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East Asian and European Firms: Comrades or Competitors*

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Abstract

This paper examines the stock market exposures of sectors in France, Germany, Japan, and South Korea. If a firm in one country competes with firms in another country, an appreciation of its currency relative to its competitors' currency should lower its profitability and its stock price. If a firm cooperates with firms in another country by purchasing imported intermediates from them, an appreciation of its currency relative to its comrades' currency should increase its ability to purchase inputs and raise its profitability and stock price. The results indicate that 60 percent of the sectors examined in France and Germany and 27 percent of the sectors examined in Korea benefit when their currency appreciates against the Japanese yen and that virtually no sectors are harmed by yen depreciations. This implies that Japanese firms play a vital role as suppliers of intermediate goods to firms in France, Germany, and Korea. By contrast, the results point to substantial competition between European and Korean firms.

Keywords: Exchange rate exposure, stock returns, international trade

JEL classification: F10, G10

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1. Introduction

How does an appreciation affect a nation's companies? If exporting firms pass through exchange rates into foreign currency prices, then their export volumes should decrease. [1] If exporting firms price to market (i.e., keep foreign currency prices constant), then their profit margins in their own currency should fall. Either way, their profits should decrease. If import-competing firms find that an appreciation of their currency causes foreign firms to lower domestic currency prices, then the volume of imports that compete against their goods should increase. If foreign firms keep the prices of imports coming into the home country constant, then the foreign firms' profit margins should increase. Either way, foreign firms should be better able to compete against domestic firms in the domestic market.

A country's firms do not only compete with foreign firms but also cooperate with them. Foreign firms supply parts and components, primary goods, and capital goods that are inputs for domestic firms and also purchase inputs from domestic firms. When the home country's currency appreciates, domestic firms can either purchase more of these inputs, purchase the same quantity at lower cost, or purchase higher quality imported inputs. This should benefit domestic firms.

One way to investigate the overall impact of exchange rate changes on firm profitability is to examine how they impact stock prices. Finance theory indicates that stock prices equal the expected present value of future cash flows. If a domestic firm competes with foreign firms, then an appreciation of its currency relative to its competitor's currency should decrease the domestic firm's profitability through the channels discussed above. If a domestic firm cooperates with foreign firms by purchasing imported inputs, then an appreciation should

[1] The extent of pass through depends on whether shocks are perceived as temporary or permanent and on the nature of strategic interactions between firms (see, e.g., Amiti et al., 2019, and Burstein and Gopinath, 2014).

increase the home firm's profitability by increasing its ability to purchase imported inputs. If a firm is both competing and cooperating with firms in another country, then the overall reaction of stock prices to the exchange rate indicates whether the cooperation or competition channel predominates. Thus examining the response of stock prices to exchange rate changes can shed light on whether domestic and foreign firms are competitors or comrades.[2]

Foders and Vogelsang (2014) employed the unit value method to investigate the types of competition practiced by German, Japanese, Korean, Chinese, and American firms over the 1990-2011 period. They classified competition into price competition, quality competition, and ambiguous competition. They defined price competition as the case where consumers are unwilling to pay higher prices for domestic goods than for imported goods and quality competition as the opposite case. They also classified the technological intensity of goods based on research and development (R&D) intensity using the European Commission's (2013) method. They reported that Germany engages in quality competition, especially in medium level technology goods. They also found that Japan and Korea engage in a combination of price and quality competition across technology levels.

Bas (2015) and the *Conseil National de Productivité* (2019) investigated price and non-price competitiveness across OECD countries. They assumed that price competitiveness is driven by the ratio of export prices of domestic firms to export prices of foreign firms expressed in a common currency. They first attempted to explain changes in the countries' export market shares caused by factors such as changes in export price ratios. Changes in market shares that could not be attributed to changes in these standard factors were then taken to reflect non-price

[2] Since stock prices equal the expected present value of future cash flows, exchange rate changes that impact profitability should also impact stock prices in the same direction under the assumption that the impact on expected cash flows dominates any impact on discount rates.

competitiveness. The *Conseil National de Productivité* reported the number of sectors where countries ranked in the top ten in non-price competitiveness. They found that Germany was the clear leader in 2007 and 2016, with almost 90 out of the 102 sectors investigated in the top ten. They also reported that France and Japan lagged behind Germany in terms of the numbers of sectors in the top ten in non-price competitiveness.

Hu, Parsley, and Tan (2021) investigated cooperative relationships between importers and exporters. They employed a partial equilibrium model to investigate the relationship between import currency appreciation and the quality of imported inputs. They defined quality as any factor other than price that raises demand. They demonstrated theoretically that an appreciation of the importer's currency makes imported intermediates cheaper. In their model this allows firms to switch to higher quality intermediates and thus to export higher quality final goods. Using firm level data from China's ordinary customs regime over the 2001-2006 period and firm level effective exchange rates, they reported that import currency appreciations increase both import and export quality. They noted that nothing in their work is specific to China or to developing countries.

Ahmed (2009) investigated how appreciations of the Chinese renminbi and of Asian countries supplying parts and components to China affect China's exports. He showed theoretically that both appreciations of the renminbi and of currencies in Asian supply chain countries would cause China's exports to other countries to fall. He then used quarterly data and an autoregressive distributed lag model to investigate China's exports over the 1996Q1 – 2009Q2 period. He reported that a 10 percent renminbi appreciation versus non-supply chain countries reduces exports in the processing customs regime by 17 percent and that a 10 percent appreciation versus Asian supply chain countries increases processing exports by 15 percent.

This points to a cooperative relationship between China and Asian supply chain countries, as an appreciation of the renminbi against upstream countries increases China's exports to downstream countries.

Thorbecke (2019a) investigated the response of Japanese semiconductor stocks to changes in the Japanese yen, Korean won, New Taiwan (NT) dollar, and other variables. He also investigated the response of a Japanese high-end electronic parts producer, Murata Manufacturing, to these exchange rates. Using daily data over the 4 January 2005 to 31 January 2019 period, he reported that a 10 percent appreciation of the yen reduces returns on Japanese semiconductor stocks by 3.1 percent and a 10 percent appreciation of the NT dollar increases returns on Japanese semiconductor stocks by 3.5 percent. The opposite signs on the yen and NT dollar exchange rates is evidence of price competition between Japanese and Taiwanese semiconductor manufacturers. For Murata, he found that the NT dollar does not affect returns. Murata produces high-end ceramic capacitors and Taiwanese firms produce lower-end capacitors, so there is not much competition between them in these goods. On the other hand, he presented evidence that a depreciation of the Korean won benefits Murata. This supports the argument of Patel and Wei (2019) that there is a complementary relationship between Japanese parts and components makers and downstream producers. A weaker won increases exports of Korean final goods and thus imports of Japanese parts and components used to produce these final goods.

This paper uses an approach similar to Thorbecke's (2019a), but extends it to many sectors in the two largest countries in Europe, France and Germany, and the two most advanced economies in East Asia, Japan and South Korea. It investigates how exchange rate changes between these countries' currencies affect sectoral stock returns. An appreciation of the euro

relative to the Japanese yen benefits 60 percent of the sectors in France and Germany and harms less than 10 percent in France and none in Germany. An appreciation of the Korean won relative to the Japanese yen benefits 27 percent of the sectors in Korea and harms none. These findings indicate that French, German, and Korean firms cooperate with Japanese firms by importing inputs. The results reported below also point to extensive competition between European and Korean firms.

The next section presents an analytical description of trade in the four countries. Section 3 describes the data and methodology. Section 4 contains the results. Section 5 concludes.

2. An Analytical Description of France, Germany, Japan, and Korea's Trade

Tables 1-4 indicate that the economies of France, Germany, Japan, and South Korea have similarities and differences. Table 1 presents the dollar value of exports and exports as a share of GDP from these countries in several categories in 2019. The year 2019 avoids distortions caused by the COVID-19 pandemic that arrived in 2020. Row (2) reports exports for chemicals, and all four countries are large exporters. Although not reported in Table 1, the leading chemical exports include makeup and cosmetics for France, industrial chemicals and plastic items for Germany, hydrocarbons, makeup, and photographic chemicals for Japan, and hydrocarbons, makeup, and polymers for Korea. Row (3) reports exports for pharmaceuticals, and the two European countries are leading exporters while the two Asian countries are not. Row (4) reports exports for vehicles, and all four countries are major exporters. For France, 50 percent of vehicle exports are aircrafts and their parts and 40 percent are motor vehicles and their parts. For Germany, 75 percent are motor vehicles and their parts and 15 percent aircrafts and their parts. For Japan, almost 85 percent are motor vehicles and their parts and 8 percent are cargo ships.

For Korea, more than 70 percent are motor vehicles and their parts and more than 20 percent are cargo ships.

Row (5) indicates that all four countries, and especially Germany, are leading exporters of machinery. For France these include gas turbines and medical equipment, for Germany medical instruments, centrifuges, and many other categories, for Japan photographic equipment, printers, copiers, and engines, and for Korea parts for office equipment, liquid crystal displays, and optical fibers. Row (6) indicates that all four are leading exporters of electronics, and for Korea electronic exports comprise almost 10 percent of GDP. For France, these include integrated circuits and television transmission equipment, for Germany integrated circuits, television transmission equipment, and electrical goods, for Japan integrated circuits, semiconductor devices, and electrical goods, and for Korea integrated circuits (more than 50 percent), telephones, and semiconductor devices.

Table 1 also indicates that agricultural exports exceed 3 percent of GDP for France and Germany but are less than 1 percent of GDP for Japan and Korea. Service exports contribute 11 percent of GDP for France, 9 percent of GDP for Germany, 6 percent of GDP for Korea, and 4 percent of GDP for Japan. Travel & tourism, information and communication technology (ICT) services, and other services are all larger as a share of GDP for France than for the other countries. For all four countries, crude oil exports are close to zero.

Table 2 presents imports into these countries in several categories in 2019. Machinery imports in row (5) are important, ranging from 1.9 percent of GDP for Japan to 5 percent of GDP for Germany. For France, Germany, and Japan these include gas turbines, computers, and medical instruments and for Korea these include parts for office machinery, computers, and liquid crystal displays. Agricultural imports in row (13) range from 1.6 percent of GDP for

Japan to 3.4 percent of GDP for Germany. For France and Germany these include coffee, chocolate, and cheese, and for Japan and Korea these include pork, corn, and beef. Vehicle imports in row (4) are important for France and Germany. For France 55 percent of vehicle imports are cars and parts and 16 percent are parts for aircrafts. For Germany 70 percent are cars and parts and 7 percent are parts for aircrafts. Chemical imports in row (2) are important for France, Germany, and Korea. These include many categories of chemicals. Service imports in rows (15) through (17) equal 10 percent of GDP for France and Germany, 8 percent for Korea, and 4 percent for Japan.

Table 3 presents the difference between exports and imports. Looking first at the difference between goods exports and goods imports in column (18), France runs a deficit of 3.1 percent of GDP, Japan a surplus of 1.9 percent, Korea a surplus of 4.5 percent, and Germany a surplus of 8.7 percent. When services are included in column (19), France's deficit decreases to 2.2 percent of GDP, Japan's surplus decreases to 1.7 percent, Korea's surplus decreases to 2.9 percent, and Germany's surplus decreases to 8.1 percent.

Germany's surplus is driven by surpluses of 4 percent of GDP in machinery, 3.5 percent in vehicles, 1.2 percent in chemicals, 1.0 percent in pharmaceuticals, and 0.7 percent in electronics. Korea's surplus is driven by surpluses of 4.8 percent of GDP in electronics, 3.5 percent in vehicles, 2 percent in chemicals, 1.4 percent in machinery, 1.1 percent in refined oil, and 0.5 percent in iron & steel. Japan's surplus is driven by surpluses of 2.7 percent of GDP in vehicles, 1.8 percent in machinery, 0.8 percent in chemicals, and 0.6 percent in electronics. France's deficit is driven by deficits of 1 percent of GDP in textiles, -0.8 percent in crude oil, -0.6 percent in machinery, -0.5 percent in electronics, and -0.4 percent in refined oil and in metals.

Another way to shed light on these data is to calculate each country's comparative advantage by sector. Table 4 presents this using the empirical comparative advantage (ECA) measure developed by Baldwin and Okubo (2019). They calculated ECA as $(X_{cik} - M_{cik})/(X_{cik} + M_{cik})$, where X represents exports, M represents imports, *c* represents country, *i* represents sector, and *k* represents product type.[3]

Table 4 indicates that France has a comparative advantage in pharmaceuticals, travel & tourism services, iron & steel, ICT services, and chemicals. Germany has a comparative advantage in vehicles, machinery, pharmaceuticals, chemicals, metals, and electronics. Japan has a comparative advantage in vehicles, iron & steel, travel & tourism, machinery, chemicals, electronics, ICT services, and other areas. Korea has a comparative advantage in vehicles, refined oil, electronics, chemicals, iron and steel, machinery, and metals. None has a comparative advantage in crude oil, minerals, or textiles and only France has a small comparative advantage in agriculture.

3. Data and Methodology

Many papers have investigated firms' exposure to exchange rates (see, e.g., Ito et al., 2016, and Dominguez and Tesar, 2006). The methodology involves regressing sectoral stock returns on the return on the overall stock market and the change in the exchange rate. Many papers have also estimated portfolio's exposures to macroeconomic variables (see, e.g., McElroy and Burmeister, 1988). Chen, Roll, and Ross (1986) argued that, while few events are completely exogenous, causality should flow from the macroeconomic variables on the right-hand side of the regression equations to the sectoral stock returns on the left-hand side and that the causality flowing in the other direction should be of second order.

[3] Table 4 does not distinguish between parts and final goods in the calculations.

The macroeconomic variables employed here are the return on each country's aggregate stock market, the return on the world stock market, the change in the price of crude oil, the country's exchange rate relative to the U.S. dollar, the euro, the Japanese yen, and the Korean won, and monetary policy indicators. There is a long tradition in finance of using the return on the country's stock market to capture the impact of the overall economy on sectoral stock returns (see, e.g., Brown and Warner, 1980, 1985). Analogously the return on the world stock market is used to capture the effect of the world economy on sectoral stock returns. Europe and Asia have different benchmarks for crude oil prices. The change in the natural log of Brent Crude oil spot prices is employed for France and Germany and the change in the natural log of Dubai crude oil spot prices is used for Japan and South Korea.

To measure monetary policy in France and Germany the data set of Altavilla et al. (2019) is employed. They reported how European Central Bank (ECB) quantitative easing changes, forward guidance, and policy rate changes affect French and German interest rates.[4] For French stock returns all of the changes in 2-year, 5-year, and 10-year interest rates on French government bonds caused by ECB press releases, press conferences, and monetary policy events are employed. For German stock returns all of the changes in 2-year, 5-year, and 10-year interest rates on German government bonds caused by ECB press releases, press conferences, and monetary policy events are employed. For Korean stock returns the change in the Bank of Korea base rate is employed. For Japanese stock returns no variable was found to consistently measure Bank of Japan policy changes.

[4] These data are available here: https://www.ecb.europa.eu/pub/economic-research/resbull/2020/html/ecb.rb200722~528ea64f0d.et.html#:~:text=This%20section%20briefly%20introduces%20the%20new%20resource,%20the,policy%20announcements%20for%20a%20wide%20range%20of%20assets.

Data on sectoral and economy-wide stock returns, the return on the world stock market, the changes in the spot prices of Brent and Dubai crude oil, the exchange rate variables, and the change in the Bank of Korea base rate are obtained from the Datastream database. Data on French and German monetary policy indicators are obtained from Altavilla et al. (2019). Daily data over the 22 January 2001 to 19 January 2021 are employed.[5] There are 5,216 observations. The long time series provide lots of independent variation in the right hand side variables. Together with the assumption that causality flows from the right-hand side variables to the left-hand side variables, this should generate consistent parameter estimates. Augmented Dickey–Fuller tests on the sectoral stock returns and the right hand side variables permit rejection in every case of the null hypothesis that the series have unit roots. Sectoral returns are thus regressed on the macroeconomic variables.

The estimated equations take the form:

$$\Delta R_{i,c,t} = \alpha_0 + \alpha_1 \Delta R_{m,c,t} + \alpha_2 \Delta R_{m,World,t} + \alpha_3 \Delta P_{oil,t} + \alpha_4 \Delta USD_{c,t} + \alpha_5 \Delta Euro_{c,t} + \alpha_6 \Delta Yen_{c,t} + \alpha_7 \Delta Won_{c,t} + \alpha_8 \Delta MP_t + \varepsilon_{i,c,t} \quad (1)$$

where $\Delta R_{i,c,t}$ is the change in the log of the stock price index for sector *i* in country *c*, $\Delta R_{m,c,t}$ is the change in the log of the price index for the aggregate stock market in country *c*, $\Delta R_{m,World,t}$ is the change in the log of the price index for the world stock market, $\Delta P_{oil,t}$ is the change in the log of the spot price for Brent crude oil (for European stocks) or Dubai crude oil (for Asian stocks), $\Delta USD_{c,t}$ is the change in the log of the country's nominal exchange rate relative to the U.S. dollar, $\Delta Euro_{c,t}$ is the change in the log of the country's nominal exchange rate relative to the euro, $\Delta Yen_{c,t}$ is the change in the log of the country's nominal exchange rate relative to the Japanese yen,

[5] In cases when stock return data are unavailable on 22 January 2001, the data are employed beginning on the first date they are available.

$\Delta Won_{c,t}$ is the change in the log of the country's nominal exchange rate relative to the Korean won, ΔMP_t represents the change in the monetary policy variable, and $\varepsilon_{i,c,t}$ is a mean-zero error term. [6]

Aggregation is a tricky issue in economics (see, e.g., Stoker, 2010). For instance, aggregating outcomes on individual firm profitability into sectoral evidence requires considering how demand elasticities may differ across firms. In this paper many of the sectors specified by Datastream have only one firm. Other sectors have one large firm and smaller firms. Since the Datastream indices are value-weighted, the response of the large firm to macroeconomic variables will drive the sector's response. Thus the challenges that aggregation poses to inference are less severe in this study.

Including two European countries permits investigation of how exchange rate exposures differ across countries with different characteristics. France and Germany are both large economies, but Germany runs a surplus in goods trade and a deficit in services trade while France runs a deficit in goods trade and a surplus in services trade. In many sectors Germany also engages in quality competition while France engages in price competition. Including both economies makes it possible to investigate whether exchange rate responses vary because of these different characteristics.

4. Results

Column (2) of Table 5 reports the impact of the yen/euro rate on French sectoral stock prices. Out of 33 sectors, 20 benefit when the euro appreciates relative to the yen and only three are harmed. The sector that benefits the most is construction machinery. The only firm in this

[6] Since real exchange rates are not available on a daily basis, the paper uses nominal exchange rates. Because the prices of goods and services change more slowly than nominal exchange rates, most of the change in daily nominal exchange rates reflect changes in real exchange rates.

sector is Manitou. Manitou employs engines from the Japanese company Kubota. An appreciation of the euro relative to the yen decreases the euro price of these engines and Manitou gains. The sector that benefits the second most is recreational vehicles. The only firm in this sector is Beneteau. Beneteau uses outboard motors made by the Japanese company Yamaha. An appreciation of the euro relative to the yen decreases the euro price of outboard motors and Beneteau gains. The sector that benefits the third most is recreational products. The only firm in this sector is Trigano. Trigano uses Japanese parts in its motor homes and other products. An increase in the yen/euro rate decreases the euro price of these parts and benefits Trigano. Table 1 lists many other sectors that benefit from a stronger euro relative to the yen. These include iron and steel, where companies such as Vallourec use specialty pipe made by the Japanese company Nippon Steel, and travel & tourism, where an increase in the yen/euro rate allows companies such as Voyageurs du Monde to sell more packages to tourists going to Japan.

Column (2) of Table 5 indicates that only three sectors lose when the yen depreciates relative to the euro. One is software. Table 4 reports that both Japan and France have comparative advantage in software. Japanese *monotsukuri*, or manufactured items, are less important as inputs into the software sector than into the sectors discussed in the previous paragraph. French and Japanese firms compete in this sector. Also in the cosmetics industry Japanese inputs are less important to French firms, and Japanese and French firms compete with each other.

Unlike for the yen/euro exchange rate, column (4) of Table 5 indicates that there are only two sectors out of the 33 examined that benefit when the euro appreciates relative to the Korean won. One is telecommunication services. French companies like Orange offer phones from the Korean company Samsung with their telecommunication plans. When the won/euro rate

increases, these phones become cheaper in euros and Orange benefits. The other sector that gains from an increase in the won/euro rate is electronic entertainment. French gaming companies receive input from Korean programmers and gain when the euro strengthens relative to the won.

Also unlike for the yen/euro rate, 13 of the 33 sectors are harmed when the euro appreciates relative to the won. These include automobiles, auto parts, biotechnology, industrial suppliers, and many others. These results indicate that there is much competition between French and Korean firms.

Turning to results for German sectors in Table 6, the benefits of an increase in the yen/euro rate are even clearer than for French sectors. Column (2) indicates that out of 37 sectors investigated, 22 benefit when the euro appreciates relative to the yen and none are harmed. A wide variety of German sectors use Japanese inputs. Aerospace companies use Japanese parts, industrial engineering companies use Japanese industrial engines, and German construction companies use Japanese construction equipment. In addition, as with France an increase in the yen/euro rate enables more European tourists to visit Japan.

There is only one sector in column (2) of Table 6 where the results indicate at the 10 percent level that an increase in the yen/euro rate causes harm. This is software. As with France, there exists competition between German and Japanese software companies. In addition, the results for automobiles indicate with a probability value of 0.102 that an appreciation of the euro relative to the yen harms the German automobile industry. This finding suggests that there is some price competition between German and Japanese automakers.

As is the case for France, column (4) of Table 6 indicates that there are only two German sectors that benefit when the euro appreciates relative to the Korean won. These are

telecommunication service providers and computer service providers. As with France, telecommunication service providers in Germany offer Korean phones with their services. When the euro appreciates relative to the won, the euro cost of these phones decreases and their profits increase. Also as in the case of France, many sectors benefit when the euro depreciates relative to the won. These include computer hardware, specialized machinery, construction machinery, auto parts, and several other sectors. This indicates that German firms in these sectors compete against their Korean counterparts.

Table 7 presents the results for Japanese sectors. Column (2) indicates that 16 out of the 36 sectors examined lose when the yen appreciates relative to the euro. Three of the sectors with the largest yen/euro coefficients are marine transport (i.e., shipbuilding), oil equipment & services, and iron & steel. These are intensely competitive sectors. For instance, steel is produced in more than 90 countries so importing countries have options to substitute domestic steel for foreign steel.[7] In addition, four types of machinery (agricultural, construction, specialized, and industrial) suffer when the yen appreciates against the euro. Also, the general industrial sector, the industrial engineering sector, the industrial supplier sector, and the industrial support services sector also lose when the yen/euro rate falls. Thus both sophisticated machinery sector stocks and industrial stocks fall when the yen strengthens. The coefficient on auto parts is also positive and statistically significant and the coefficient on automobiles is positive and has a probability value of 0.08. Thus many Japanese machinery, industrial, and automobile firms suffer from a stronger yen relative to the euro.

Column (2) of Table 7 also indicate that nine of the 36 sectors gain when the yen appreciates against the euro. One is the semiconductor industry. Japanese companies import

[7] I am indebted to Dr. Anthony de Carvalho for this comment.

photolithography equipment from the Dutch companies ASML, as ASML produces the only machines using extreme ultraviolet light. One machine costs more than USD 100 million. An appreciation of the yen reduces the yen costs of these machines and increases the profitability of Japanese semiconductor manufacturers. Another sector that gains is travel & tourism, as a stronger yen relative to the euro enables more Japanese tourists to visit Europe. Also, food and home improvement retail gain from a decrease in the yen/euro rate, as it reduces the yen cost of food and furniture imported from the Eurozone.

Column (4) of Table 7 indicates that 9 out of the 36 sectors examined lose when the yen appreciates relative to the Korean won. Three of these sectors are marine transport (i.e., shipbuilding), oil equipment & services, and iron & steel. As discussed above, these are intensively competitive sectors. In addition, two types of electronic equipment sectors suffer when the yen/won rate falls. Table 4 indicates that Korea has strong comparative advantage in electronics, and Japanese firms lose competitiveness to Korean firms when the yen strengthens (see Sato et al, 2013). The Japanese cosmetics and household furnishings sectors also lose when the yen appreciates relative to the won. Finally, the results for three types of machinery (construction, specialized, and industrial) indicate at the 10% level that machinery stocks fall when the yen/won rate drops.

The results in column (4) of Table 7 indicate that, even at the 10% significance level, there is only one sector that gains when the yen appreciates against the Korean won. This is the telecommunications services sector. As is the case with Europe, Japanese service providers offer Korean phones with their plans. When the yen/won rate falls, the yen costs of these phones fall and these firms become more profitable.

Table 8 presents the results for Korean sectors. Column (2) indicates that eight out of the 34 sectors examined lose when the won appreciates relative to the euro. Two sectors with large won/euro coefficients are marine transport (i.e., shipbuilding) and iron & steel. As discussed above, these are intensively competitive sectors. In addition, industrial engineering and construction lose when the won appreciates against the euro. Industrial engineering firms such as Doosan Heavy Industries make gas and wind turbines that compete with similar products made in Europe. Korean construction firms also compete for projects with European firms.

Column (2) of Table 8 also indicates that seven of the 34 sectors gain when the won appreciates against the euro. These include the semiconductor industry and other electronics sectors. As with Japanese companies, Korean firms import sophisticated capital goods such as photolithography equipment from Europe. An appreciation of the won reduces the won costs of these machines and increases the profitability of Korean electronics manufacturers. Another sector that gains is consumer staples, as a stronger won reduces the won cost of foods imported from Europe. Finally, software and consumer digital services that benefit from European contributions gain when the won appreciates relative to the euro.

Column (4) of Table 8 indicates that, at the 5 percent significance level, there are no sectors that lose when the won appreciates against the Japanese yen. At the 10 percent significance level, the auto parts and household equipment producers sectors lose when the won strengthens against the yen. This indicates some price competition with Japanese firms in these industries. On the other hand, nine firms in diverse sectors gain when the won appreciates against the yen. This points to the importance of Japanese inputs in sectors such as industrial machinery, marine transport, industrial engineering, iron & steel, and commercial vehicle parts.

The important implication of these results is that Japan is a crucial upstream supplier for France, Germany, and Korea. The opposite exchange rate exposures of the European sectors to the Japanese yen and the Korean won function like the results of a controlled experiment. Hausmann et al. (2014) reported that both Japan and Korea export advanced goods. Using the method of reflections pioneered by Hidalgo and Hausmann (2009) to measure productive capabilities, they found that Japan exported the most sophisticated goods out of 133 countries in 2019 and Korea exported the fourth most sophisticated goods.[8] Table 5 also indicates that both countries have strong comparative advantage in goods exports. The evidence that so many European sectors benefit and so few are harmed from euro appreciations relative to the yen and that the opposite pattern holds for euro appreciations relative to the won indicates that there is extensive cooperation between European and Japanese firms and extensive competition between European and Korean firms.

France and German both have many sectors that benefit from appreciations relative to the Japanese yen and that lose from appreciations relative to the Korean won. In spite of their differing comparative advantages and ways of competing, both European economies are similarly impacted by changes in the yen and the won.

5. Conclusion

This paper investigates whether firms in France and Germany compete or cooperate with firms in Japan and South Korea. If a firm in one country competes with firms in another country, then a depreciation of the domestic firm's currency should make it more competitive relative to foreign firms and increase its profitability. If a firm in one country cooperates with firms in

[8] Japan's export basket was the most sophisticated out of 133 countries in 2019 and Korea's export basket was the fourth most sophisticated. These data are available at: https://atlas.cid.harvard.edu/

another country by purchasing imported inputs, then a depreciation of the domestic firm's currency should decrease its ability to purchase foreign inputs and decrease its profitability. Since finance theory indicates that stock prices equal the expected present value of future cash flows, examining the response of stock prices to exchange rates can shed light on whether competitive or complementary relationships predominate.[9]

The results point to a complementary relationship between Korean firms and the telecommunications services sectors in France, Germany, and Japan. This is because telecommunications service providers offer Korean smartphones with their plans. An appreciation relative to the Korean won renders the local currency prices of these phones cheaper and increases the profitability of telecommunications service providers. The results also reveal a complimentary relationship between European firms and the semiconductor sectors in Japan and Korea. European firms such as ASML provide vital capital goods to semiconductor firms. An appreciation relative to the euro renders the local currency prices of these goods cheaper in Asia.

The findings point to a complimentary relationship between Japanese firms and many sectors in the other countries. For France and Germany, 60 percent of the sectors examined gain when the yen/euro rate increases. For Korea, 27 percent gain when the yen/won rate increases. Only 9 percent of the sectors examined in France are harmed when their currency appreciates against the yen and no sectors in Germany and Korea are harmed. These results indicate that Japanese firms provide vital inputs to firms in France, Germany, and Korea and that Japanese firms cooperate more than they compete with downstream firms in the other three countries.

[9] This paper employs daily data to investigate whether sectors in a country are cooperating or competing with sectors in other countries. The World Input-Output Database (WIOD), available at: http://wiod.org/home, provides another way to investigate whether sectors in a downstream country obtain inputs from an upstream country. As the WIOD data are available annually, future research should use lower frequency data to investigate interactions between European and Asian firms.

Hausmann et al. (2014) reported that Japan had the most complex economy in every year from 1995 to 2019.[10] On the other hand, France's complexity ranking fell from 8th in 1995 to 19th in 2019. Emlinger, Jean, and Vicard (2019) also found that France's export dynamism has fallen, with its global share of exports of goods and services falling 40 percent between 1999 and 2017.

The finding that Japan produces vital manufactured goods points to a way for France to regain its manufacturing prowess. France could do this by attracting Japanese foreign direct investment (FDI). Ozawa (2007) noted that Japanese firms transmit a 'package' of capital, managerial skill, and technical knowledge to host country partners. Kojima (1973) observed that Japanese partners impart know-how and general industrial experience concerning assembly techniques, material selection, combination, and treatment techniques, machine operation and maintenance techniques, provision of blueprints; and technical data, training of engineers and operator, plant lay-out, selection and installation of machinery and equipment, quality and cost controls, and inventory management. The IMF (2012) presented econometric evidence that a 1 percent increase in Japanese FDI over the 1985-2011 sample period raised growth in the host economy by between 0.58 and 0.69 percent. The IMF reported that this far surpassed growth caused by FDI from other countries.

How could France attract Japanese FDI? Dunning (1988) demonstrated that a country's ability to draw in FDI depends among other factors on its locational advantages. Locational characteristics include factor endowments, technology transferability, wage levels, human and physical infrastructure, and market-friendly institutions. Bénassy-Quéré et al. (2019) observed that France has lost attractiveness as a manufacturing location. They noted that high taxes on

[10] The data discussed in this paragraph are available at: https://atlas.cid.harvard.edu/

production multiply costs throughout the production chain. France's *Conseil National de Productivité* (2019) remarked that these taxes are distortionary. The *Conseil* also reported that the skills of French workers are below the OECD average, that older workers lose skills, and that there is a large gap between skills of students from different socio-economic backgrounds.

To attract FDI, France should address these locational disadvantages. Tax reform to ameliorate distortions and high costs would help. In addition, educational reforms to raise the average skills of workers is important. This is difficult because students from disadvantaged neighborhoods face heavy challenges. Often there is only one parent in the house, and that parent works long hours. Drugs and crime proliferate in their neighborhoods. Students become detached from schools and other institutions of the French Republic. Overcoming these obstacles and facilitating learning requires focused attention from parents, educators, government officials and other stakeholders.

The results in this paper point to close cooperation between Japanese and Korean firms. These symbiotic interactions are hindered by inter-governmental conflicts. For instance, in 2019 Japan and Korea removed each other from their lists of preferential trading partners. Korean electronics firms then faced obstacles in obtaining vital chemicals such as fluorinated polyimide and hydrogen fluoride from Japan.

A free trade agreement (FTA) between Japan and Korea could maintain the flow of goods between these countries. Korean observers express apprehension about confronting Japanese competition. The results in this paper, however, indicate that Japanese exports benefit many sectors in Korea. Also, Korean consumers are patriotic and may continue to purchase Korean goods even if an FTA causes the prices of Japanese goods in Korea to fall. An FTA would remove uncertainty and help maintain the flow of vital commodities to Korea. It would also

ensure Japanese access to Korean products. Governments in both countries should continue to consider an FTA, and also an FTA that includes countries such as China.

Firms competing in consumer markets generate efficiency gains. Firms cooperating across countries by trading imported inputs multiply these gains. France, Germany, Japan, and Korea have all gained from an open liberal order. They should continue to lead the battle for free trade. If they cannot convince the U.S. to join, they should study the benefits and costs of an expansive free trade agreement between European and Asian countries. One input to this study could come from extending the approach of this paper to more European and Asian economies.

Table 1. Exports by Sector in France, Germany, Japan, and Korea.

		France		Germany		Japan		Korea	
(1)	Sector	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP
(2)	Chemicals ex. Pharmaceuticals	81	3	184.6	4.8	93.9	1.9	81	4.9
(3)	Pharmaceuticals	34	1.3	89.4	2.3	8.1	0.2	5	0.3
(4)	Vehicles	100	3.7	293	7.6	167	3.3	78	4.7
(5)	Machinery	89	3.3	346	9	188	3.7	93	5.7
(6)	Electronics	41	1.5	156	4.1	111	2.2	159	9.7
(7)	Iron & Steel	14	0.5	25	0.7	26	0.5	22.7	1.4
(8)	Metals ex. Iron & Steel	21	0.8	79	2.1	28	0.6	24.3	1.5
(9)	Crude Oil	0.1	0	0.6	0	0.1	0	0.5	0
(10)	Refined Oil	8.2	0.3	12.5	0.3	10.4	0.2	37.4	2.3
(11)	Minerals ex. Crude & Refined Oil	9.7	0.4	27.9	0.7	4.5	0.1	5.2	0.3
(12)	Textiles	27	1	66	1.7	10	0.2	15	0.9
(13)	Agriculture	91	3.4	123	3.2	13	0.3	13	0.8
(14)	Stone	16	0.6	33	0.9	20	0.4	6	0.3
(15)	Travel & Tourism Services	63.7	2.4	70.0	1.8	46.0	0.9	20.9	1.3
(16)	ICT Services	46.5	1.7	41.1	1.1	66.4	1.3	22.1	1.4
(17)	Other Services	183.8	6.8	240.1	6.3	96.6	1.9	61.0	3.7
(18)	Total (Goods Only)	555	20.5	1498	38.9	718	14.1	540	32.9
(19)	Total (Goods & Services)	849	31.3	1850	48.1	927	18.2	644	39.2

Source: Hausmann et al. (2014), updated at atlas.cid.harvard.edu, and calculations by the author.

Table 2. Imports by Sector in France, Germany, Japan, and Korea.

		France		Germany		Japan		Korea	
(1)	Sector	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP
(2)	Chemicals ex. Pharmaceuticals	73	2.7	137.7	3.6	52.2	1	48.6	3
(3)	Pharmaceuticals	24.1	0.9	52.3	1.4	20.1	0.4	6	0.4
(4)	Vehicles	96.9	3.6	157	4.1	29.6	0.6	20.3	1.2
(5)	Machinery	105	3.9	194	5	96.8	1.9	70.6	4.3
(6)	Electronics	53.4	2	130	3.4	79.9	1.6	80.5	4.9
(7)	Iron & Steel	12	0.4	24.2	0.6	7.3	0.1	14.7	0.9
(8)	Metals ex. Iron & Steel	32	1.2	65.7	1.7	25.6	0.5	20.5	1.3
(9)	Crude Oil	21.9	0.8	34.8	0.9	55.5	1.1	57.4	3.5
(10)	Refined Oil	19.2	0.7	22.2	0.6	12.2	0.2	18.7	1.1
(11)	Minerals ex. Crude & Refined Oil	18	0.7	49	1.3	74.3	1.5	43.9	2.7
(12)	Textiles	55.1	2	86.3	3.3	48.8	1	24.3	1.5
(13)	Agriculture	84	3.1	129	3.4	83.3	1.6	40.2	2.5
(14)	Stone	21.3	0.8	33	0.9	15.2	0.3	8.76	0.5
(15)	Travel & Tourism Services	51.7	1.9	93.0	2.4	21.2	0.42	32.8	2.0
(16)	ICT Services	40.1	1.5	44.1	1.2	50.2	1.0	26.1	1.6
(17)	Other Services	178.3	6.6	237.8	6.2	147.5	2.9	72.1	4.4
(18)	Total (Goods Only)	639	23.6	1165	30.3	624	12.3	465	28.3
(19)	Total (Goods & Services)	909	33.5	1540	40.1	843	16.6	596	36.3

Source: Hausmann et al. (2014), updated at atlas.cid.harvard.edu, and calculations by the author.

Table 3. Exports minus Imports by Sector in France, Germany, Japan, and Korea.

		France		Germany		Japan		Korea	
(1)	Sector	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP	Billions of USD	Percent of GDP
(2)	Chemicals ex. Pharmaceuticals	8	0.3	46.9	1.2	41.7	0.8	32.4	2
(3)	Pharmaceuticals	9.9	0.4	37.1	1	-12	-0.2	-1	-0.1
(4)	Vehicles	3.1	0.1	136	3.5	137.4	2.7	57.7	3.5
(5)	Machinery	-16	-0.6	152	4	91.2	1.8	22.4	1.4
(6)	Electronics	-12.4	-0.5	26	0.7	31.1	0.6	78.5	4.8
(7)	Iron & Steel	2.3	0.1	0.7	0	18.7	0.4	8	0.5
(8)	Metals ex. Iron & Steel	-10.7	-0.4	13.4	0.4	2.4	0	3.8	0.2
(9)	Crude Oil	-21.8	-0.8	-34.2	-0.9	-55.4	-1.1	-57.0	-3.5
(10)	Refined Oil	-11	-0.4	-9.7	-0.3	-1.8	0	18.7	1.1
(11)	Minerals ex. Crude & Refined Oil	-8.3	-0.3	-21.1	-0.6	-69.8	-1.4	-38.8	-2.4
(12)	Textiles	-28.1	-1	-20.3	-0.5	-38.8	-0.8	-9.3	-0.6
(13)	Agriculture	7	0.3	-6	-0.2	-70.3	-1.4	-27.2	-1.7
(14)	Stone	-5.3	-0.2	0	0	4.8	0.1	-2.8	-0.2
(15)	Travel & Tourism Services	12.1	0.5	-23.1	-0.6	24.7	0.5	-11.9	-0.7
(16)	ICT Services	6.4	0.2	-3.0	-0.1	16.2	0.3	-4.0	-0.2
(17)	Other Services	5.5	0.2	3.1	0.1	-50.9	-1.00	-11.1	-0.7
(18)	Total (Goods Only)	-84	-3.1	333	8.7	94	1.9	75	4.5
(19)	Total (Goods & Services)	-60	-2.2	310	8.1	84	1.7	48	2.9

Source: Hausmann et al. (2014), updated at atlas.cid.harvard.edu, and calculations by the author.

Table 4. Empirical Comparative Advantage by Sector in France, Germany, Japan, and Korea.

(1)	Sector	France	Germany	Japan	South Korea
(2)	Chemicals ex. Pharmaceuticals	0.052	0.146	0.285	0.25
(3)	Pharmaceuticals	0.17	0.262	-0.426	-0.091
(4)	Vehicles	0.016	0.302	0.699	0.587
(5)	Machinery	-0.083	0.282	0.32	0.137
(6)	Electronics	-0.131	0.091	0.163	0.328
(7)	Iron & Steel	0.077	0.016	0.562	0.214
(8)	Metals ex. Iron & Steel	-0.208	0.092	0.045	0.085
(9)	Crude Oil	-0.991	-0.966	-0.996	-0.983
(10)	Refined Oil	-0.402	-0.28	-0.08	0.333
(11)	Minerals ex. Crude & Refined Oil	-0.3	-0.274	-0.886	-0.788
(12)	Textiles	-0.342	-0.133	-0.66	-0.237
(13)	Agriculture	0.04	-0.024	-0.73	-0.511
(14)	Stone	-0.142	0	0.136	-0.187
(15)	Travel & Tourism Services	0.104	-0.141	0.369	-0.222
(16)	ICT Services	0.074	-0.035	0.139	-0.083
(17)	Other Services	0.015	0.005	-0.209	-0.083

Note: The table presents empirical comparative advantage (ECA) calculated according to the method of Baldwin and Okubo (2019). They calculated ECA as $(X_{cik} - M_{cik})/(X_{cik} + M_{cik})$, where X represents exports, M represents imports, *c* represents country, *i* represents sector, and *k* represents product type. This table does not distinguish between parts and final goods.

Table 5. The Exposure of French Sectoral Stock Returns to the Japanese Yen/Euro and Korean Won/Euro Exchange Rates.

	Japanese yen/euro		Korean won/euro	
(1)	(2)	(3)	(4)	(5)
Sector	Coefficient	Standard Error	Coefficient	Standard Error
Aerospace	-0.008	0.041	-0.085*	0.049
Auto Parts	0.133***	0.036	-0.220***	0.039
Automobiles	0.174***	0.047	-0.179***	0.044
Biotechnology	0.069	0.057	-0.183***	0.055
Cement	0.184***	0.045	-0.119*	0.061
Cosmetics	-0.097***	0.035	0.084*	0.048
Electronic Entertainment	0.007	0.058	0.193***	0.062
Electronic Equipment: Gauges	0.135**	0.055	-0.095*	0.050
Electronic Components	0.108**	0.044	-0.050	0.049
General Industrials	0.156***	0.052	-0.174*	0.089
Home Construction	0.107**	0.053	-0.092	0.088
Industrial Engineering	0.105**	0.044	0.046	0.048
Industrial Materials	0.135**	0.058	-0.122**	0.052
Industrial Suppliers	0.112**	0.045	-0.219***	0.060945
Industrial Support Services	0.011	0.028	-0.064**	0.025
Industrial Transport	0.038	0.025	-0.138***	0.035
Iron & Steel	0.157***	0.059	-0.109*	0.064
Luxury	-0.015	0.024	0.012	0.034
Machinery: Agriculture	0.073*	0.042	-0.096**	0.047
Machinery: Construction	0.219***	0.063	-0.142	0.100
Medical Services	0.142**	0.066	-0.064	0.065
Nonferrous Metal	0.075	0.070	-0.171**	0.083
Oil Equipment & Services	0.156***	0.049	-0.062	0.072
Oil: Crude Production	0.147***	0.050	-0.120**	0.058
Pharmaceuticals	-0.032	0.032	-0.026	0.037
Recreation Products	0.186***	0.042	-0.123***	0.046
Recreation Vehicles	0.217***	0.050	-0.141**	0.055
Restaurants & Bars	0.108**	0.045	0.028	0.050
Semiconductors	-0.092*	0.048	0.108	0.079
Software	-0.098**	0.041	0.086	0.057
Telecommunication Equipment	0.090**	0.042	-0.043	0.045
Telecommunication Services	-0.103**	0.040	0.133***	0.046
Textile Products	0.135**	0.058	-0.122**	0.052

Note: The table presents results from regressions of the returns on the French sectors listed in column (1) on the change in the log of the Japanese yen/euro nominal exchange rate (column (2)), the change in the log of the Korean won/euro nominal exchange rate (column (4)), the change in the log of the U.S. dollar/ euro nominal exchange rate, the return on the French stock market, the return on the world stock market, the change in the log of the spot price for Brent crude oil, and Altavilla et al's (2019) measures of the changes in 2-year, 5-year, and 10-year French government bonds driven by European Central Bank press conferences, press releases, and monetary events. An increase in the exchange rate variables represent appreciations of the euro. The sample period extends from 22 January 2001 to 19 January 2021. There are 5216 observations. When return data are not available on 22 January 2001, the sample begins on the first date when return data become available. Standard Error in columns (3) and (5) are heteroscedasticity and autocorrelation consistent standard errors.

Source*:* Datastream database and calculations by the author.

*** (**) [*]denotes significance at the 1% (5%) [10%] level.

Table 6. The Exposure of German Sectoral Stock Returns to the Japanese Yen/Euro and Korean Won/Euro Exchange Rates.

	Japanese yen/euro		Korean won/euro	
(1)	(2)	(3)	(4)	(5)
Sector	Coefficient	Standard Error	Coefficient	Standard Error
Aerospace	0.185***	0.065	-0.050	0.074
Auto Parts	0.114***	0.031	-0.079**	0.038
Automobiles	-0.095	0.058	-0.082	0.059
Biotechnology	-0.079	0.058	0.001	0.051
Cement	0.122**	0.053	0.050	0.076
Chemicals	0.029	0.022	0.006	0.027
Computer Hardware	-0.003	0.073	-0.366***	0.105
Computer Services	0.036	0.050	0.085**	0.043
Construction	0.175***	0.040	-0.073	0.053
Consumer Services	0.173***	0.046	-0.120**	0.055
Delivery Service	0.109***	0.042	-0.003	0.052
Electronic Equipment: Gauges	0.092	0.059	-0.272***	0.071
Electrical Components	0.598**	0.296	0.366	0.271
Farming, Fishing	0.143***	0.043	-0.082*	0.047
Food Producers	0.088***	0.029	-0.026	0.033
Home Improvement Retail	0.108*	0.060	-0.076*	0.046
Industrial Engineering	0.069**	0.029	-0.005	0.036
Industrial Goods & Services	0.054**	0.025	0.005	0.022
Industrial Materials	0.191***	0.0513	-0.098**	0.050
Industrial Suppliers	0.211***	0.066	-0.193***	0.071
Industrial Support Services	0.087**	0.035	-0.049	0.037
Industrial Transport	0.076**	0.032	-0.037	0.042
Iron & Steel	0.071	0.057	0.087	0.065
Machinery: Construction	0.084*	0.049	-0.200**	0.087
Machinery: Industrial	0.090***	0.032	-0.004	0.032
Machinery: Specialty	0.149***	0.041	-0.145***	0.047
Medical Equipment	0.124***	0.046	0.040	0.054
Medical Supplies	0.098***	0.033	-0.014	0.034
Pharmaceuticals	0.013	0.025	-0.056*	0.030
Railroad Equipment	0.181***	0.063	0.088	0.063
Recreational Services	0.086	0.079	-0.177**	0.088
Semiconductors	0.017	0.067	0.153	0.099
Software	-0.068*	0.041	0.061	0.042
Telecommunications Equipment	0.064	0.067	-0.003	0.056
Telecommunications Services	-0.028	0.035	0.127**	0.059
Transport Services	0.087**	0.043	-0.051	0.075
Travel & Tourism	0.135**	0.062	-0.151**	0.068

Note: The table presents results from regressions of the returns on the German sectors listed in column (1) on the change in the log of the Japanese yen/euro nominal exchange rate (column (2)), the change in the log of the Korean won/euro nominal exchange rate (column (4)), the change in the log of the U.S. dollar/ euro nominal exchange rate, the return on the German stock market, the return on the world stock market, the change in the log of the spot price for Brent crude oil, and Altavilla et al's (2019) measures of the changes in 2-year, 5-year, and 10-year German government bonds driven by European Central Bank press conferences, press releases, and monetary events. An increase in the exchange rate variables represent appreciations of the euro. The sample period extends from 22 January 2001 to 19 January 2021. There are 5216 observations. When return data are not available on 22 January 2001, the sample begins on the first date when return data become available. Standard Error in columns (3) and (5) are heteroscedasticity and autocorrelation consistent standard errors.

Source*:* Datastream database and calculations by the author.

*** (**) [*]denotes significance at the 1% (5%) [10%] level.

Table 7. The Exposure of Japanese Sectoral Stock Returns to the Japanese Yen/Euro and Japanese Yen/Korean Won Exchange Rates.

	Japanese yen/euro		Japanese yen/Korean won	
(1)	(2)	(3)	(4)	(5)
Sector	Coefficient	Standard Error	Coefficient	Standard Error
Automobiles	0.048*	0.028	-0.019	0.029
Auto Parts	0.070***	0.025	0.018	0.035
Biotechnology	-0.005	0.078	0.021	0.097
Chemicals	0.061***	0.018	0.016	0.017
Consumer Electronics	-0.011	0.032	0.035	0.033
Cosmetics	-0.051	0.035	0.115**	0.052
Electrical & Electronic Equipment	-0.013	0.018	-0.029	0.022
Electronic Entertainment	0.084**	0.042	-0.022	0.069
Electronic Equipment: Controls	0.026	0.045	0.129***	0.039
Electronic Equipment: Other	0.022	0.049	0.136***	0.055
Electronic Components	0.024	0.022	-0.002	0.027
Food Retail, Wholesale	-0.122***	0.031	-0.049	0.034
General Industrials	0.063**	0.027	0.003	0.025
Household Furnishing	-0.039	0.030	0.059**	0.029
Home Improvement Retail	-0.141***	0.038	0.003	0.045
Industrial Engineering	0.086***	0.020	0.050*	0.027
Industrial Suppliers	0.132***	0.032	0.098**	0.047
Industrial Support Svs	0.125***	0.024	0.088***	0.034
Iron & Steel	0.112***	0.033	0.100***	0.035
Machinery: Agricultural	0.119**	0.051	0.020	0.047
Machinery: Construction	0.131***	0.043	0.148*	0.084
Machinery: Industrial	0.085***	0.022	0.051*	0.028
Machinery: Specialty	0.100***	0.031	0.088*	0.046
Marine Transport	0.184***	0.045	0.095**	0.043
Medical Equipment	0.025	0.030	0.041	0.051
Medical Services	-0.100**	0.047	0.023	0.059
Oil Equipment & Services	0.161**	0.074	0.219***	0.070
Pharmaceuticals	-0.004	0.024	0.010	0.045
Recreation Products	0.094***	0.033	-0.028	0.034
Recreational Services	-0.081**	0.032	0.041	0.033
Semiconductors	-0.090***	0.034	0.005	0.044
Software	-0.073**	0.032	0.003	0.039
Telecommunications Equipment	-0.140***	0.042	-0.050	0.038
Telecommunications Services	-0.161***	0.038	-0.117*	0.062
Textile Products	0.067**	0.033	0.030	0.038
Travel & Tourism	-0.078***	0.025	0.012	0.031

Note: The table presents results from regressions of the returns on the Japanese sectors listed in column (1) on the change in the log of the Japanese yen/euro nominal exchange rate (column (2)), the change in the log of the Japanese yen/Korean won nominal exchange rate (column (4)), the change in the log of the Japanese yen/U.S. dollar nominal exchange rate, the return on the Japanese stock market, the return on the world stock market, and the change in the log of the spot price for Dubai crude oil. An increase in the exchange rate variables represent depreciations of the yen. The sample period extends from 22 January 2001 to 19 January 2021. There are 5216 observations. When return data are not available on 22 January 2001, the sample begins on the first date when return data become available. Standard Error in columns (3) and (5) are heteroscedasticity and autocorrelation consistent standard errors.

Source*:* Datastream database and calculations by the author.

*** (**) [*]denotes significance at the 1% (5%) [10%] level.

Table 8. The Exposure of Korean Sectoral Stock Returns to the Korean Won/Euro and Korean Won/Yen Exchange Rates.

	Korean won/euro		Korean won/Japanese yen	
(1)	(2)	(3)	(4)	(5)
Sector	Coefficient	Standard Error	Coefficient	Standard Error
Auto Parts	-0.009	0.050	0.090*	0.053
Automobiles	-0.076	0.053	0.070	0.048
Basic Materials	0.098***	0.031	-0.054	0.033
Basic Resources	0.160***	0.039	-0.096**	0.039
Biotechnology	0.005	0.087	-0.135	0.094
Cement	-0.003	0.087	-0.163**	0.078
Chemicals	-0.033	0.043	0.043	0.046
Commercial Vehicle Parts	0.082	0.052	-0.169***	0.057
Computer Hardware	-0.056	0.056	-0.049	0.061
Computer Services	-0.061	0.080	-0.093	0.079
Consumer Digital Services	-0.182***	0.069	-0.007	0.061
Construction & Materials	0.090**	0.036	-0.119***	0.040
Construction	0.101**	0.043	-0.130***	0.045
Consumer Electronics	-0.122**	0.054	0.002	0.052
Consumer Staples	-0.070**	0.032	0.035	0.027
Cosmetics	0.033	0.056	-0.025	0.054
Diversified Industrials	-0.094**	0.043	-0.056	0.043
Food Producers	0.067*	0.039	-0.023	0.040
Household Equipment Producers	-0.087	0.067	0.125*	0.074
Industrial Engineering	0.181***	0.051	-0.141***	0.051
Industrial Goods & Services	-0.009	0.023	-0.032	0.023
Industrial Metals & Mines	0.157***	0.039	-0.098**	0.039
Industrial Support Services	0.100*	0.054	-0.025	0.049
Iron & Steel	0.146***	0.041	-0.135***	0.041
Machinery: Industrial	0.013	0.073	-0.119	0.077
Marine Transport	0.153***	0.049	-0.149***	0.051
Oil Refining & Marketing	0.062	0.063	0.053	0.054
Pharmaceuticals	-0.066	0.103	-0.035	0.104
Software & Comp Services	-0.190***	0.067	0.028	0.059
Semiconductors	-0.159**	0.075	-0.027	0.061
Technology Hardware	-0.130***	0.047	-0.002	0.040
Telecommunications Equipment	-0.138	0.096	-0.103	0.096
Telecommunications Services	-0.068*	0.038	0.054	0.036
Travel & Leisure	-0.044	0.044	0.023	0.042

Note: The table presents results from regressions of the returns on the Korean sectors listed in column (1) on the change in the log of the Korean won/euro nominal exchange rate (column (2)), the change in the log of the Korean won/Japanese yen nominal exchange rate (column (4)), the change in the log of the Korean won/U.S. dollar nominal exchange rate, the return on the Korean stock market, the return on the world stock market, the change in the log of the spot price for Dubai crude oil, and the change in the Bank of Korea base rate. An increase in the exchange rate variables represent depreciations of the won. The sample period extends from 22 January 2001 to 19 January 2021. There are 5216 observations. When return data are not available on 22 January 2001, the sample begins on the first date when return data become available. Standard Error in columns (3) and (5) are heteroscedasticity and autocorrelation consistent standard errors.
Source*:* Datastream database and calculations by the author.
*** (**) [*]denotes significance at the 1% (5%) [10%] level.

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