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Imports, Exports, and the Impact of Mergers on Domestic Markets: A Case Study from Japan's Copper Tube Industry*

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Abstract

This paper empirically examines the role of imports in the assessment of domestic mergers. It constructs and estimates a structural model of demand and supply to describe Japan's copper tube, taking an explicit account of cross-border transactions. Obtained simulation results show that the merger would have raised domestic price significantly, implying that import pressure was not as significant as was considered at the time of the merger.

Keywords: import pressure, export environment, merger simulation, competition policy

JEL classification: L41, L44, F14

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1 Introduction

In many countries and industries, corporate activities have an international aspect. Firms often compete with imported goods and sell their products not only in their domestic market, but also foreign markets as exporters. Since firms determine their pricing strategies taking these international aspects into account, it is important to evaluate how the international factors influence the degree of competitiveness the firms face for assessment of firms' market power.

This paper examines the relation of import and export to competition in a domestic market, focusing on a merger case in Japan. Mergers between major firms in a country increase the degree of domestic market concentration. The high concentration level is usually a concern from the viewpoint that it allows those firms to control product prices, which does harm to economic welfare. However, it may be inappropriate to suppose that the increase in concentration ratio of domestic firms directly leads to higher prices in the domestic market. For example, the combined firm may give up raising their product price, if imported goods are sufficiently substitutable to the domestic goods and import level can immediately react to the increase in product prices, because customers may shift their purchase from domestic goods to imported goods in a case where the domestic firms raise the price. The domestic firms may refrain the price raise in view of this possibility.

This effect of import to restrain market powers of domestic firms is called 'import-as-market-discipline' effect, which is empirically analyzed by a lot of previous studies. Levinsohn (1993) examines the changes in mark-up (price to marginal cost ratio) after trade liberalization in Turkey and finds that the mark-up are curtailed after the trade liberalization. Following this study, several papers investigate the impact of change in trade policy on mark-ups or market power of firms [1]. For example, Bottaso and Sembenelli (2001) analyze how the EU single market program affects the mark-ups of Italian firms. Konings and Vandenbussche (2005) focus on the policy change in the opposite direction, i.e., introduction of

[1]There is another strand of literature as for the impact of trade liberalization on economic welfare through changes in firms' activities. Many empirical studies analyze how productivities or efficiencies of firms change after trade liberalization (e.g., Pavcnik (2002) and Amiti and Konings (2007)).

anti-dumping protection, and obtain the result that mark-ups of the affected firms increased after being anti-dumping protection introduced.

These studies analyze the impact of the drastic change of trade policy on firms' market power and find the 'import-as-market-discipline' effect. Meanwhile, we investigate how a merger's impact on the firms' market power depends on international aspects of the industry. Thus, our study focuses on drastic change in market concentration ratio rather than drastic change in barriers to import, which is the research object of the previous studies.

Competitive pressure from import is one of the elements that should be considered in review process of meger proposals. In fact, merger guidelines of Japan Fair Trade Commission (JFTC) include assessment of import pressure. JFTC checks whether price increase by the combined company would induce more import within some period, based on examination of institutional barriers to import, substitutability between domestic and imported goods, and so on, if necessary.

It is arguable, though, how competition policy authorities assess the extent of import pressure on the industry. Import penetration rate is often used as a quantitative proxy of import pressure, but there are several concerns about it. For example, the extent of import pressure is not necessarily related to actual size (quantity or value) of import. Import pressure can work effectively even when there is no actual increase in import, if the combined firm forecasts upsurge of import in case of the product price increase. In an extreme case of no actual import, mere possibility that sizable import would occur in response to raising price can restrain price hike by the merged company [2]. On the contrary, the large amount of import may not put pressure on the product price, if foreign companies cannot timely increase production and shipment to the domestic market (for example, due to capacity constraint) in response to price raise by the combined firm, hence import is inelastic to the domestic price.

In fact, the relation between import penetration and mark-ups in domestic markets is mixed. Konings, van Cayseele, and Warzynski (2001) analyze industries in Belgium and Netherland and find that sectors more peretrated by import are *less*

[2]Salvo (2010) shows that import affects domestic price even when actual import size is small in the analysis of Brazilian cement industry.

competitive especially in Netherland, where no competition policy existed. This result implies that the effectiveness of import pressure may depend on competitive environment of the domestic market. Thus, when evaluating the extent of import pressure, we need to know features of competition in the domestic market, such as how customers see imported goods differentiated from domestic ones and how import reacts to price changes of domestic goods [3].

In addition to import pressure, export environment is also likely to influence price setting in the domestic market. If the export price is lower, then a combined firm may hesitate to raise its domestic prices, because it wants to supply more in the domestic market which is more preferable than export markets. As compared to import, empirical analyses on the relation between export and merger is scarce. Ohashi and Toyama (2017) is among a handful of exceptions. They investigate if a merger induces more export by the merged firms, while our interest is in how export market condition affects activities in the domestic market of the combined firms and hence the domestic economic welfare.

The case analyzed in this paper is a merger occurred in Japanese copper tube industry. As described in the next section, the second and fourth largest firms in the industry merged in 2013. JFTC judged that import pressure was sufficient, because the import penetration rate was around 15% and transportation cost was low due to the product attributes of copper tubes. At the same time, Japan is an exporter of copper tubes. Export accounts for about 15 to 20% of total shipment by Japanese copper tube producers.

We take an approach of merger simulation to evaluate import pressure and influence from export environment on domestic market changes caused by a merger. We construct and estimate a model to describe Japan's copper tube market with considering import and export. Then we simulate the domestic market outcomes with and without the merger, and compare them in order to evaluate key variables such as domestic price. Our main interest is in how different the impact of the merger is for different patterns of import and export.

In the remainder of this paper, Section 2 overviews the Japanese market of

[3]Zimmerman and Carlson (2012) present the condition about the price elasticity of import supply and demand to determine whether the combined company can increase the profit by some extent, while they do not analyze an actual merger case.

copper tubes and introduces our case of merger. Section 3 describes our estimation model of the market structure and how to estimate and simulate the model, as well as the data used in the estimation part. In section 4, the estimation results of the model are presented. We also examine the results of our merger simulation for various settings about import and export in order to evaluate import pressure and the influence from export market. Section 5 provides concluding remarks.

2 Overview on Japanese Copper Tube Industry

The case analyzed in this paper is the merger between Furukawa-Sky (hereafter, Furukawa) and Sumitomo Light Metal Industries (hereafter, Sumitomo) in October 2013. Main product line of these two companies is alminium products. They accounted for about 70% of total sales of the combined company, UACJ, as of the merger. Sales share of copper tube [4] was about 5%, but it was the second largest product line of UACJ and one of the segments under the merger review. In Japanese copper tube market at that time, Furukawa and Sumitomo were the fourth and the second largest fims and held the combined share of about 35% [5]. There were two other major companies in the market as of the merger proposal, one of which exited before UACJ was established.

While Japan's domestic market of copper tube was highly concentrated, JFTC took import pressure into their consideration and concluded that "import pressure sufficiently works in the industry," based on the facts that (1) import share was around 15%, (2) transportation cost is regarded low enough, because the product quality is unlikely deteriorate during transportation from overseas, and (3) products from East Asian countries were inexpensive [6]. As a result, JFTC approved this merger.

Copper tube is made of copper ingots with the purity of 99% or more. Copper has so high heat conductivity that copper tubes are mainly used for heat exchangers

[4]The word 'tube' and 'pipe' are usually combined to name this industry. Strictly speaking, these two words are distinct in several attributes, but we label the industry just as 'tube.'

[5]More precisely, this figure was the share of Furukawa's parent company, Furukawa Electric, and a Sumitomo's subsidiary, Sumikei Copper Tube.

[6]See JFTC (2013).

of air-conditioners and so on. About 60% of copper tube produced in Japan are shipped out to ‘cooling machines’ including air-conditioners.

Figure 1 shows Japanese companies’ shipments to domestic market (total shipment less export) and exports, and imports in the industry since five years before the merger. Japanese companies’ shipments to both domestic and export markets were on a declining trend. Shipment to domestic market in early 2008 was around 10,000 tons per month and dropped to around 8,000 tons per month in 2015. This long-run downward trend in Japanese copper tube market reflects that production of air-conditioners, main customers of copper tube, reached the plateau in the middle of 2000s. During the same peirod, export plummeted by more than half from nearly 4,000 tons per month to less than 1,500 tons per month.

Another factor relating to shrinkage of Japanese copper tube production is penetration of import. Import of copper tube mainly comes from countries like China, Korea, and Thailand. Japanese market accounted for about 5 to 10% of total export of copper tube by these three countries. There were large potential of diverting export to Japan from other destinations (Landes and Posner (1984)). These three countries have held more than 90% of total import of copper tube in Japan all over our sample period. Import share of Japanese copper tube industry has been steadily increasing even before the merger proposal. It almost doubled from less than 1,000 tons per month in 2008 to between 1,500 and 2,000 tons per month in 2013, surpassing export by Japanese companies. This structural change in the industry led to the conclusion by JFTC mentioned above. After the merger, both domestic shipment and import have stayed at the almost same level, or slightly increased.

Figure 1 shows another important attribute of this industry, the seasonality of demand. Shipment of copper tubes is higher than the 13-month moving average values from spring to summer. This is because most part of copper tube demand comes from air-conditioner equipment production, which has the peak in these months. The similar seasonal pattern is also observed for import.

Figure 2 depicts prices of copper tube, for domestic shipments, imports, and exports. Copper tube prices recovered from drastic drop in the recession period following the 2008 financial crisis, then has leveled off, or slightly declined in the medium run. No remarkable rise in copper tube price is observable after the merger, except for a temporary spike of domestic product price just after the merger. There are moderate difference between domestic and imported product prices, but it seems to almost disappear around 2013. Export prices are also lower than domestic product prices at least until 2013. This implies that Japanese copper tube producers exploit market powers in the domestic market, while export market is competitive. The reason why export prices shot up after the late 2012 will be discussed in the later section.

In this figure, we also see very similar patterns between import and export prices. Their correlation coefficient is 0.86. This fact implies that the international market of copper tube is competitive and both import and export prices coincide with the same international values. This observation is consistent with that Japan's share in copper tube export main exporter countries is 5 to 10%, and that Japan's share in the world's copper tube export is 2 to 6% during our study period.

Figure 3 plots prices of copper, the main raw material of copper tube. Since copper tube is made of a minimum 99% of pure copper, price of copper is one of the dominant factors determining production cost. Domestic copper price shown in Figure 3 is defined by the copper ingot shipment values divided by quantities, which are collected by Ministry of Economy, Trade, and Industry (METI). International copper prices are those at The London Metal Exchange (LME) converted into yen-base values using monthly average of yen-dollar rate. The two copper price data show quite similar patterns, which reclects that copper is highly marketable and homogeneous at the international level, though there are modest gaps between them. Similarly to copper tube price, copper price dropped sharply after the 2008 financial crisis, then recovered up to the previous level. Then it has leveled off, or just slightly increased since around the merger.

Shrinking demand shown in Figure 1 is likely to lower copper tube price, while the cost factor shown in Figure 3 may put an upward pressure on copper tube price. Export market condition may be favorable to raising domestic prices. Controling these factors, we evaluate how much the merger itself gives an impact on copper tube price in Section 4.

3 Model, Estimation Method, and Data

3.1 Model

This paper evaluates the merger between Furukawa and Sumitomo, considering import and export. We compare the impact of the merger for different settings about import and export in order to assess the influence of import pressure and export environment on the domestic market. To this aim, we construct and estimate a model of Japanese copper tube industry. The model consists of three markets of copper tube industry in Japan: domestic goods market, imported goods market, and export market. Domestic goods market is described as a Cournot competition model among Japanese copper tube producers. Imported goods are imperfect substitutes of domestic products for customers [7]. It is supplied from a competitive international market with a given international price [8] . Japanese copper tube producers also export their products competitively, taking international prices as given [9]. They determine supply quantities to domestic and export markets based on these conditions of both markets and their cost functions so as to maximize their profits.

Since there are gaps between the prices of imported copper tubes and dometic ones as shown in Figure 2, it is reasonable to treat domestic and imported goods as imperfect subsitutes. The two demand functions depend on prices of both domestic and import goods as

$$Q_D = f_D(P_D, P_M, \boldsymbol{Z}) \tag{1}$$

and

$$Q_M = f_M(P_D, P_M, \boldsymbol{Z}), \tag{2}$$

where Q_D and Q_M are quantities of domestic and imported goods, respectively. P_D and P_M are prices of domestic and imported goods, and $\boldsymbol{Z}$ is a vector of shift factors of these demands. f_D and f_M are assumed to satisfy usual sign conditions

[7]If imported goods is perfectly subsitute to domestic ones, the model takes the form of residual demand function approach like Baker and Bresnahann (1988) and Kaplow and Shapiro (2007).

[8]We also examine the model with imported goods supplied in accordance with a supply function that takes the product prices in the domestic market as given.

[9]Japan's share in the world's copper tube export is about 5% or less during our sample period.

such as $\partial f_k/\partial P_k < 0$ and $\partial f_k/\partial P_l > 0$, for $k, l \in \{D, M\}$, $l \neq k$. Details about $\boldsymbol{Z}$, along with shifters of other functions mentioned below, are provided in the next subsection. An index of time is omitted for simplicity of expression.

In domestic goods market equilibrium, Q_D equates to the sum of supplies for the market by Japanese copper tube producers. Japanese producer i chooses its supply to domestic market q_i so as to maximize its profit in the way of a Cournot competiton model [10]. The first-order condition of this profit maximization problem is

$$P_D + \frac{\partial f_D^{-1}(Q_D, P_M, \boldsymbol{Z})}{\partial Q_D} q_i = c_i(q_i + x_i, \boldsymbol{W}_i), \tag{3}$$

where $f_D^{-1}(Q_D, P_M, \boldsymbol{Z})$ is the inverse demand function of domestic goods. $c_i(q_i + x_i, \boldsymbol{W}_i)$ is firm i's marginal cost function depending on i's total output, i.e., the sum of domestic supply q_i and export x_i, and shifters of marginal cost function, $\boldsymbol{W}_i$. c_i depends on i reflecting the firm-specific technological level. The equilibrium of the domestic goods market is governed by domestic goods demand function (1) and supply rules (3).

We assume that two international markets are competitive, hence import and export prices are exogenous. Once the domestic goods price P_D is determined at the equilibrium level of the domestic goods market, P_D^*, the quantity of import Q_M is equal to:

$$Q_M = f_M(P_D^*, \overline{P}_M, \boldsymbol{Z}), \tag{4}$$

where $\overline{P}_M$ is the international price of imported copper tube.

Japanese producers are price takers in export market in constrast to domestic market. Thus, firm i's optimization problem on export level becomes

$$\overline{P}_X = c_i(q_i + x_i, \boldsymbol{W}_i), \tag{5}$$

given the export price $\overline{P}_X$. (5) determines firm i's export level x_i, while q_i is determined by the domestic market equilibrium based on (1) and (3).

[10]We do not consider the issue of capacity constraint. If production capacities are limited and capacity constraint is binding, the mark-up will be large even when those companies' market power is low (Brendsrup, Paarsch, and Solow (2006)). However, the market of copper tube was on the declining trend as shown in Figure 1, so it is unlikely that capacity constraint was actually binding in our study period.

Note that there is an important abstraction in our model. We omit dynamic aspects such as investment and divestment. Although change in capacity size is generally important in capital-intensive industries like copper tube, our data shows relatively small change in the industrial capacity size. It decreased by 7.6% over the seven years of our study period. The decline of capacity size is especially small, 0.4%, for the post merger period (two years). These figures suggest that change in capacity size did not play an important role at least during our study period [11].

3.2 Estimation method

We need to specify functional forms of f_D, f_M, and c_i in order to estimate our model introduced in the previous subsection. As for demand functions, we assume a standard CES utility function of domestic and import goods, then combining (1) and (2), we obtain the following relative demand function [12]:

$$\ln\left(\frac{Q_D}{Q_M}\right) = a_D + b_P \ln\left(\frac{P_D}{P_M}\right) + b_Z \boldsymbol{Z} + u_D, \tag{6}$$

u_D is an error term of this relative demand function. The absolute value of b_P, the coefficient of log of relative price, can be interpreted as the elasticity of substitution between the domestic and the import goods.

Marginal cost supply function takes a log-linear form:

$$\ln MC_i = a_C + b_y \ln y_i + b_W \boldsymbol{W}_i + u_{C,i}. \tag{7}$$

MC_i is marginal cost level for firm i. From (5), this value is equal to $\overline{P}_X$. y_i is total output of firm i, i.e., $y_i \equiv q_i + x_i$. $u_{C,i}$ and u_M are error terms. $u_{C,i}$ includes firm fixed effects to capture differences in technology among firms. Firm fixed effect of the combined company, UACJ, may be different from those of Furukawa and Sumitomo due to possible efficiency gain caused by the merger.

[11] Nishiwaki (2016), who analyzes merger-induced divestment in Japanese cement industry, shows that the number of cement distribution centers decreased by 35.2% for 18 years. This figure is equivalent to 13.7% decrease for seven years, which is almost twice as large as ours.

[12] See Blonigen and Wilson (1999), for example.

We specify shift factors of these equations, $\boldsymbol{Z}$ and $\boldsymbol{W}_i$ as follows. One of the key (relative) demand shifters $\boldsymbol{Z}$ is production level of air-conditioners in Japan. Air-conditioners are main users of copper tubes, so the amount of air-conditioner production may affect relative demand of domestic to imported copper tubes. For example, to fulfill the large amount of production, air-conditioner producers may opt for more imported goods in their peak seasons. We also include a time trend term to capture the upward trend in relative demand of imported goods shown in Figure 1.

Firms' cost function depends not only on their output level, but also capacity size and the price of copper, basic raw material for copper tube. Capacity size varies with firms, so does $\boldsymbol{W}_i$. We also include non-linear time trend and a peak-month dummy that takes one from April to July and zero otherwise. These variables capture macro shocks such as technological change and seasonality of copper tube production.

To estimate (6) and (7), we need to deal with endogeneity issues. For example, when some demand shock favor to domestic goods occurs, the relative price of domestic goods would rise. This means b_P of (6) may be overestimated (since b_P should be negative, the absolute value of b_P may be subject to lowering bias.)

For proper identification, we use instrumental variables (IVs) for estimating (6) and (7). As usual, we use supply shifters as IVs for demand side estimation, and demand shifters for supply side estimations. We add several other variables to the list of IVs.

More specifically, as IVs for estimating (6), we adopt yen-dollar rate, the difference of international and domestic copper price, electricity price, and growth rate of industry-level capacity size of copper product production. We also include 12-month lagged air-conditioner production quantity as an IV, because unobserved shock to relative demand of domestic goods may correlate to air-conditioner production in Japan.

In estimation of marginal cost function (7), we use air-conditioner production quantity as one of the IVs. Yen-dollar rate of the month and one-month before are also included, because they are exogenous to supply behaviors of producers and shifts the domestic goods demand. We add the price of stainless pipe, one of the substitutes of copper tube, to IVs for marginal cost estimation.

(6) is estimated at industry level. There may be a concern about serial correlation of error terms. To deal with this issue, we adjust standard errors of estimates by GMM technique with heteroskedasticity- and autocorrelation-consistent, or HAC weighting matrix. The order of lags for the weighting matrix is chosen in accordance with the criterion proposed by Newey and West (1994).

Marginal cost function (7) is estimated at firm level. Taking heterogeneity of firms into consideration, we treat error term in (7) as

$$u_{C,it} = v_{C,i} + e_{C,it}.$$

$v_{C,i}$ is a firm fixed effect reflecting technological level of firm i. $e_{C,it}$ is an idiocyncratic shock for i at time t. $e_{C,it}$ is possibly serially correlated, so we adopt dynamic panel estimation technique proposed by Arellano and Bond (1991) to estimate (7) as well as two-stage least square method for fixed effect model with IVs.

3.3 Data

The data for quantities and prices of copper tube in Japanese market comes from monthly public statistics, along with the data about import and export. The data on quantities and values of domestic copper tube shipment is obtained from two data sources. The data of Japanese producers' total shipment quantities and values of 'copper products (pipes and tubes)' is provided by *Current Survey of Production* by METI, and import and export quantity and value data of 'copper tubes and pipes, of refined copper' from *Trade Statistics of Japan* by Ministry of Finance. Since total shipment in *Current Survey of Production* includes export as well as domestic shipment, we subtract export from them to obtain the data of shipment to the domestic market. Price of copper tube is defined as values divided by quantities by month for domestic shipment, import, and export.

Domestic copper price is obtained in the same manner of copper tube price. We divide shipment values of 'electrolytic copper' by its quantities, both of which are derived from *Current Survey of Production* by METI. This survey is also the data source of industry-level capacity size of copper products. Production of air-conditioner is obtained from machinery industry part of the survey.

International copper price is that at London Metal Exchange (LME), which is available monthly. Since it is a dollar-based value, we convert it into a yen-based value using the monthly average of yen-dollar rates. Price data of electricity and stainless pipe come from domestic producer price indices provided by Bank of Japan.

Estimation of (7) requires firm-level data. We exploit individual data of copper tube shipment and monthly production capacity of copper products collected by METI for *Current Survey of Production*.

Our sample period starts from October 2008, exactly five years before the merger. The end of our sample period is May 2015 due to the data availability. Descriptive statistics of main variables are presented in Table 1. Table 1(a) summarizes them for pre-merger period. Table 1(b) is for post-merger period. Comparing Table 1(a) and (b), we see that quantity of domestic copper tube slightly decreased by 1.2% around the merger on average, while import quantity of copper tube shot up by 26.0%, showing the steady upward trend. Price of domestic copper tube fell by 3.4% and import price rose by 17.2%. Average firm-level production size of copper tube largely increased after the merger. This is due to exit of a smaller producer and the merger.

4 Results

4.1 Estimation results

Table 2 reports the estimation results for relative demand function (6). Column (A) is the result using pre-merger data only, while the result in column (B) is based on the data including post-merger period with post-merger dummy being added to explanatory variables. Both estimation results have about 60% goodness-of-fit and satisfy the over-identification restriction.

All of the estimated coefficients are significant with expected signs. Relatively higher price of the domestic goods over the imported goods significantly reduces the relative demand for dometic goods. Since estimates by OLS are larger than these coefficients, our estimation method deals with overestimation due to endogeneity bias. Higher level of air-conditioner production is favorable to imported goods. In high season, customers are more likely to fulfil their demand of copper tubes by the imported goods. The relative size of demand in domestic goods is steadily declining at the rate of 3% per month, though the declining trend halted after the merger, conditional on the relative price of domestic and imported goods.

The elasticity of substitution between the domestic and the imported goods, the absolute value of the coefficient of relative price, is about two for both cases. This value is rather high compared to those obtained in the previous studies. Blonigen and Wilson (1999) report that only 14 out of 146 sectors have 1.5 or above of b_P in (6) for U.S. industry-level data. This result is consistent with that copper tube is comparatively homogeneous in quality as discussed in Section 2.

Own and cross elasticities of demand are calculated from the estimates of b_P and price levels of domestic and imported products. At the point of the merger, own elasticity of demand (absolute value) is around 1.5 for both domestic and imported products. Demand of both products are not so elastic with respect to their own prices. Cross elasticities as of the merger are from 0.4 to 0.6.

Estimation results of firm-level marginal cost function (7) are presented in Table 3. We report the result from fixed effects estimation without instrumental variables for refernce in column (A). Column (B) is the result for fixed effects estimation with IVs, but without considering serial correlations. The coefficient of output, b_y, is 0.390, significantly positive, thus this cost function shows decreasing return to scale. This figure is greater than that of column (A). Since positive cost shock would restrain the output, the estimate of column (A) should be subject to an underestimation bias. The result of column (B) is consistent with this view.

As for other variables in column (B), capacity size has a significantly negative coefficient, thus a firm owning larger capacity has a cost advantage. Higher copper price means higher cost, but the coefficient is insignificant.

Column (C) shows the result addressing serial correlations by GMM proposed by Arellano and Bond (1991). Standard errors are adjusted following Roodman (2009). Hansen's J-test supports over-identification condition. Main results are qualitatively similar to column (B). That is, b_y is significantly positive and greater than that of column (A). The coefficients of capacity size and copper price have the same signs as column (B), though their significance is changed.

4.2 Merger simulations

In merger simulations of this paper, we compare the values of endogenous variables in the actual case and counterfactual one. In the actual case, we solve the equilibrium for Ω^m, a set of domestic companies actually staying in the market at the time. That is, Ω^m contains the combined company, UACJ, but Furukawa and Sumitomo are excluded after the merger. On the contrary, our counterfactual cases are based on Ω^n that includes Furukawa and Sumitomo even after the merger, as if they have remained separated, but not UACJ. For Ω^m and Ω^n respectively, we calculate endogenous variables, Q_D, P_D, Q_M, y_i, and x_i, given import price P_M and export price P_X, which we assume exgogenous, and structural parameters and shift factors of (6) and (7). The differences of these endogenous variables between Ω^m and Ω^n gives evaluation of the economic impact of the merger. Note that we treat this merger as exgogenous. As mentioned in Section 2, copper tube was not a central business area for Furukawa and Sumitomo. It is reasonable to see that the merger in the field of copper tube occured incidentally, along with the merger in the field of alminium products.

To begin with, we check how credibly our model replicates the real Japanese copper tube market. Four panels of Figure 4 graphically compare values calculated from the model (solid lines) with observed ones (double lines) for industry-level endogenous variables, Q_D, Q_M, P_D. The first two panels (A) and (B) show domestic goods quantities and prices. The model fits well until around 2012, but two lines for both variables diverge since then. Productions of domestic goods are underestimated and its prices are overestimated. Drastic change in exchage rate behavior of the period can be considered to be behind this divergence. As shown in Figure 5, yen was rapidly depreciated against dollar since late 2012, when Japan's large-scale monetary easing expanded further. Since this depreciation of yen was abrupt, Japanese exporters did not adjust their dollar-based export prices immediately [13]. This seems to have caused unintended upsurge in yen-based export prices of copper tube shown in Table 1. Export prices increased 13% on average

[13] Shimizu and Sato (2015) report that export prices of Japanese manufacturers in terms of destination currency did not change so much in response to the depreciation of the yen in this period.

after the merger, while domestic prices dropped by 3%. As a result, the observed export prices after late 2012 may significantly exceed its previously assumed level, which should be equal to marginal costs. Thus, observed export prices supposedly overestimate actual marginal costs. It is likely that this resulted in overestimation of prices of domestic copper tube and underestimation of its quantity.

On the contrary, our model successfully simulates imports of copper tube as shown in panel (C) and (D) of Figure 4. Both quantities and prices are almost equal to actually observed values all over the period. After late 2012, quantities and prices are overestimated due to the overestimation of domestic prices (demand curve of imported goods shifts outward), but the size of biases are small. This is because over-valuation of export prices affects import only indirectly via the level of P_D in import demand function (2).

Figure 6 shows the comparison of actually observed and simulated values for firm-level production quantities y_i, i.e., the sum of shipment to domestic market q_i and export x_i. As in Figure 4, solid lines indicate the simulated values and double lines for actual ones. For panels (A)-(E), the parameters of marginal cost function are derived from column (B) of Table 3. For all firms, we see well-fitted simulation results. As discussed above, the yen-based export prices are probably higher than the levels expected by Japanese firms. This should lead to underestimated quantity of shipment to domestic market q_i, while higher export prices mean larger export quantities x_i. These two effects cancel out each other, then the simulated values of production quantities $y_i \equiv q_i + x_i$ have little biases [14]. Panel (D') uses the parameters obtained from column (C) of Table 3 for Furukawa. Simulated production levels are similar to what is depicted in panel (D), but they fluctuate more. Since our sample size is limited, GMM estimation used in column (C) of Table 3 may suffer from a severe small sample bias. Thus, we take the result of column (B) of Table 3 as a base case for our marginal cost function.

We evaluate the impact of the merger between Furukawa and Sumitomo on endogenouos variables, Q_D, Q_M, P_D, q_i, and y_i by solving the model for Ω^m and

[14]One drawback of our simulation is that simlated export quantities take nagative values in some cases, because simulated q_i exceeds simulated y_i. However, in our model, domestic market equilibrium including import is independent of export level. We focus on the results for the domestic market hereafter.

Ω^n and comparing the results. Our baseline model are obtained from column (B) of Table 2 and column (B) of Table 3 [15]. The results are presented in Figure 7. Solid lines plot the results for the merger case based on Ω^m and dashed lines are for the no-merger case based on Ω^n.

Panel (A) of Figure 7 shows the impact of the merger on Japanese producers' shipment to domestic market. It declines by 18.8% on average by this merger. Domestic price of copper tube increases by 13.2% correspondingly as shown in panel (B) [16]. This increase in prices is significant in view of the fact that the criterion of SSNIP test is about 5% increase of price. On the contrary, the merger gives a less impact on import goods market. As depicted in panel (C), the quantities of import rises by only 6.3% in spite of the upsurge of domestic goods prices.

The impact of the merger on the merging parties' total production y_i is presented in Figure 8. Since the merging parties improve their efficiency, the decrease in domestic shipment due to competition effect is canceled out by increase in export. As a result, the merging parties increase y_i by 7.2%, thus the industry sum of total production is slightly pushed up by 3.4%.

4.3 Size of import pressure

We find a substantial price increase caused by the merger, hence reduced consumers' welafre, in spite of increased import. This implies that the import pressure is insufficient in this case if at all. This subsection takes a closer look at the size of the import pressure. Import pressure works when the influx of foreign goods timely occurs if the domestic price is raised because of the merger. This increase in import satisfies the increase in its demand caused by the shift of import demand function. Taking this effect into account, the merging party restrains raising the price.

[15] Simulation results based on column (A) of Table 2 are quite similar to what is reported below.

[16] We also examined the model with partially inelastic import supply. If production capacities of foreign producers are limited, then immediate expansion of import supply is costly. The import supply function with a positive slope corresponds to such a case. We estimated a log-linear import supply function, whose results are provided in Table A1, and exercised the similar merger simulations mentioned in this section. In this case, the merger increases the domestic goods price by 13.5%.

We evaluate the size of import pressure in this sense as follows. Our basic idea of evaluation is comparing the merger's impacts on domestic price under the hypothetical no-import-pressure environmentwith those under the actual environment. Our merger simulations in the previous subsection reflect the acutal size of import pressure. For comparison, we conduct the similar simulation without import pressure. In this hypothetical case, the price increase due to the merger should be higher than what we obtain in the previous subsection. We regard this difference in price increase as the size of import pressure in our study.

We set up the situation without import pressure by fixing import at the no-merger level (shown as the dotted line in panel C of Figure 7) even when the merger occurs. Import prices in this situation are counterfactually determined to satisfy (4), given the import quantity, shift factors $\boldsymbol{Z}$, and domestic price determined by the domestic goods market equilibrium. The rest of the model remains unchanged.

As a result, the increase in domestic prices after the merger is 13.6% on average if there is no import pressure. This means that import pressure in this case contains the price rise by 2.6% ($= (13.6 - 13.2)/13.6$). The size of import pressure is unremarkable.

4.4 Export environment and merger impact

This subsection explores how the environment of export market affects the impact of the merger on domestic market. Since marginal revenues from domestic market should be equal to export price through firms' marginal cost (from (3) and (5)), low export price forces down the price of the domestic goods the combined firm charges. On the other hand, when export price is lower, the larger share of shipment of each firm should go to the domestic market. In this sense, raising domestic price has more influence on firms' profit. The size of these effects depends on the change in export prices and the domestic demand function.

Since we treat export price as exogenous, it is a parameter of our model. We can evaluate the impact of the merger on domestic market outcomes by solving the model for different level of export prices and comparing those results. The impact of the merger is again defined as the difference of endogenous variables for Ω^m and Ω^n. We set our counterfactual level of export prices as 5% lower than actual ones.

Simulation results are summarized in Table 4. The first two columns show the results under actual levels of export prices after the merger. That is, these figures are the average values for what is illustrated in Figure 4. The first column presents the average values of endogenous variables for Ω^m and the second column for the percent changes of simulated values between Ω^m and Ω^n cases. We can see the same figures mentioned in subsection 4.2.

The last two columns of Table 4 provide the levels and percent changes caused by the merger for endogenous variables in the case when export prices were counterfactually 5% lower than the actual levels. Prices of the domestic goods after merger is 4.6% lower in this case than the case using actual export prices. However, the impact of the merger itself is slightly larger when export price is lower.

5 Concluding Remarks

This paper quantitatively evaluates how international factors such as import and export affect the domestic market outcome caused by a merger. More specifically, we focus on the following two issues. First, we examine how much import pressure restrains raising product prices after a merger. We conduct merger simulations for the case of Japanese copper tube industry, where the existence of import pressure was one of the issues in the merger review. The results show that the import pressure is rather weak in our case. The merger induces product prices to rise by 13.2% in the domestic market, while the size of increase in import due to the merger is 6.3%.

This increase in import has little effect on the domestic market after the merger. If import after the merger was counterfactually fixed at the level without it, the domestic price would increase by 13.6% due to the merger. This means that the increase in import caused by the merger pushes back the domestic price only by 2.6%.

Second, we study the impact of export market environment on the merger outcomes. If export price was 5% lower, the price level in the domestic market after the merger would be 4.6% lower. This tight relation between export price and domestic price is an important factor when we evaluate the impact of a merger ex post. The size of price increase due to the merger would be smaller when export price was lower in our case, though.

Our findings on import is different from what competition authority expected as of the merger review, while we demonstrate that export market environment has a solid impact on the domestic market through domestic firms pricing strategy. These results suggest that we should take a careful look at the existence/non-existence of influence from international factors based on thorough information about the market considered, when assessing the welfare impact of a merger. Accumulating studies like this paper for cases of other industries is important for more appropriate assessment of proposed mergers.

A Import Supply Function

We used another model of the industry with import supply function $Q_M = g_M(P_M, \boldsymbol{S})$, where $\boldsymbol{S}$ is an import supply shifter vector and $\partial g_M / \partial P_M > 0$. We specify the functional form of g_M as log linear like

$$\ln Q_M = a_M + b_M \ln P_M + b_S \boldsymbol{S} + u_M. \tag{8}$$

Import supply shifter vector $\boldsymbol{S}$ includes the difference of copper price between domestic and international markets, a time trend, and a peak-month dummy.

To deal with the endogeneity issue about estimating (8), we use air-conditioner production quantity, one of the demand shifters mentioned in section 3, as instrumental variables (IVs). Yen-dollar rate of the month and one-month before are also included, because they are exogenous to supply behaviors of foreign producers and correlate to the price of imported goods. We add the price of stainless pipe, one of the substitutes of copper tube, to IVs for import supply estimation.

The estimation results are shown in Table A1. Standard errors are modified by using HAC weighting matrix to address serial correlations of error terms. Column (A) is the result using pre-merger data only and column (B) presents the result of our full sample with post-merger dummy. In both cases, the coefficients are precisely estimated with expected signs.

Using this import supply function, the equilibrium of imported goods is described as

$$f_M(P_D, P_M, \boldsymbol{Z}) = g_M(P_M, \boldsymbol{S}) \tag{9}$$

instead of (4). We conducted merger simulation based on this industry model and obtained essentially similar results to those with perfectly elastic import supply.

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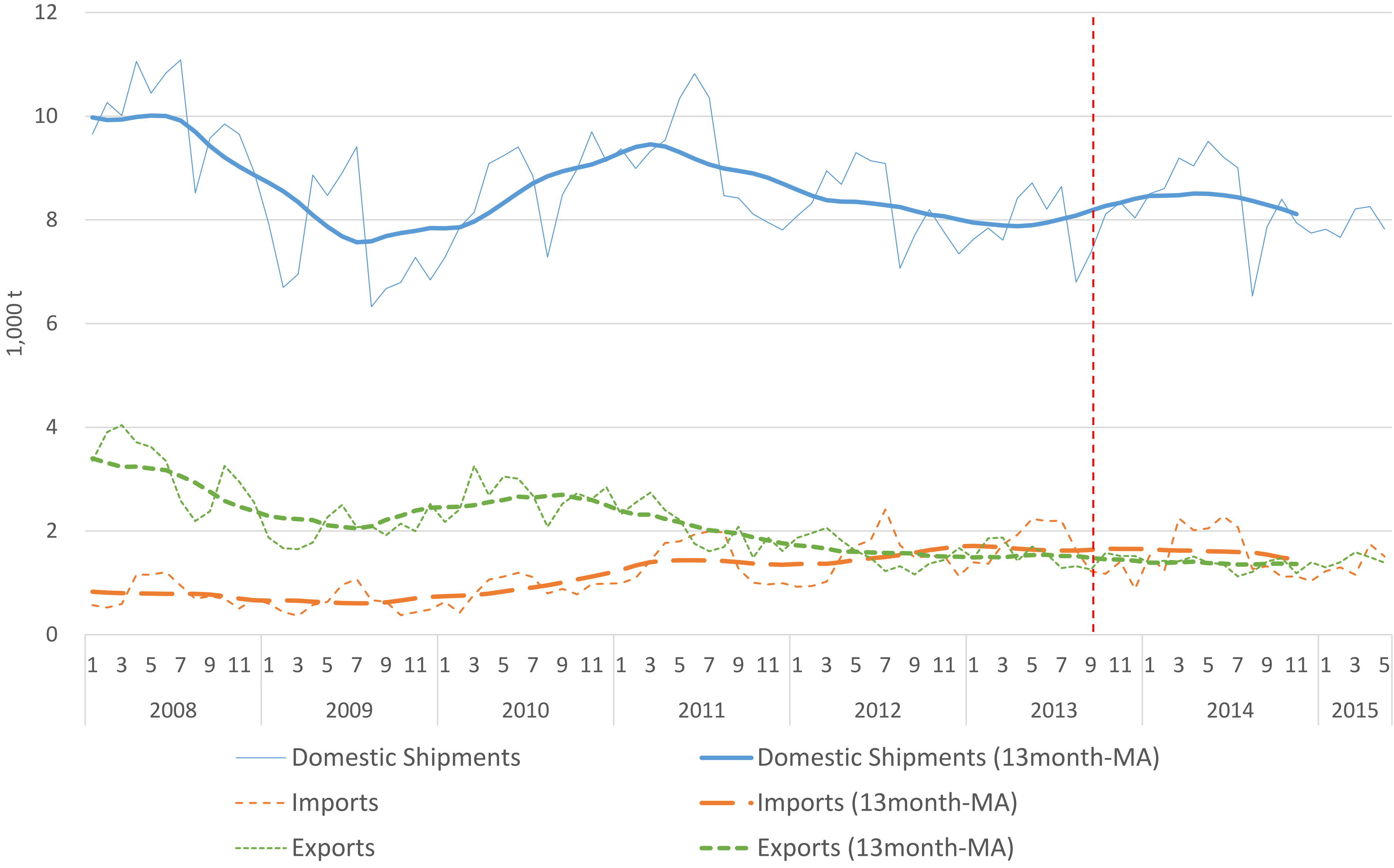
Figure 1. Domestic Shipments, Imports, and Exports of Copper Tube in Japan



(Source) *Current Survey of Production*, METI, for domestic shipments. *Trade Statistics of Japan*, MOF, for imports and exports.

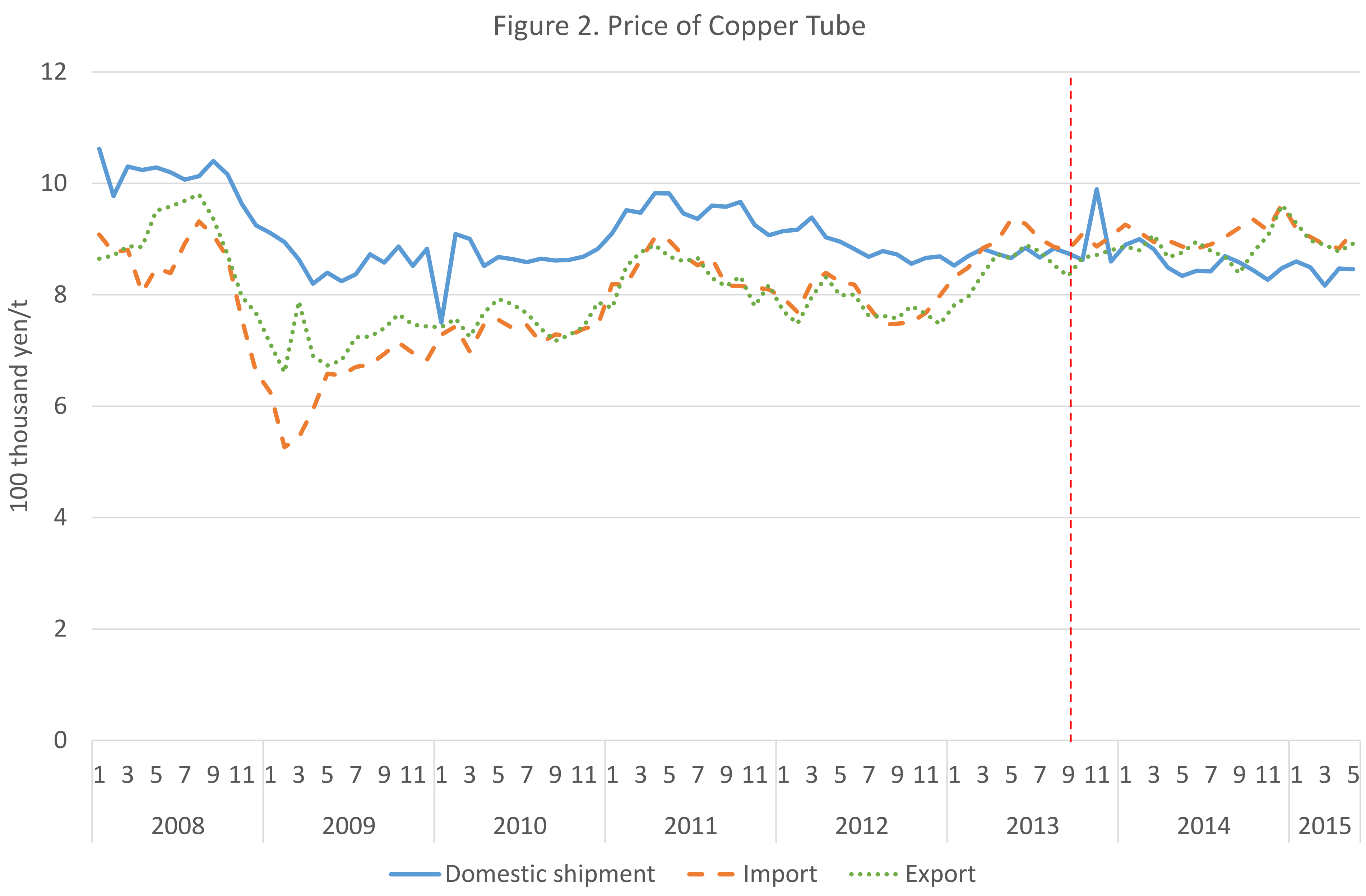


Figure 2. Price of Copper Tube
100 thousand yen/t
0
2
4
6
8
10
12
1 3 5 7 9 11 1 3 5 7 9 11 1 3 5 7 9 11 1 3 5 7 9 11 1 3 5 7 9 11 1 3 5 7 9 11 1 3 5 7 9 11 1 3 5
2008
2009
2010
2011
2012
2013
2014
2015
Domestic shipment
Import
Export

Figure 3. Price of Copper Ingot

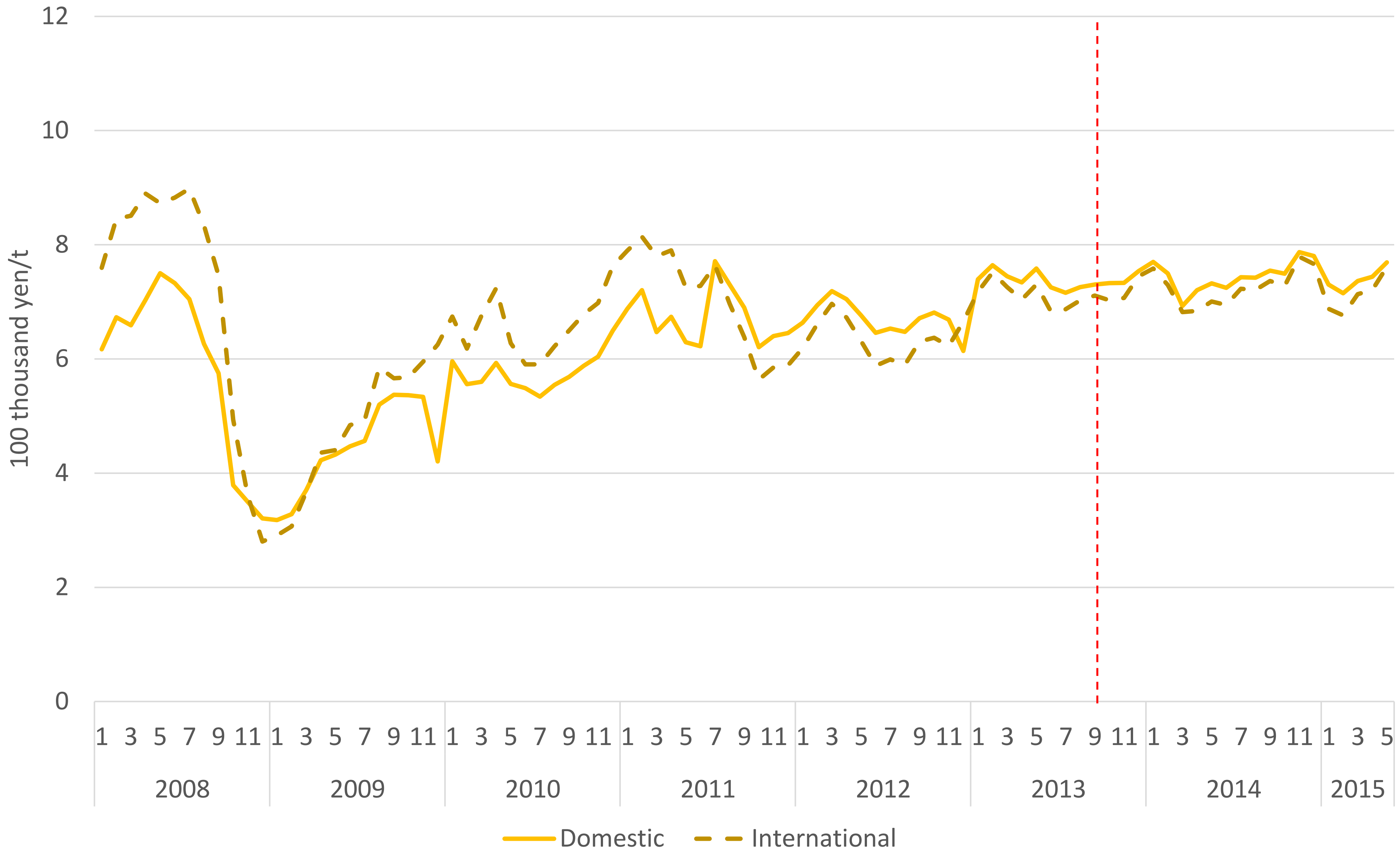
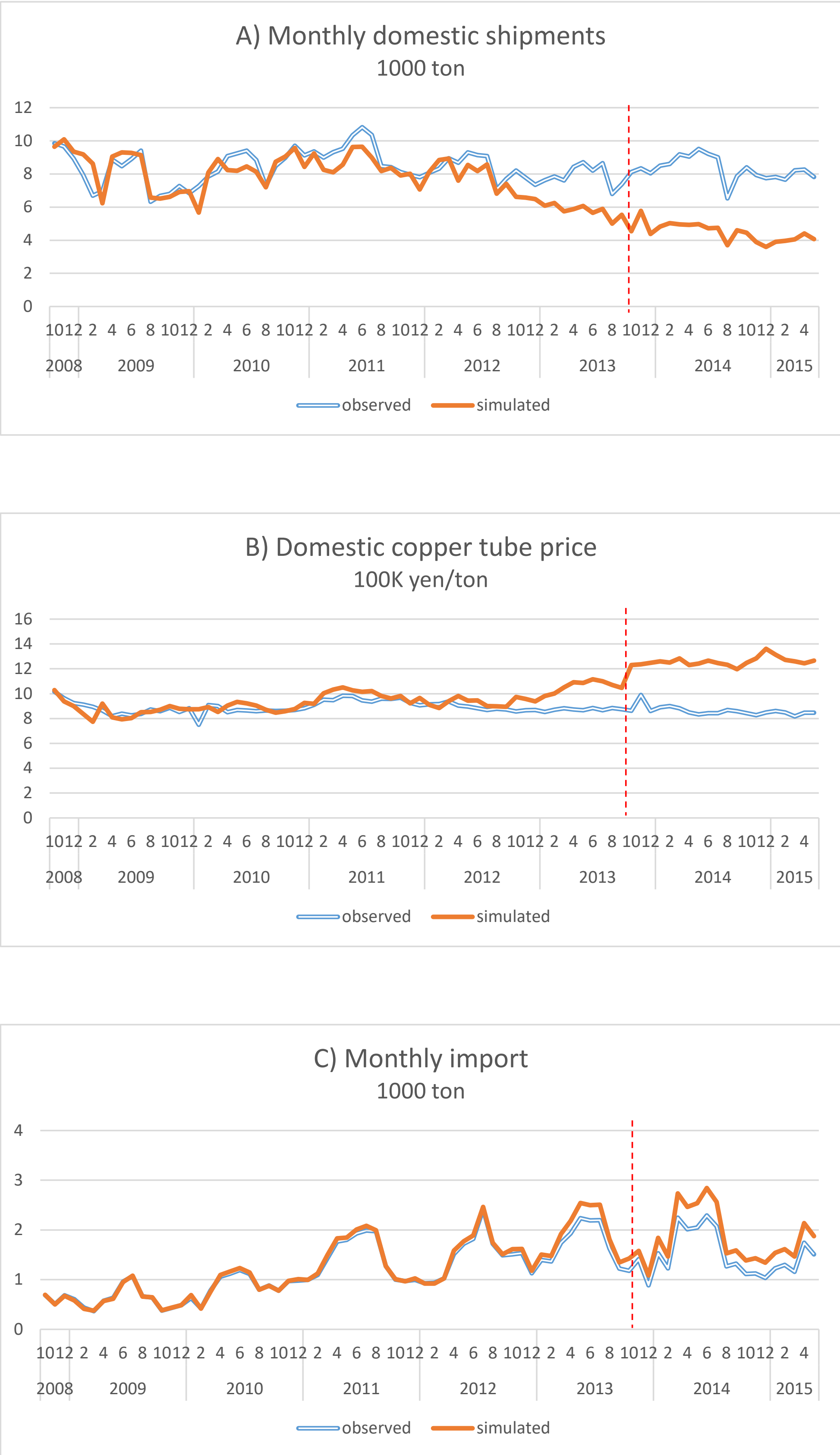


Figure 4. Observed and Simulated Domestic Market Outcome



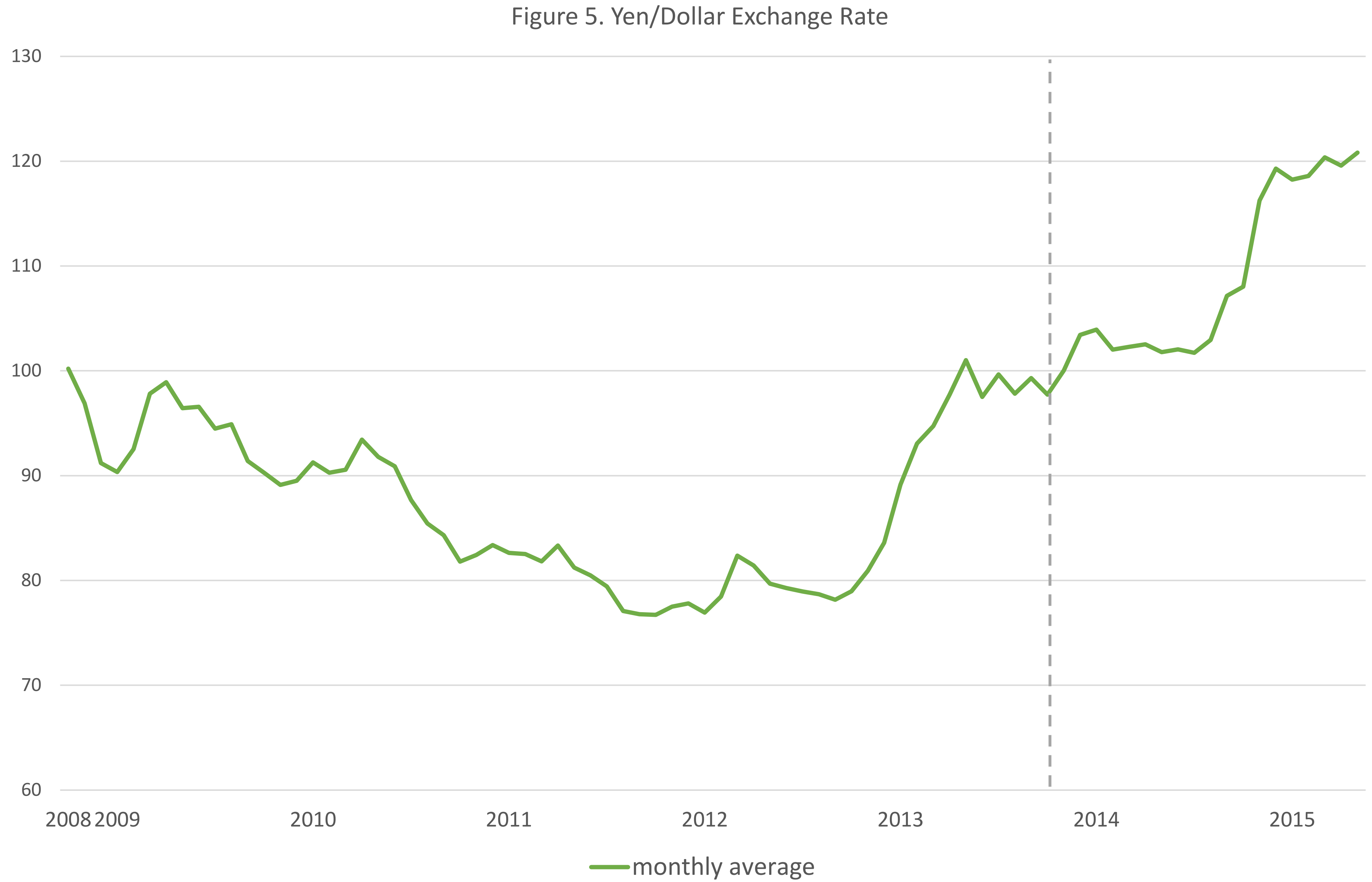


Figure 5. Yen/Dollar Exchange Rate
130
120
110
100
90
80
70
60
2008
2009
2010
2011
2012
2013
2014
2015
monthly average

Figure 6. Observed and Simulated Production by Firm

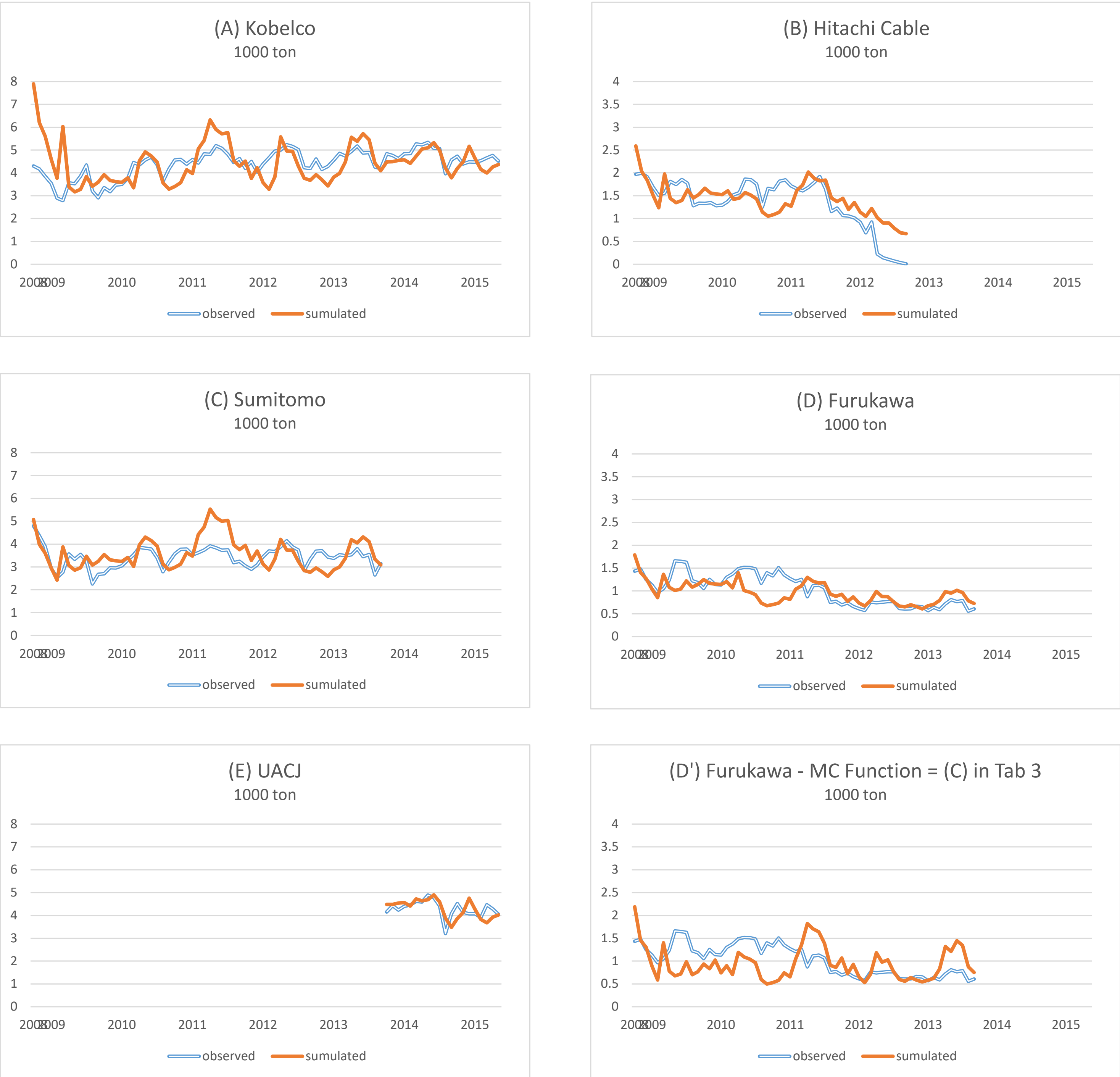
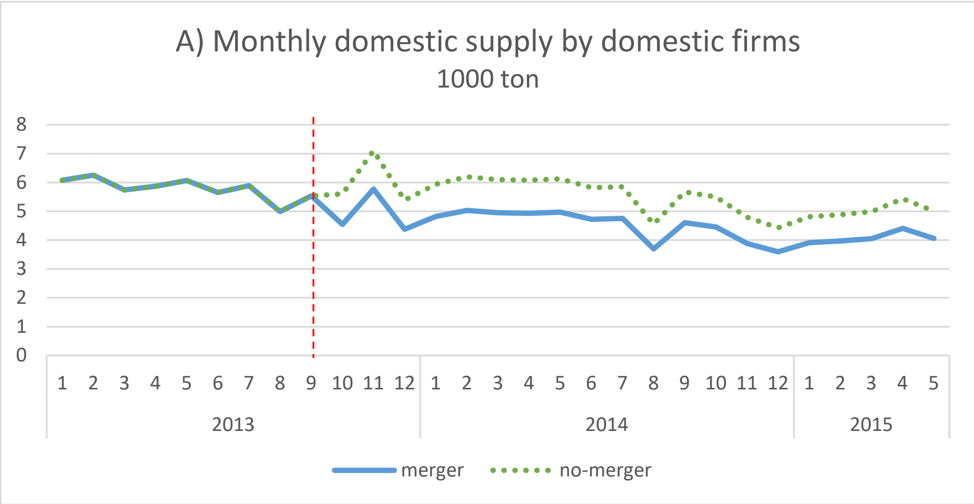
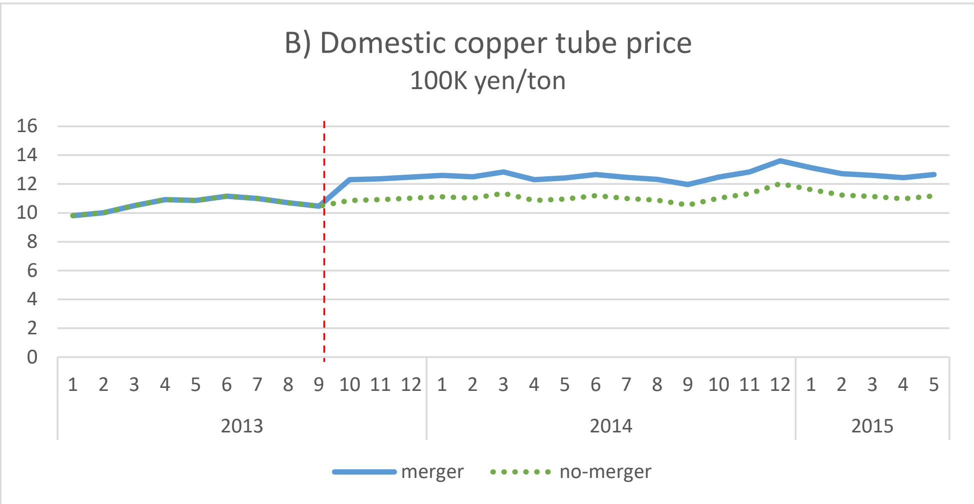
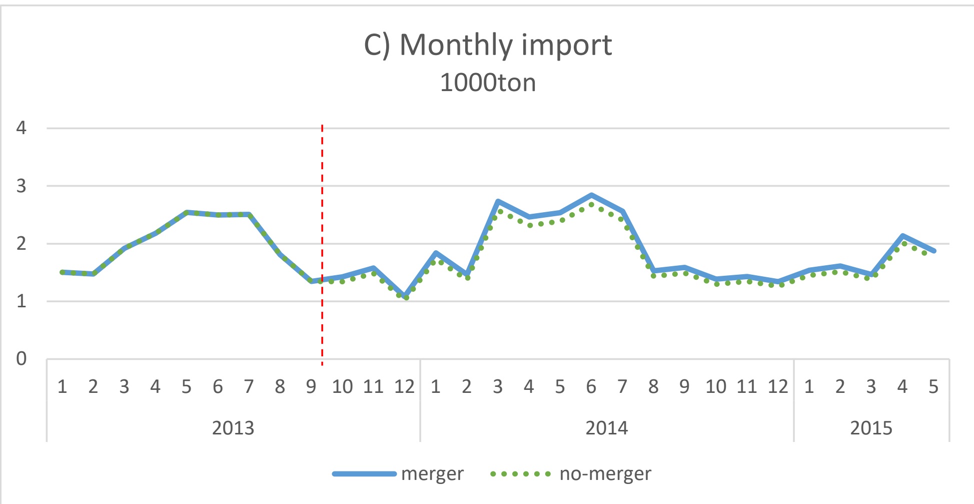


Figure 7. Impact of Merger on Domestic Market Outcome







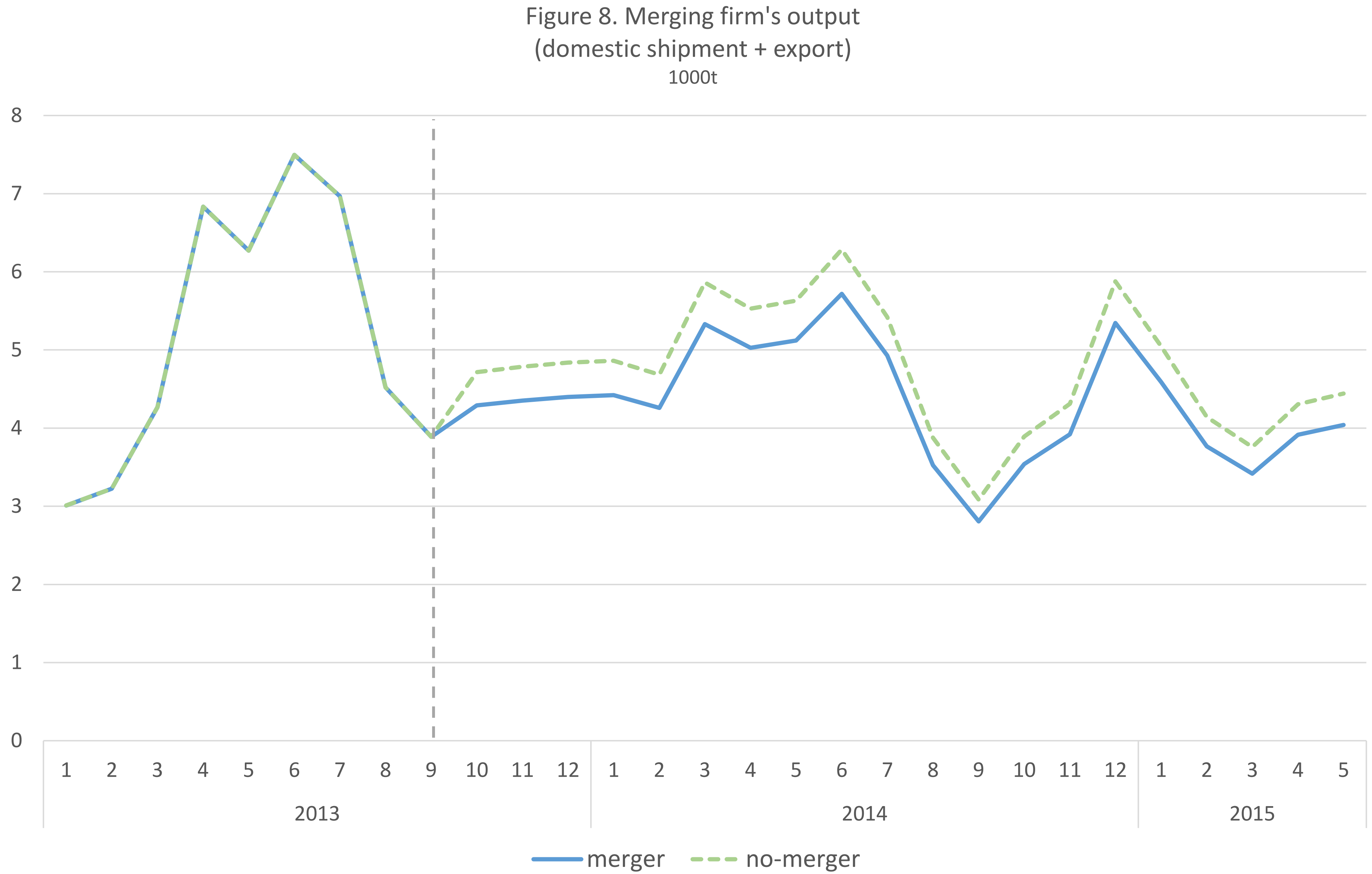


Figure 8. Merging firm's output
(domestic shipment + export)
1000t
8
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5
2013
2014
2015
merger
no-merger

Table 1 (a). Descriptive Statistics of Variables Used in Estimations (Pre-merger Period: Oct 2008 - Sep 2013)

Variable	Unit	Mean	Median	S.D.	Min	Max
Industry-level data (#obs.=60)						
Quantity of domestic copper tube	ton	8389.53	8446.00	1016.75	6325.00	10820.00
Price of domestic copper tube	1,000 yen/ton	891.29	882.39	45.99	750.21	1016.19
Import quantity of copper tube	ton	1178.60	1064.50	540.32	366.00	2415.00
Import price of copper tube	1,000 yen/ton	773.72	768.19	91.87	526.44	935.56
Export price of copper tube	1,000 yen/ton	785.47	779.94	57.26	660.91	889.55
Air-conditioner production	10,000 units	150.71	145.65	26.74	103.08	209.54
Domestic copper price	1,000 yen/ton	600.64	634.60	123.40	317.80	771.10
Copper price (int'l) - Copper price (domestic)	1,000 yen/ton	20.92	2.25	65.21	-57.99	204.30
Industry-level capacity size of copper products	ton/month	96697	96135	2309	94185	101834
Price index of electricity	2010=100	108.21	107.40	9.80	94.80	135.00
Import price index of iron ore	2010=100	101.88	107.10	28.10	53.50	145.40
Yen-dollar rate	yen/dollar	87.48	88.39	7.62	76.72	101.01
Firm-level data (#obs.=222)						
Production of copper tube	ton	2654.64	2866.50	1439.31	558.00	5229.00
Firm-level capacity size of copper products	ton/month	5126.13	5000.00	1583.34	3000.00	9000.00

Table 1 (b). Descriptive Statistics of Variables Used in Estimations (Post-merger Period: Oct 2013 - May 2015)

Variable	Unit	Mean	Median	S.D.	Min	Max
Industry-level data (#obs.=20)						
Quantity of domestic copper tube	ton	8290.95	8236.00	688.95	6532.00	9515.00
Price of domestic copper tube	1,000 yen/ton	860.86	848.96	36.32	816.71	989.41
Import quantity of copper tube	ton	1484.95	1309.50	430.27	886.00	2290.00
Import price of copper tube	1,000 yen/ton	906.91	904.44	19.91	883.12	963.28
Export price of copper tube	1,000 yen/ton	887.31	879.95	25.58	838.63	961.10
Air-conditioner production	10,000 units	153.99	150.69	23.60	114.07	200.39
Domestic copper price	1,000 yen/ton	743.10	742.90	22.64	692.80	787.10
Copper price (int'l) - Copper price (domestic)	1,000 yen/ton	-22.29	-21.64	10.37	-42.46	-7.81
Industry-level capacity size of copper products	ton/month	94310	94335	137	94085	94535
Price index of electricity	2010=100	136.53	137.65	6.48	127.00	146.00
Import price index of iron ore	2010=100	102.76	101.75	18.39	71.40	126.20
Yen-dollar rate	yen/dollar	108.44	103.68	8.28	97.73	120.82
Firm-level data (#obs.=40)						
Production of copper tube	ton	4517.20	4516.50	415.86	3208.00	5335.00
Firm-level capacity size of copper products	ton/month	6840.00	6885.00	1653.70	5000.00	8470.00

Table 2. Estimation Results of Relative Demand Function

	(A) pre-merger data only			(B) incl. post-merger data		
	Coef.	S.E.		Coef.	S.E.	
Domestc price/Import price	-1.836	0.243	a	-2.169	0.611	a
Air-conditioner production	-1.343	0.119	a	-1.265	0.124	a
trend	-0.032	0.001	a	-0.033	0.003	a
Post merger dummy				0.598	0.029	a
const.	24.583	1.705	a	23.642	1.555	a
Coef of Relative Price by OLS	0.541	0.441		0.169	0.411	
R-squared	0.612			0.612		
	Stat.	p-value		Stat.	p-value	
Hansen's J statistics	2.209	0.530		3.231	0.357	
Own price elasticity of domestic product demand as of the merger (Sep 2013)	1.417			1.582		
Own price elasticity of import product demand as of the merger (Sep 2013)	1.419			1.587		

Dep. Var. = Domestic quantity/Import quantity

#obs. = (A) 60 (B) 80

a: significant at 1% b: significant at 5% c: significant at 10%

Standard errors are derived by using HAC weighting matrix.

Table 3. Estimation Results of Marginal Cost Function

	(A) FE			(B) FE + IV			(C) FE + GMM		
	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.	
ln (output)	0.062	0.022	b	0.390	0.089	a	0.201	0.022	a
ln (capacity size)	-0.091	0.077		-0.518	0.101	a	-0.143	0.184	
ln (copper price)	0.140	0.020	a	0.006	0.078		0.154	0.027	a
Peak Months Dummy	0.005	0.006		-0.046	0.009	a	-0.053	0.011	a
trend	-2.11.E-03	0.001	c	-7.36.E-04	0.002		-1.11.E-03	0.003	
trend^2	4.66.E-05	0.000	b	5.10.E-05	0.000	a	1.37.E-05	0.000	
const.	6.068	0.712	a	7.974	1.055	a	5.386	1.578	a
R-squared	0.428			0.128			-		
							Stat.	p-value	
Hansen's J statistics							0.000	1.000	

Dep var = ln(export price)

#obs. = 262

a: significant at 1%   b: significant at 5%   c: significant at 10%

(A, B) Standard errors are adjusted for 5 clusters in firmid

Table 4. Average Impact of Merger on Main Variables and Export Price Level

	Export price = Actual		Export price = 5% lower	
	level for merger case	%change caused by merger	level for merger case	%change caused by merger
domestic price	1263.5	13.49%	1189.5	13.68%
domestic shipment	4605.4	-18.10%	5077.1	-18.12%
import price	954.9	1.61%	947.8	1.68%
import quantity	1691.2	4.11%	1657.3	4.30%

Demand = (B) incl. post-merger peirod
Import supply = (B) incl. post-merger peirod
Marginal cost = (B) FE + IV

Table A1. Estimation Results of Import Supply Function

	(A) pre-merger data only			(B) incl. post-merger data		
	Coef.	S.E.		Coef.	S.E.	
Price of imported copper tube	2.191	0.287	a	2.532	0.453	a
Copper price (int'l) - Copper price (domestic)	-0.469	0.233	b	-0.595	0.270	b
trend	0.009	0.002	a	0.006	0.003	b
Peak Months Dummy	0.380	0.034	a	0.373	0.035	a
Post merger dummy				-0.418	0.112	a
const.	-8.007	1.884	a	-10.179	2.938	a
Coef of Price by OLS	1.332	0.300	a	1.478	0.288	a
R-squared	0.813			0.762		
	Stat.	p-value		Stat.	p-value	
Hansen's J statistics	2.778	0.427		3.465	0.325	

Log-linear model.

#obs. = (A) 60 (B) 80

a: significant at 1% b: significant at 5% c: significant at 10%

Standard errors are derived by using HAC weighting matrix.