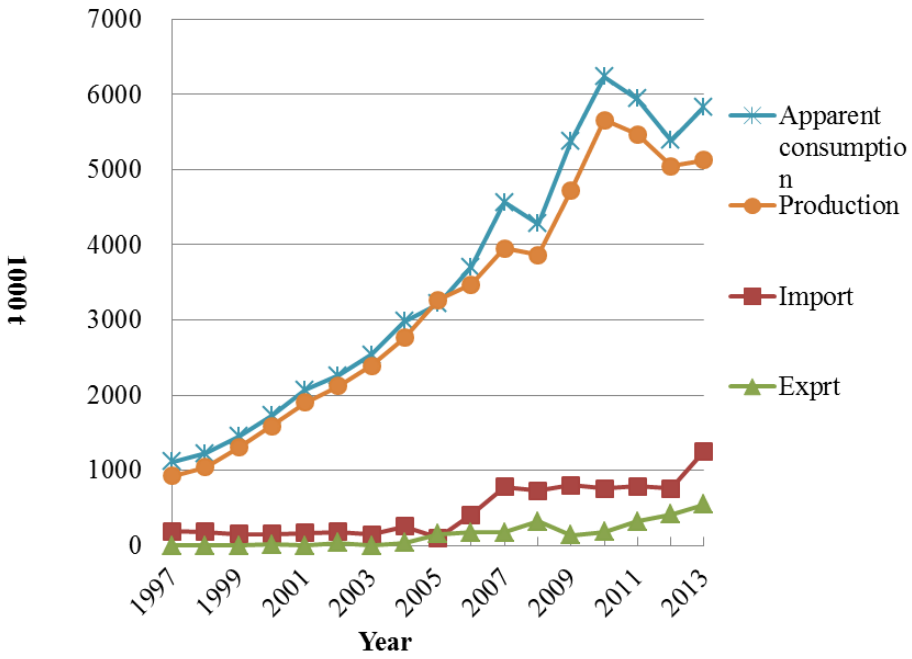
Figure 3. Material flow of the Vietnamese iron and steel industry in 2013



Unit: 1000 tons.
Source: Compiled from SEAISI [2014].

Figures 4 and 5 show the changes in the demand-supply relationship of long products and billets. In Viet Nam, self-sufficiency in long products was achieved in the early 2000s. Production increases in long products initially induced the import of billets. After 2005, production of billets rapidly increased while the import volume decreased. Production has increased from downstream to upstream processes in response to domestic demand.[19] The supply chain from crude steel to final products has now been instituted in the long sector. The next step is the stable procurement of scrap or pig iron as an input for crude steel.

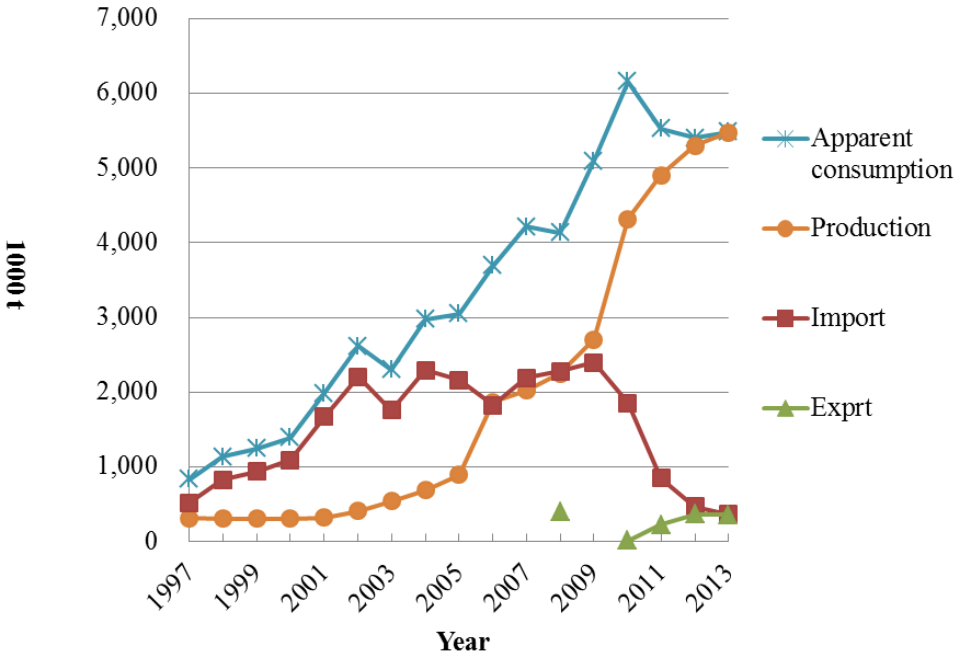
Figure 4. Change in demand-supply relations of long steel products in Viet Nam



Source: Compiled from SEAISI [various years].

[19] This type of development conjures the theory of the flying geese pattern (Akamatsu [1962]). However, the production change from downstream to upstream is not a single pattern of product diversification and product change. A change from crude product to fine product can be supposed. Moreover, the response to the increase in domestic demand is not the only principle of production change; response to changes of comparative advantage is possible. There is not enough space in this footnote for a theoretical explanation of the various development patterns, theoretical models, and effectiveness of the flying geese approach.

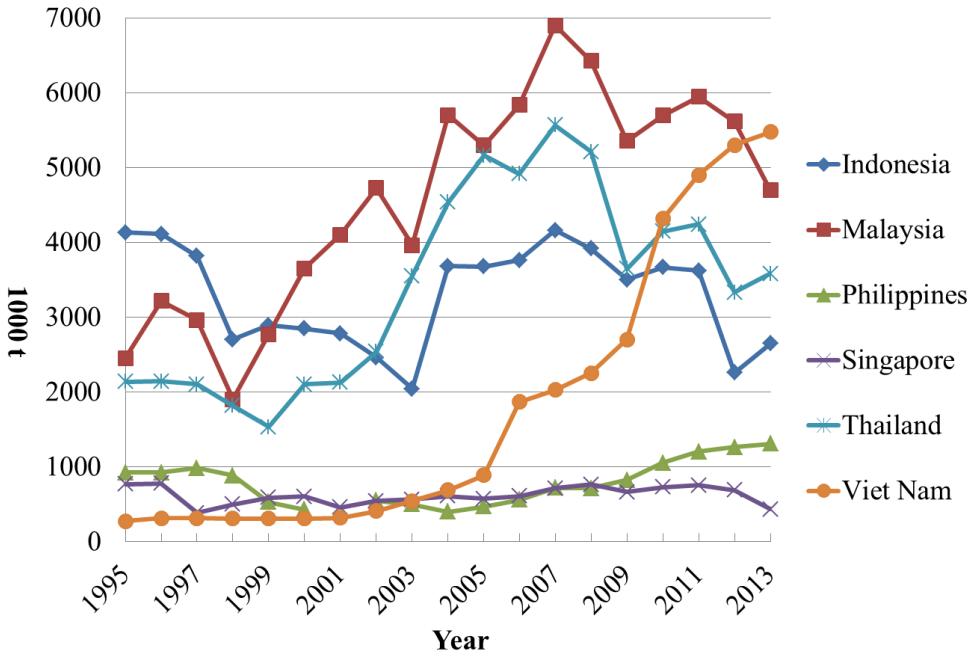
Figure 5. Change in demand-supply relations of billets in Viet Nam



Source: Compiled from SEAISI [various years].

In spite of its limitation to the long sector, the expansion of crude steel production in Viet Nam was remarkable in comparison with other ASEAN economies. Figure 6 shows this. Crude steel production in Viet Nam increased from less than 1 million tons in 2005 to 5.474 million tons in 2013, which was the top among ASEAN economies. The self-sufficiency rate of crude steel production, which means the rate of crude steel production to apparent consumption of steel mill products, changed from 15.7 % in 2005 to 46.5% in 2013 in Viet Nam. In this year, trade in crude steel (ingot and semi-product) achieved a balance. Exports were 354 thousand tons, while imports were 363 thousand tons. The Vietnamese steel industry attained import substitution at this important stage of production in correspondence with the rise of demand for steel in construction.

Figure 6. Changes in crude steel production in ASEAN economies.



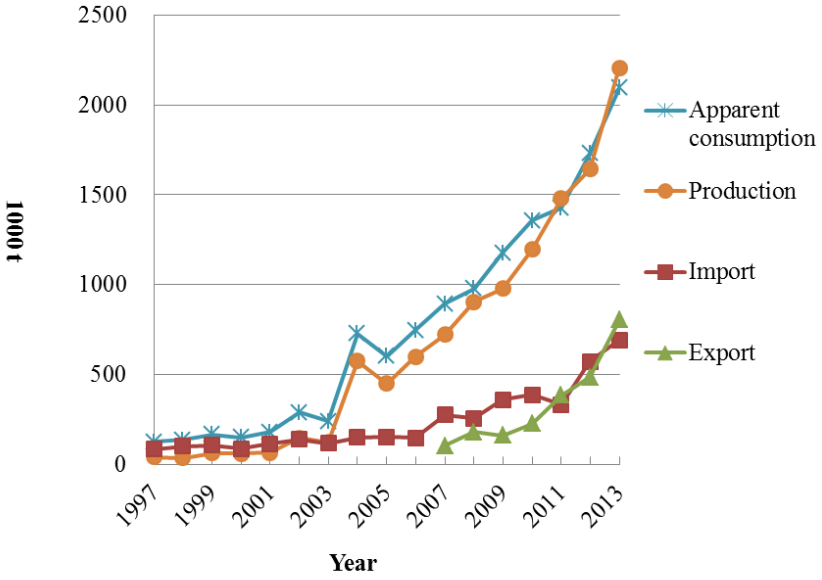
Source: Compiled from SEAISI [various years].

3.1.3 Growth of Flat and Pipe Sector with Limitations to Downstream Processes

In contrast with the long sector, the growth of production in the flat and pipe sector was limited to pipe-fitting, cold-rolling, and surface-treating processes.

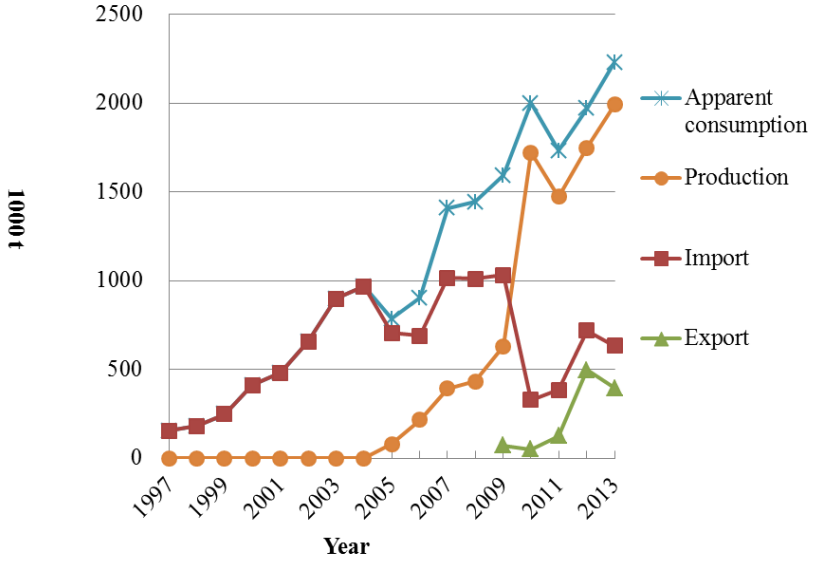
As Figure 7 shows, the production of surface-treated sheets increased with demand growth. In 2010s, both exports and imports increased, because the division of labor represented by specification levels deepened. It can be supposed that Viet Nam is importing high-grade sheets for automobile and other manufacturing uses, while exporting lower-grade sheets for construction. The production growth of surface-treated sheets induced demand for cold-rolled sheets as a host material. In response to this demand, as Figure 8 shows, the production of cold-rolled sheets rose in the latter half of 2000s. In the pipe sector, as Figure 9 show, self-sufficiency was achieved in the mid-2000s and production expansion continued after that. In essence, import substitution of these three products has progressed remarkably.

Figure 7. Change in demand-supply relations of surface-treated steel sheets in Viet Nam



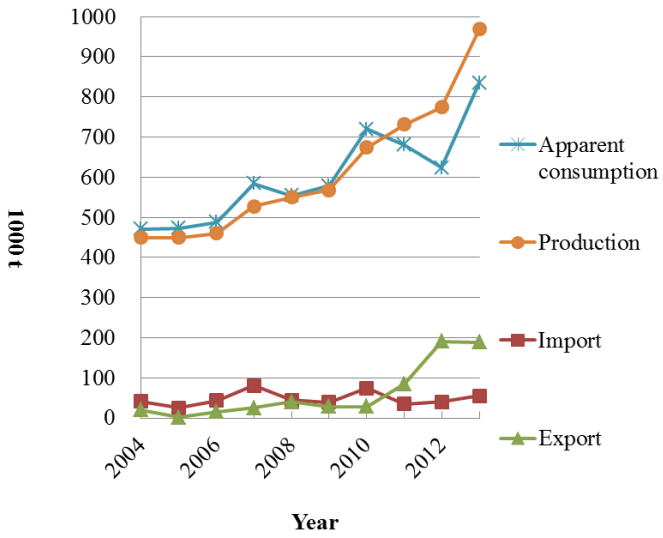
Source: Compiled froma SEAISI [various years].

Figure 8. Change in demand-supply relations of cold-rolled steel sheets in Viet Nam



Source: Compiled from SEAISI [various years].

Figure 9. Change in demand-supply relations of welded steel pipe in Viet Nam



Source: Compiled from SEAISI [various years].

However, hot-rolled sheets and plates are not produced in Viet Nam;[20] hence, production of cold-rolled sheets and welded pipes directly induces the import of hot-rolled sheets.

Imports of hot-rolled sheets and plates increased from 1.367 million tons in 2005 to 6.039 million tons in 2013. This is the most important import-substitution challenge for the Vietnamese steel industry.

3.2 Production and Capital Investment of Major Enterprises

The issue of this sub-section is the assessment of major enterprises and their production capacity in the long and flat sectors. Though the pipe sector is not covered, the investigation of two large sectors is enough to assess the degree of industrial development. For analysis, the enterprises are broken down into types by production structure, for which the indicators are coverage of production processes and degree of vertical integration. The various types of enterprise are located within industrial supply chains. This typology and location provides a description of the industrial organization. Through such analysis, the overall degree of rationality and problems of partial, fragmented production processes in the Vietnamese iron and steel industry will be revealed concretely. Moreover, it will be

[20] Cuu Long-Vinashin Steel Company installed a plate mill and started operations in 2007. However, these operations soon ceased.

possible to analyze the cooperation and competition between different types of enterprise.[21]

3.2.1 The Long Sector

Table 3 shows the production capacity and production record of major producers of long products in 2013. There were thirteen such enterprises, which occupied 77% of production. In 2015, the number of major enterprises became fifteen, because the operation of new entrants started.[22] By classification of production structure, there are three integrated iron and steel enterprises, of which one has only iron-making and steel-making processes, while five have EAF-rolling mills, two are steel-making producers with induction furnaces (IFs), and two are rolling companies.

Most of the products in the long sector are bar and wire rod. Additionally, Thai Nguyen Iron and Steel Corporation (TISCO) and Pomina Steel produce structural shapes. While POSCO SS Vn—a newly instituted company backed by South Korean capital—seems from its company name to make specialty steel, several professionals say that it produces ordinary bars and shapes.

From the perspective of ownership, the decline of SOEs under VNS is evident. Instead, joint ventures between foreign companies and VNS, 100% foreign capital companies, and private companies became the major producers. In particular, it is worthy of attention that both top and second producers, Pomina Steel and Hoa Phat Group (HPG), are non-state-owned joint stock companies with production volumes above 700 thousand tons.

According to production structure, integrated producers HPG and TISCO are relatively large in Viet Nam. They have a standard size of rolling machine with a capacity of 300 thousand tons per annum. However, their production scale of crude steel with BF and converter is tiny in comparison with integrated mills in advanced economies. HPG's crude steel production is less than 1 million tons, while the minimum efficient scale of integrated mills in advanced economies is 3 million tons. The technology source of HPG and TISCO is China.[23] China is a special case in the industry, because it has many small-scale integrated producers.

TISCO, one of the VNS-affiliated companies, is an old SOE, construction of which began in the 1950s. It has experienced many problems in terms of technology and

[21] This methodology was developed in Mizota [1982], Okamoto [1984], Nagashima [1987], and Kawabata [2005].
[22] In this paper, two types are considered as major enterprises in the long sector. One is existing enterprises for which the production record of long products or billets was above 150 thousand tons in 2013. The other is new entrants that are able to produce 150 thousand tons or more per annum.
[23] Interview at TISCO (August 5, 2014) and Hoa Phat Steel (August 4, 2014).

Table 3. Major enterprises in the long steel sector in Viet Nam (2013)

Iron making (Blast furnace)				Vertical integration	Steel making				Vertical integration	Hot rolling			
Enterprise	Ownership	Capacity	Note		Enterprise	Ownership	Capacity	Note		Enterprise	Ownership	Capacity	Production
Hoa Phat	Private	3829	350m㎥, 450㎥	→	Hoa Phat	Private	11430	BOF, EAF, IF	→	Hoa Phat	Private	11480	727
TISCO	VNS65%		100㎥, 120㎥	→	TISCO	VNS65%		EAF	→	TISCO	VNS65%		482
Others (about 10)					Pomina	Private		EAF	→	Pomina	Private		737
					VNS（Phu My)	VNS		EAF	→	VNS(Phu My)	VNS		386
					Vietnam Italy	Private		EAF	→	Vietnam Italy	Private		242
					An Hung Tuong	Private		IF		Vina Kyoei	VNS JV(Japan)		427
					Hai Phong Steel	Private		IF		Kyoei Vietnam	FDI (Japan)		215
					Others (about 20)					Viet Duc	Private		189
(Start in 2014)					(Start in 2014)					Vinausteel	VNS JV(Australia)		182
*Viet – Trung Mining and Metallurgy	VNS JV(China)	550	550㎥	→	*Viet – Trung Mining and Metallurgy	VNS JV(China)	550	EAF		SSE	FDI(Australia)		173
										VPS	VNS JV(South Korea)		167
										Others (about 15 members of VSA)			862
										Others (non-members of VSA)			約500
										Sub Total			5123
					(Start in 2015)					(Start in 2015)			
					*POSCO SS Vietnam	FDI(South Korea)	1000	EAF	→	*POSCO SS Vietnam	FDI(South Korea)	1000	-
					*Vina Kyoei	VNS JV(Japan)	500	EAF	→	*Vina Kyoei new line	VNS JV(Japan)	500	-

Unit: 1000 ton.

Source: Production of each enterprise is from VSA [2014a]. Subtotal of production including non-member enterprise is from SEAISI [2014].

Capacity is mainly from SEAIAI [2014] supplemented by OECD [2014], websites of each enterprise, and interview record and newspapers.

operations (Kawabata [2001]). The internal volumes of TISCO's two BFs are 100 and 120 cubic meters; such furnaces are below international standards and are the target of shutdowns even in China.[24]

As the two micro BFs at TISCO cannot supply enough pig iron for the steel-making process, TISCO has to buy scrap to provide 40-50% of its raw material in steel making.[25] Though TISCO started a capital investment project to rehabilitate its obsolete production system in September 2007, it did not progress on schedule due to financial problems. This project included the development of an iron mine and the installation of a BF with an internal volume of 550 cubic meters, along with a converter and billet caster. This would add an annual crude steel production capacity of 500 thousand tons. In the original plan, the investment volume was 178.7 million dollars. However, problems in the negotiations with the engineering company and delays in construction drove the cost up to 377 million dollars. The construction was halted and TISCO asked the Government Office for help. The Prime Minister decided that the State Capital Investment Corporation should acquire additional stocks of TISCO to the value of 4.76 million dollars. By virtue of this additional capital, construction resumed.[26] It is clear that TISCO cannot survive without governmental subsidies.

In contrast to TISCO, the performance of HPG has been very good. HPG was listed on the Ho Chi Minh City Stock Exchange in 2007. It recorded a net profit for the six consecutive fiscal years from 2009 to 2014. In these five periods, HPG recorded revenue growth four times, gross profit growth in four times, net profit growth three times, and 14.8-24.3% of return on revenue (VPBS [2014] p.34). This rate is higher than those for Pomina Steel and Vietnam Italy Steel (VIS), which are also private enterprises in the long sector (VPBS [2014] p.25). HPG has an integrated iron and steel complex with a capacity of 1 million tons in north Hai Duong Province and is carrying out an expansion plan to reach 1.75 million tons. On completion of the plan, the total capacity of the group will be 2 million tons. As the Hai Duong steel complex was constructed on a greenfield site on a river front, the layout of equipment is rational and provides a modest advantage for

[24] With regard to the upscaling of blast furnaces in China, see Kawabata and Zhao [2014].
[25] Interview at TISCO, August 5, 2014. For the steel-making processes of TISCO, EAF technology is adopted, despite the fact that it is usual to adopt converters in an integrated steel complex. The reason for this is the tiny capacity of the blast furnaces. TISCO thus has to use much scrap in addition to melted iron in the steel-making process. The cold scrap rate is limited in converter, the heat source of which is melted iron. In contrast, EAF technology can be operated with scrap only.
[26] Interviews at VNS (August 4, 2014) and TISCO (August 5, 2014); also "TISCO to get $63.2 million to expand production," *Viet Nam News biz hub*, January 28, 2015 (http://bizhub.vn/news/9696/tisco-to-get-632-million-to-expand-production.html) and other news articles.

shipping.[27] Two BFs in operation have internal volumes of 350 and 450 cubic meters; a further planned BF is expected to have a volume of about 1000 cubic meters. As an integrated steel complex, Hai Duong complex is comparatively small. Such a complex is unusual in advanced economies, but is observed in many cases in China (Kawabata and Zhao [2014]). The investment volume of HPG was 3.2 trillion VND for phase 2, which included the second BF; and is 3.8 trillion VND for phase 3, which includes the third BF. The total cost of phases 2 and 3 is 7 trillion VND, which is equal to about 324 million USD at the exchange rate in April 2015 (HPG [2013] p.28, [2014] p.36). HPG is investing in larger production capacities, using smaller amounts of capital without governmental subsidies, when compared with TISCO.

Pomina Steel and twelve other EAF-based producers insisted that HPG is protected by a governmental policy that banned the export of iron ore.[28] However, the effect of this policy is limited. HPG procures half of its iron ore from captive mines that are not impacted by the export ban policy. Moreover, HPG's executive says that in the future, iron ore will be imported for use in generating expanded capacity.[29]

Including new entrants like POSCO SS and the new line of Vina Kyoei Steel (VKS), a joint venture between VNS and Kyoei Steel from Japan, all the major EAF-rolling enterprises have EAFs with an annual capacity of 500 thousand tons or more and peripheral facilities like ladle furnaces (LFs). These meet international technical standards. This represents a rapid development over the last decade, considering there was no such modern EAF until the first half of the 2000s (Kawabata [2003]). Among re-rolling producers, Kyoei Steel Viet Nam (KSVC) has a rolling mill that meets international standards. Though the rolling mills of other re-rollers are smaller than that of KSVC, no irregular features are observed.

Besides integrated mills and EAF rolling mills, some companies are operating induction furnace-based production of billets. In advanced economies, induction furnaces (IFs) are used for smelting pig iron for casting. However, in some developing economies, including

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[27] HPG [2014], p.24, plant visit, and interviews with executives and managers at HPG, August 4, 2014.
[28] "Cross-border iron ore smuggling," *Viet Nam Net Bridge*, December 3, 2014 (http://english.vietnamnet.vn/fms/special-reports/117753/cross-border-iron-ore-smuggling--the-real-concern.html).
[29] Interview at HPG, August 4, 2014. It is not clear whether the target of this export ban policy is natural resource protection or the protection of domestic iron-making enterprises. We think the effect might be other than the protection of HPG. It is possible this policy delays the development of Thach Khe iron ore mine, which has the most reserves in Viet Nam (544 million tons). There are some technical challenges in the development of Thach Khe mine that include an ore bed under the sea and the high zinc content of the ore (Japan Economic Foundation [2009] pp.26-28). Foreign high technology and huge capital investments are necessary for promoting this development; however, it would be blocked by the export ban policy.

Viet Nam and India, they are applied to steel making.[30] They are adopted because the investment cost is low and the production adjustment is easy. Although there are no statistics for IFs, anecdotal evidence indicates that about 1.5 million tons of steel can be smelted by IF.[31] Unlike EAF, the IF is originally a technology for smelting, not refining; so the quality of billets from IFs is not good. However, some changes have occurred among IF producers in the last decade. One is the expansion of production scale. Two big private IF producers, An Hung Tuong and Hai Phong Steel, installed 500 thousand tons of smelting and casting capacity.[32] Another change lies in the reinforcement of quality control. These producers are selecting good scrap in a careful manner. Moreover, they are adjusting the content of steel by LF after smelting. In fact, major companies are using billets from big IF producers after inspection.[33] These billets are usable for creating concrete bars for housing construction in the domestic market. In Viet Nam, billet production with IFs is considered as an adaptive behavior responding to factor endowment and market conditions.

Outside the major enterprises, however, opportunistic behavior with short-term profit seeking is observed. An example is the failure of small BFs installment. In the mid-2000s, some non-state-owned companies, including Van Loi Steel and Dinh Vu Steel, tried to install BFs. After the world financial crisis in 2008, these projects were revealed to be inefficient, because investment volumes were high, but operations were inflexible.[34] Vietnam Industrial Investments (VII), owner of Dinh Vu Steel from Australia, recorded a loss and sold its equity in 2011. At that time, VII reported that Dinh Vu's EAF was efficient, but the BF under construction was a burden for investors (VII [2011]).

In 2013, domestic demand for long products was 5.832 million tons (Table 2). Production capacity reached 11.43 million tons in steel making and 11.48 million tons in long rolling. Production of long products was 5.123 million tons, with the operating ratio being under 50%. In 2014-15, 2.05 million tons of steel-making and 1.5 million tons of rolling capacity were added. This is a situation of severe excess capacity.

However, the market selection process is working, because opportunistic producers were excluded and the remaining healthy private and foreign companies kept on growing. Through such market competition, import substitution of crude steel has been achieved.

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[30] Regarding the example in India, see Ishigami [2011].
[31] Interview at Kyoei Steel, August 4, 2014.
[32] Plant visit and interview at An Hung Tuong, August 20, 2015. IFs were imported from China. With regard to Hai Phong Steel, see OECD [2013] p.377.
[33] Plant visit and interview at An Hung Tuong, August 20, 2015.
[34] "Steel firms in a hole," *Vietnam Investment Review*, July 26, 2011 (http://www.vir.com.vn/steel-firms-in-a-hole.html).

The exception to this is TISCO, which cannot continue its investment without governmental subsidy. The equal footing between SOEs and other companies is still incomplete.

3.2.2 The Flat Sector

Table 4 shows the production capacity and production records of major enterprises in the flat sector in 2013.[35] In 2013, there were eleven major enterprises that provided 100% of cold-rolled sheets and 88% of surface-treated sheets. In 2014, one re-rolling and surface-treating producer with large-scale facilities was added. Including the new entrant, by classification of production structure, five companies have both cold-rolling and surface-treating process; four companies have only cold rolling, of which three are ordinary steel and one is a stainless steel producer; and three companies have only surface-treating processes. As is the case with the long sector, SOEs under VNS are declining. In addition to private companies, 100% foreign capital companies are rising. The top producer of cold-rolled sheets is POSCO Vietnam with South Korean capital and the second is Hoa Sen Group (HSG) with domestic private capital. HSG is also the clear top producer of surface-treated sheets.[36]

In the flat sector, the suitability of each producer's technology and product lines to the needs of market segments should be noted. In surface treating, China Steel Sumikin Vietnam (CSVC), which is a joint venture between CSC from Taiwan and Nippon Steel & Sumitomo Metal (NSSMC) from Japan, and Perstima Vietnam, which is a Malaysian- and Japanese-affiliated company, can produce high-grade sheets for manufacturing.[37] CSVC is the first producer in Viet Nam to produce galvannealed sheet (GA) for the body panels of automobiles and for electrical appliance, with annual capacity of 300 thousand tons.

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[35] In this paper, the following four types are considered as major enterprises in flat sector; 1) a company that has cold rolling mill, 2) a company with the production of surface treated sheets with 150 thousand tons or more in 2013, 3) a company that produces the high grade surface treated sheets for manufacturing, 4) a new entrant company that is possible to meet the requirements described above from the standpoint of production equipment.

[36] Nippon Steel & Sumitomo Metal (NSSMC) was a 15% of shareholder of POSCO Vietnam from the time of institution. However, NSSMC sold its equity to POSCO in March 2015. The author confirmed this in a telephone interview with NSSMC, June 16, 2015.

[37] For the production of high-grade galvanized sheet for manufacturing industries, advanced equipment and/or operations with special knowledge and technical know-how are needed. Though the standard type of galvanizing line is applicable in high-grade production to a moderate extent, various types of inspection equipment should be added to the line and materials must be strictly selected. In the case of GA sheets, a special machine to spread the zinc and iron content within the sheet after the galvanizing must be added. For making tin-plated and tin-free steel, a special type of surface-treating line that is different from galvanizing is needed. Moreover, the traceability of products is very important, because these outputs are used for food and beverage cans.

Table 4. Major enterprises in the flat steel sector in Viet Nam (2013)

Cold rolling					Vertical integration	Surface treatment				
Company	Ownership	Capacity	Production	Note		Company	Ownership	Capacity (GI/GL)	Production	Note
Hoa Sen	Private	3430	743	Reverse*5 (980thos.tons)	→	Hoa Sen	Private	3419	875	GI,GL,PP
SUNSCO	FDI (Japan)		134	Reverse*1 (250thous.tons)	→	SUNSCO	FDI (Japan)		218	GI,GL,PP
Nam Kim Steel	Private		N.A.	Reverse*1 (200thous.tons)	→	Nam Kim Steel	Private		159	GI,GL,PP
Dai Thien Loc	Private		75		→	Dai Thien Loc	Private		126	GI,GL,PP
POSCO Viet Nam	FDI (South Korea)		885	Tandem*1 (1200 thous. tons)		Ton Dong A	Private		159	GI,GL,PP
Phu My Flat Steel	VNS		112	Reverse*2(405thous. tons)		SSSC	VNS JV(Japan and Malaysia)		157	GI,PP
Thong Nhat Flat Steel	VNS		22	Reverse*1(200 thous. tons)		Perstima Viet Nam	FDI (Malaysia and Japan)		64	Tinplate, tin-free plate
POSCO VST	FDI (South Korea)		97	Sendzimir*1(235 thous.tons)		Other GI and PPGI producers (10 VSA member companies)			237	GI,GL,PP
Total			2067			Total			1996	
Start in 2014						Start in 2014				
*CSVC	FDI (Taiwan and Japan)	1200	-	Tandem*1,electrical sheet is also produced	→	*CSVC	FDI (Taiwan and Japan)	300		GI, GA

Unit: 1000 tons.

Note: GI: Galvanized Sheet, GL: 55%Al-Zn alloyed treated sheet, GA: Galvannealed Sheet, PPGI: Prepainted galvanized sheet, PPGL: Pre-painted 55%Al-Zn alloyed treated sheet.

Source: Production is from VSA [2014]. The number is different from Figure 3 because the latter is from SEAISI. Production capacity is mainly from SEAISI [2014], supplemented by OECD [2014], websites of each enterprise, and interview record and newspapers.

Perstima Vietnam has 130 thousand tons of capacity for tin plate and tin-free steel sheet for cans.[38] However, it is hard for these two companies to maintain high operating ratios, because the demand of steel sheets for manufacturing is small in Viet Nam. In particular, finding customers is an important challenge for CSVC, because it has a large-scale capacity oriented toward automotive steel. Export expansion is one option.

All the other surface-treated sheet producers, that is, HSG and other major private enterprises—including Maruichi Sun Steel (SUNSCO) with Japanese capital, Southern Steel Sheet Corporation (SSSC), which is a joint venture among VNS, Japanese and Malaysian companies—, as well as non-major producers have the standard types of galvanizing and painting lines. Those enterprises are producing galvanized sheet (GI), 55% aluminum-zinc coated sheet (GL), pre-painted coated sheet with zinc (PPGI), or 55% aluminum-zinc alloy (PPGL).[39] Most of these products are used in construction. Computed from Table 4, these companies are responsible for 96.8% of surface-treated sheet production in Viet Nam. This means that most of the surface-treated steel sheets produced in Viet Nam are for construction. [40] Cold-rolled sheets are produced as a host material in the surface-treating process. The enterprises in this sector experienced growth through exploiting the construction market.

In the cold-rolling process, two large-scale producers, POSCO Vietnam and CSVC, have a tandem cold rolling mill and a continuous annealing line (CAL) with an annual capacity of 1.2 million tons.[41] Both mills are the state of the art facilities that can produce high-grade cold-rolled sheets for manufacturing industry. In particular, CSVC can produce non-grain-oriented electrical steel sheet for motor cores with a special annealing and coating line (ACL) after cold rolling. When the operating ratio is high, POSCO Vietnam and CSVC can achieve economies of scale and low-cost production. In fact, however, both companies are confronted with insufficient demand for high-grade sheets in Viet Nam.

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[38] Interview at CSVC, August 6, 2014 and website of Perstima Vietnam (http://www.perstima.com.vn/general-information.asp).

[39] GI sheet and GL sheet can be produced on the same production line. Another line is needed to paint the GI or GL sheet.

[40] The author reached this deduction from certain facts. The standard type of coating line is designed for production of construction sheets. In all plant visits and interviews from 2000 to 2015, the author found that all companies in this group produced surface-treated sheets for construction as a major product. In general, however, it is possible to produce surface-treated sheets for steel furniture, refrigerators, and electrical switchboards. More detailed investigation is needed.

[41] A tandem rolling mill is a rolling machine that has some rolling stands arranged linearly. Hot rolled coil as host material is released at the entry side of the mill. It is rolled through all the rolling stands without stopping until reaching the exit side coiler. The exit coiler then reels the product, which has been converted to cold-rolled sheet.

Reversing mill is a rolling machine that has only one rolling stand. Hot coil is releases from one side coiler, rolled through the stand, and reeled at the other side coiler. Such operation is repeated several times. Finally, cold rolled sheet are gotten.

POSCO Vietnam and CSVC have to produce the full-hard cold-rolled sheet as a host material for surface-treating processes. Such product adjustment lifts the operating ratio of the cold-rolling mill, while fixing the low operating ratio of CALs and ACLs.[42] These producers have no choice but to search the foreign market to utilize their facilities for high-grade sheets.

A subsidiary of VNS and all private companies have reversing mills with an annual capacity of about 200 thousand tons. A reversing mill is a small standardized machine; its productivity is lower than that of a tandem mill when both mills run at full capacity. However, its operation is flexible and efficient for some partially integrated producers like HSG, which have to produce sufficient cold-rolled sheets for the galvanizing process. It is possible for such companies to increase their rolling capacity little by little with a reversing mill, while avoiding excess capacity. Moreover, such producers do not have to install CAL, because all cold-rolled sheets are full-hard host materials for surface treating. Sole cold-rolling companies like Phu My Flat Steel (PFS) have a batch-type annealing furnace for small-scale production. POSCO VST has a sendzimir cold-rolling mill to produce stainless cold-rolled sheet. Its annual capacity is 235 thousand tons, which is normal by international standards.[43]

In 2013, domestic demand for surface-treated sheets was 2.095 million tons, while demand for cold-rolled sheets was 2.229 million tons, including the host material for surface treating (Table 2). Production capacity was 3.419 million tons per annum in surface treating and 3.43 million tons per annum in cold rolling. An excess capacity situation is observed in the flat sector, although not to the extent of the long sector. While increasing exports alleviated the difficulty to some extent (Figures 7, 8), the operating ratios in 2013 were 58.4% in galvanizing and 60.3% in cold rolling.[44]

The performance differences among companies is widening under the fierce competition for survival. HSG is a winner as the top producer of surface-treated sheets. It has been listed on Ho Chi Minh City Stock Exchange since 2008. It recorded a continuous profit from 2009 to 2014. In that period, sales and gross profit increased in five continuous fiscal years, while net profit increased in three of the five years. Gross profit on sales was

[42] Cold-rolled sheet as a final product is annealed after cold rolling in the same factory. However, cold-rolled sheet as a host material for galvanizing is not annealed there, because an annealing zone is embedded in a continuous galvanizing line. Such non-annealed cold-rolled sheet is called *full-hard* sheet. When the cold-rolling company produces full-hard sheet, CAL does not operate. Moreover, ACL in a cold-rolling factory operates only when electrical steel sheet is produced.

[43] POSVO VST website (http://poscovst.com.vn/Eng/History.aspx). A sendzimir mill is one kind of reversing mill. Many multistage rolls are girdled around a small-sized work roll. It is suitable for the rolling of highly work-hardened steel, like stainless steel.

[44] The author calculated these values from the record of production volumes in VSA [2014a]. Based on the data in SEAISI [2014], the operating ratios were 58.1% in cold rolling and 64.4% in galvanizing.

12.9-19.6% (HSG [various years]). HSG is grasping the domestic market for surface-treated sheets for construction through a captive sales network represented by 136 branches.[45]

The performance of sole cold-rolling companies is not good. POSCO Vietnam, as a top producer, kept a steady operating ratio of 73.7%. However, it recorded continuous losses over 2011-2013 (POSCO [2013], pp.F-22, F-26, F-31). The situation of two subsidiaries of VNS is worse. Operating ratios were 27.6% at PFS and 10.9% at Ton Nhat Flat Steel (TNFS). These two companies do not engage in any surface-treating processes. In sales to customers, they are losing the battle against POSCO Viet Nam. The entry of CSVC in 2014 intensified the competition even more. It is difficult for these two subsidiaries of VNS to survive independently.

In essence, grasping the domestic market segment of surface-treatment sheet for construction and the procurement of cold-rolled sheet as host material are the keys to success in the flat sector. HSG is succeeding in carrying them out. Foreign enterprises that focused on high-grade sheet cannot fully utilize the strength of their technology. SOEs cannot capture the growing market.

3.3 The Importance of Formosa Ha Tinh Steel

It is getting close to the blowing-in of Formosa Ha Tinh Steel Corporation (FHS), the first large-scale integrated iron and steel company in Viet Nam.

FHS is a foreign capital company, of which majority is hold by the Formosa Plastic Group from Taiwan. In February 2015, CSC, a top steel producer in Taiwan, increased its equity from 5% to 25%. Moreover, JFE Steel, the second-largest steel enterprise in Japan, decided to make a 5% investment.[46] FHS was instituted in 2008 to install the large-scale integrated steel complex at the coastal area in central Ha Tinh Province. The project site was a space that JICA and former Arcelor (now Arcelor Mittal) had suggested as the best location for a steel complex for VNS in the 1990s and 2000s. Although the first stage of construction should have completed in 2015, an anti-Chia insurgency on the territorial dispute in 2014 delayed the completion to 2016.[47]

The first stage of the FHS project contains an integrated iron and steel complex with 7.07 million tons of annual capacity, a harbor with eleven boating docks with a transaction

[45] Interview at HSG, August 6, 2014.
[46] "JFE Steel to Acquire 5% Stake in Vietnam's First Integrated Steelworks Project," *JFE Steel News Release*, July 30, 2015 (http://www.jfe-steel.co.jp/en/release/2015/150730.html), retrieved March 1, 2016.
[47] Workers from mainland China were working at the construction site of FHS. Some of them died in the insurgency; some Vietnamese workers were also injured.

volume of 28.61 million tons per annum, and a power station with 6.5 MW of electricity-generating capacity.[48] The scale and location of FHS meets international standards in this industry. When the construction is complete, crude steel production capacity in Viet Nam will reach about 20 million tons per annum, of which one-third or more will be occupied by FHS.

In the early stages, there was some skeptical argument about the feasibility of the FHS project, because Formosa Plastic Group had no experience in the iron and steel industry. However, it seemed increasingly likely to be completed as the details of progress were revealed. Table 5 shows that FHS is in charge of procuring equipment from internationally known suppliers. CISDI Engineering, a BF supplier, has installed 14 large-scale BFs with 4000 cubic meters of internal volume in China[49], although FHS is its first export project of large BFs.[50]

Moreover, Steel Plantech and Primetals Technologies, which provide converters, hot strip mills, and some downstream facilities, are world-class suppliers. State of the art production facilities have been secured for FHS. Knowledge and skills which are needed for low-cost and high-quality production will be provided by CSC and JFE Steel.

Though delay in schedule and troubles at the early stage of production are within the realm of possibility, the integrated complex of FHS will start its operation. [51]

Based on the composition of production facilities, the product mix of FHS will include 5.3 million tons of hot rolled sheets and strip, 1.2 million tons of bar and wire rod, and 100-500 thousand tons of bloom and billet. The supply of these products will create different impacts on the long sector and the flat/pipe sector.

In the long sector, the start of FHS could exacerbate the excess capacity situation. Originally, FHS was planned when billets were in short supply in Viet Nam. However, import substitution progressed with unexpected speed. Currently, production of billets, reinforced bar and wire rod for construction does not necessarily make profits for FHS.

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[48] Formosa Ha Tinh Steel, website (http://www.fhs.com.tw/Intro/cover03.html), retrieved March 1, 2016.

[49] CISDI website (http://www.cisdigroup.com/3-ironmaking-instruction.html).

[50] China Metallurgical Group (CMG) (parent company of CISDI), "Ground work of BFs that CMG accepted the order started at Formosa Ha Tinh Steel," on the website of State-owned Assets Supervision and Administration Commission of the State Council, China (http://www.sasac.gov.cn/n1180/n1226/n2410/n314289/15172482.html) (Chinese language).

[51] The FHS project was delayed because of the anti-China insurgency and other accidents. In March 2015, scaffolds broke at the construction site of the seaport. "Scaffold collapse kills at least 14 at Taiwan's Formosa steel complex in central Vietnam," *Thanh Nien News*, March 26, 2015 (http://www.thanhniennews.com/society/scaffold-collapse-kills-at-least-14-at-taiwans-formosa-steel-complex-in-central-vietnam-40301.html).

Table 5. Capital Investment Plan of Formosa Ha Tinh Steel (1st stage)

Equipment	Main Supplier	Specification	Number	Capacity per annum (Thousand tons)
Blast furnace	CISDI Engineering	4350m^3	2	6394
Converter	Steel Plantech	300t Pre-treatment facility for melted iron, Secondary treatment facility	3	7070
Continuous slab caster	Siemens	2strands T210-270、W900-1880	2	5400
Continuous billet caster	Siemens	8strands 130×130-180×180 L12m	1	1200
Continuous bloom caster	Siemens	6strands 260×300-360×450	1	1500
Billeting mill	SMS Meer	160×160, 180×180	1	1000
Hot strip mill	Primetals Technologies (Former Mitsubishi-Hitachi Metals Machinery)	Rough rolling mill (2stands), Sizing press, Finishing mill (7stands)	1	5300
Bar and wire rod mill	N.A.		1	600
Wire rod mill	N.A.		1	600

Note: Siemens VAI Metals Technologies and Mitsubishi-Hitachi Metals Machinery merged to form Primetals Technology in 2015. It is confirmed that the contract for the hot strip mill was transferred to the new company. However, the status of the contracts for continuous casters is not clear from disclosed materials.
Source: Websites and press releases of Formosa Ha Tinh Steel, Steel Plantech, Siemens, CISDI Engineering, Primetals Technologies Japan, SMS Meer, and State-owned Assets Supervision and Administration Commission of the State Council, China.[52]

[52] Formosa Ha Tinh Steel website,(http://www.fhs.com.tw/Intro/cover04.html), Steel Plantech website, page of "Products" (http://steelplantech.com/en/product/) (Retrieved March 1, 2016), "Received an order of BOF Steel Making Plant for Formosa Ha Tinh Steel Corporation, Vietnam," *Steel Plantech Press Release*, August 9, 2012 (http://steelplantech.com/news/2643/) (Retrieved on March 1, 2016), "Formosa Heavy Industries orders four continuous casting lines from Siemens for major steelmaking project in Vietnam," Siemens, *Press Release*, Dec. 24, 2012 (http://www.siemens.com.tw/release/pdf/20121224_111348e.pdf), "Receive Order for a large-scale Hot Rolling Equipment for Vietnam" *Mitsubishi Hitachi Metals Machinery Press Release*, November 6, 2012. This company was reorganized into Primetals Technologies as a result of combination with Siemens VAI Metals (http://www.primetals.co.jp/japan/press/121106.html), "Formosa Ha Tinh Steel orders semi-continuous billet mill," *SMS Meer Press Release*, March 15, 2014 (http://www.sms-meer.com/en/news-media/news/single/article/formosa-ha-tinh-steel-bestellt-halbkontinuierliche-knueppelstrasse.html), EPC Contract for Blast Furnaces of Formosa Ha Tinh Steel Inked, CISDI, *Company News*, December 10, 2012 (http://www.cisdigroup.com/news3-1213.html), China Metallurgical Group, "The construction of bar and wire rod mill that CMG accepted the order started at Formosa Ha Tinh Steel," on the website of State-owned Assets Supervision and Administration Commission of the State Council, China (http://www.sasac.gov.cn/n1180/n1226/n2410/n314274/15464817.html).

Based on the specification of a bloom caster that can make semi-products of carbon and alloy steel for spring, forging, wire, tire cord and bearing, FHS is trying to concentrate on high-grade long products.[53] Another option is to concentrate on exports. However, it is an undeniable possibility that it will provide not only high-grade steel but construction steel to domestic market to maintain its operating ratio. Competition for survival will be intensified. This could be a threat not only to existing producers, but to FHS itself.

In the flat/pipe sector, the situation is different. FHS could be a driving force for the import substitution of hot-rolled sheets and strip for which Viet Nam was totally dependent on imports. For producers of cold-rolled sheets and welded pipe, FHS could be a source of host materials. FHS will not worsen the excess capacity in these sectors; on the contrary, FHS has a chance of rapid production expansion and making profits, while promoting sectoral development. Concentration on hot-rolled sheet and strip will bring the FHS project to a successful conclusion.

There are several projects involving integrated iron and steel complexes other than FHS. They are making little progress, however. E-United Group from Taiwan planned the installation of an integrated complex at Dung Quat Economic Zone in Quang Ngai Province, but construction stopped at the stage of piling. Originally, this project was licensed in 2006 to a small re-roller, Tycoon Group, without financial and technological feasibility. E-United took it over after Tycoon hoisted the white flag.[54] Although E-United is a steel enterprise, it did not have experience in the operation of an integrated complex. Unless experienced companies from advanced economies help E-United, this project is not feasible. In fact, E-United asked JFE Steel in Japan for its participation in the project in 2012. JFE Steel, however, turned down this proposal after an investigation that lasted two years.[55] VNS tried to undertake a joint venture with Tata Steel in India to construct an integrated complex. However, VNS could not get support from central government for the plan. To make matters worse, it lost the capacity to undertake large-scale projects, because of the financial difficulties of its subsidiaries.[56]

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[53] "Formosa Heavy Industries orders four continuous casting lines from Siemens for major steelmaking project in Vietnam," Siemens *Press Release*, Nov. 26, 2012 (http://www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2012/industry/metals-technologies/imt201211301.htm).

[54] With regard to the problems of the Tycoon project, see Kawabata [2007].

[55] "JFE Steel Discontinues Steelworks Feasibility Study in Vietnam," *JFE Steel News Release*, September 16, 2014(http://www.jfe-steel.co.jp/en/release/2014/140916.html) (Retrieved on March 3, 2016).

[56] Interview at VNS, August 5, 2014.

4. The Steel Trade in Viet Nam

4.1 Steel Exports as a Result of Industrial Development

It is not easy to assess the detailed status of the steel trade in Viet Nam. Even in SEAISI statistics, total volume of imports by product is different from imports by origin. In particular, the latter is contaminated by some abnormal values. The analysis should be done under these limitations.

Export of semi-products and steel mill products from Viet Nam exceeded one million tons for the first time in 2008. After that, exports of steel mill products reached 2.145 million tons in 2013, while semi-products reached 0.354 million tons. The export ratio of steel mill products was 20.8% of production. By product, exports of surface-treated sheets were the largest (Figure 3), recording an export surplus of 164 thousand tons. In addition, bar and pipe recorded export surpluses in physical terms. The major destination of exports is listed as "others" in SEAISI statistics; the likelihood is that these are ASEAN economies.

Increasing steel exports from Viet Nam should be considered as a natural result of industrial development. Changes in the demand-supply relationship of surface-treated sheets are shown in Figure 7. Production increased after the rise in domestic demand and finally exceeded it. The export volume is not large. On the one hand, this means that the international competitiveness is not so high. On the other hand, these exports do not constitute anti-competitive behavior. Excess capacity that is observed in Viet Nam is not being used to drive exports; rather, it is leading to lower operating ratios.

4.2 Competition with Imported Steel

The Vietnamese steel industry is affected by imported steel products, especially from China.

Until the early 2000s, Viet Nam had adopted a protection policy with tariffs. For example, the tariff rate was 40% on bar and wire rod and 30% on surface-treated sheets. In 2015, however, due to the WTO database, the MFN tariff rate is 7% on billet, 7.5% on deformed bar, 10% on shape, 6.7% on wire rod, 4.7-7% on cold-rolled wide strip, 12% on GI sheet, 12% on GL sheet, 5% on wide tin plate and tin-free sheet, 10% on stainless cold-rolled wide strip, etc. The rates on plate and hot-rolled wide strip, which is not produced in Viet Nam, are 0%.[57] There might be various opinions as to whether the

[57] WTO Tariff Database (http://tariffdata.wto.org/) (Retrieved on April 5, 2015). All figures given are the highest rates for similar products.

current rate is reasonable, but it is not highly protective and is not creating distortive effects on market selection. These rates have been reduced for the decade. More reduction is in progress between Viet Nam and major trade partners due to regional free trade agreements like ASEAN Economic Community (ACE), ASEAN-China Free Trade Area (ACFTA), ASEAN-Japan Comprehensive Economic Partnership (AJCEP), and the Japan Viet Nam Economic Partnership Agreement (JVEPA), with the Trans-Pacific Strategic Economic Partnership Agreement (TPP) to be added. This tendency toward free trade cannot be reversed. Classical-style protection policies for the Vietnamese steel industry are now unimaginable.

In 2013, steel imports were 8.791 million tons of steel mill products and 366 thousand tons of semi-products. This was an all-time high for final products and the second highest, after 2009, in total volume. Import volume by product is shown in Figure 3. Imports of hot-rolled sheets and plates were 6.039 million tons and occupied 68.7% of the total. This volume continuously increased over the decade, because the demand increased without the operation of hot-rolling mill in the flat sector. Moreover, imports of wire rod increased in recent years. The import level was 735 thousand tons and occupied only 8.4% of total volume. However, the penetration ratio of imported wire rod to domestic demand reached 42.3%.[58]

Looking at import statistics by origin, the most noticeable feature is the increase of imports from China. These reached 3.513 million tons in 2013 and occupied 37.3% of all imports. This represented a rapid expansion from 16.1% in 2009. According to figures from SEAISI, 60% of imports in hot-rolled sheets and strip and 80% of imports in wire rod were from China (SEAISI [2014] p.8).

In the Chinese iron and steel industry, massive excess capacity is observed, as the Chinese government recognizes. Total production capacity of crude steel in China was 1.162 billion tons in 2013, but crude steel production was 822 million tons (Editorial Board of the Yearbook of Iron and Steel Industry of China [2014] pp.269, 293). The difference should be considered as excess capacity. This was a driving force for low-price exports to foreign economies, including Viet Nam.

Previously, competition between domestic products and imported products was limited, because hot-rolled sheets and plates were not produced in Viet Nam. In the near future, however, FHS will start the production of hot-rolled sheets. If the excess capacity in the

[58] Bar and wire rod is considered as similar products, because both of them are produced in the same rolling mill as construction steel. However, bar shows an export surplus. The import penetration ratio is under 10%. The major reason is that orders for bar tends to be small lots in many varieties and the necessity for inventory cuts is strong. Imported products tend to be in large batches with little variety.

world and China persists, the iron and steel industry in Viet Nam will face a fierce competition for survival.

5. Conclusion

5.1 Abstract of the Analysis

The results of the analysis in the previous sections can be summarized as follows.

1) Market issues. The domestic steel market in Viet Nam has expanded rapidly over the decade. Its size is as large as that of advanced ASEAN economies like Thailand and Indonesia. However, demand mainly emerges from the construction industry and concentrates in concrete bar, wire rod, and surface treated sheets. There is little demand for high-grade steel from manufacturing industries. This is, on the one hand, reflective of the Vietnamese economic structure, in which economic growth is likely to induce demand for steel. On the other, it suggests that the level of Vietnamese industrialization is not high.

2) Production issues. The iron and steel industry in Viet Nam has progressed in terms of import substitution from downstream to upstream processes. In the long sector, the import substitution of billets was completed. Crude steel production in Viet Nam became the top in ASEAN. In the flat sector, import substitution of surface-treated sheets and cold-rolled sheets and strip progressed. However, production concentrated on steel for construction more deeply than demand existed. Moreover, hot-rolled sheets as a host material of cold-rolled sheets and welded pipe are not produced. Production expansion in the flat/ pipe sector has led to massive imports of hot-rolled sheets. Internally, the industry is easily influenced by the boom and recession cycle of the construction industry. Externally, it is affected by the supply condition of the international hot rolled sheet market. These are the vulnerabilities of the production system of the Vietnamese iron and steel industry.

3) Investment issues. From the perspective of investment quality, installment of internationally standardized equipment like EAF and rolling mills is increasing. In some areas of the industry, older or small-sized technologies like small BFs, IFs, and reversing mills are adopted. This does not necessarily lead to inferior production systems, however. These technological choices could be adaptations to the specific conditions of the Vietnamese steel market; these adaptations work in some cases.

From the perspective of investment scale, an excess capacity situation induced by overinvestment is observed in both long and flat sectors. TISCO's postponed project in the long sector is due to governmental subsidies. However, this is only a partial problem. The major cause of excess capacity is overinvestment competition among private and foreign

enterprises. The construction of an integrated iron and steel complex by FHS will probably exacerbate the existing excess capacity situation in the long sector. However, FHS's production of hot-rolled sheets will be a rational import substitution step in the flat and pipe sectors.

4) Competition issues. Private and foreign enterprises became major agents of production and investment. In all sectors, competition dynamics based on survival of the fittest are observed. In general, market selection is working well in iron and steel industry in Viet Nam, while individual companies are fraught with difficulties of excess capacity.

Anti-competitive behavior is not a decisive factor in industrial organization. While TISCO is subsidized by government, the effect of this is limited. Although some support like tax breaks is given by local government to FHS, its iron and steel complex is a profit-based project with 100% foreign capital.

5) Trade issues. Steel exports from Viet Nam are a natural result of industrial development. Their volume is not large and is not an outlet for overproduced steel. Rather, Viet Nam is affected by overproduction in China in the form of import penetration. Until now, conflict between domestic producers and imported products has been limited, because hot-rolled sheets and plates had not been produced in Viet Nam. In the near future, however, competition will increase with the start of FHS's operation.

5.2 Conclusion

The iron and steel industry in Viet Nam is being given a chance for development, because steel demand from construction is increasing with the help of high steel intensity, while the low level of industrialization acts as a constraint. In total, the industry is facing an expanding domestic market with increased production. Private and foreign capital enterprises have become major agents of production and investment. Market selection by competition is working. For these reasons, it is obvious that the transition to a market economy is achieving the effects in the Vietnamese iron and steel industry. That is a major conclusion of this paper.

There are still many challenges for this industry. Its production system is vulnerable to fluctuations of demand in construction and the world market for hot-rolled sheets. Producers are suffering from excess capacity. Competition with imported products will be induced in the near future.

These challenges stem from investment competition promoted by expectations for market expansion, adaptive behaviors of enterprises to market conditions in Viet Nam, and the excess capacity situation in international markets. To put it another way, most

problems are arising from the emergence of inter-firm competition in the transition to a market economy, rather than from distortions caused by governmental intervention.

However, state-owned enterprise is still one of the issues. VNS, especially TISCO as its major subsidiary, does not constitute a self-sustaining business. TISCO needs governmental help for its investment project, despite the fact that private companies can carry out similarly sized projects without governmental expenditure. Such subsidies promote market distortion; and reform of VNS should be accelerated.

In this paper, the author made the analysis from the perspective of industrial development. Therefore, the analysis of the corporate behavior of private, state-owned, and foreign enterprises was not sufficient. The nature of joint ventures between state-owned enterprise and foreign capital was not revealed. In order to understand the growth of private enterprises and the stagnation of SOEs, the details of how each company decided its investment and technology selection, under what conditions, and with what logic, should be investigated. To understand the investment behavior of foreign enterprises, the importance of Viet Nam in the strategy of each multinational enterprise should be revealed. Joint ventures should be considered as an intersection of interests between foreign capital and state-owned enterprise. Those issues remains to be studied in future research.

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*All internet resources were retrieved on September 25, 2015, unless otherwise mentioned.

Codicil (May 11, 2016)

This is a translated version of the paper published in Japanese in September 2015. Thus it does not cover the issue of mass fish deaths in central Viet Nam and the suspicion on FHS, which broke out in April 2016.