What Drives the Stock Market Comovements between Korea and China, Japan and the US?

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ABSTRACT

This paper measures the extent of comovements in stock returns between Korea and three major countries (China, Japan and the US) using the industry level data for Korea from 2003 to 2016, in the spirit of international capital asset pricing model (ICAPM). It also examines what drives the comovements between Korea and the three countries.

We find that the comovements of Korean stock market with the US and Japanese stock markets after the global financial crisis become smaller than those before the crisis. In contrast, the comovement in stock returns between Korea and China after the global financial crisis becomes larger than that before the crisis. From our additional analysis, we conclude that trade linkage is the main driver of the comovements between Korea and the three countries.

Our finding suggests that the concentration of trade with some trading partners can be a destabilizing factor in domestic financial market if there is a negative shock in trade with those partners. Thus, it is important to diversify trade with foreign countries to keep our country's financial market more stable.

JEL classification: F15, F21, G15

Keywords: Stock Market Comovements, Trade Linkage, Financial Linkage

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Ⅰ. Introduction

The Korean stock market has shown a high degree of comovements with major countries' stock markets which may reflect increasing real linkage as well as more financial integration with those countries. It is also intriguing that the extent of comovements has been changing over time and the degree of changes seems to be different for different countries. For example, the correlations of stock market returns of Korea with China and the US rose, but that of Korea with Japan lowered during the period after the global financial crisis compared to the period before the crisis.[1] In this paper, motivated by these observations, we examine what drives stock market comovements between Korea and three major countries (China, Japan and the US).

To study this issue, we first measure the comovements in stock returns between 24 Korean manufacturing industries and the three countries using a model in the spirit of international capital asset pricing model (ICAPM), where the expected return of a country's stock market is influenced by global stock market returns. Specifically, we use the market returns of the three major countries as proxies for global stock market returns and the stock returns for Korean manufacturing industries are related to the market returns of the three countries. In our model, the degrees of the comovements between Korean manufacturing industries and the three countries are measured by slope coefficients (betas) of the three countries for those industries.

Next, we examine the driver(s) of the comovements between Korean manufacturing industries and the three countries. According to the conventional financial theory, the price of a security can be modelled as the present value of future cash flows from the security where the future cash flows are discounted at appropriate discount rates. If this is the case, the degree of commonality between securities may come from two sources: (i) comovement in cash flows (real linkage) and (ii) comovement in discount rates (financial linkage). In this paper, as proxies for the two sources of comovement, we use the ratio of trade to sales for real linkage and the share of foreign stock investment for financial linkage.

[1] The correlation coefficients of Korea-China, Korea-Japan and Korea-US stock market returns using weekly data from Datastream were 0.49, 0.59 and 0.47, respectively, for the period of 2003-2006. However, the coefficients changed to 0.69, 0.49 and 0.60, respectively, for the period of 2010-2016.

From our analysis, we find that the comovements of Korean stock market with the US and Japanese stock markets after the global financial crisis become smaller than those before the crisis. In contrast, the comovement in stock returns between Korea and China after the global financial crisis becomes larger than that before the crisis. With the two proxies for real and financial linkages, we find that trade to sales ratio is positively related to the degree of comovements in stock returns between Korea and the three countries. On the other hand, we find no evidence that financial linkage proxied by foreign stock investment is related to comovements in stock returns between Korea and the three countries.

There are previous studies such as Forbes and Chinn (2004), Elekdag et al. (2004) and Arslanalp et al. (2016), where two-stage factor model as ours is employed in order to study the linkage in financial markets across countries. These studies use aggregate and macro-level data for sample countries and thus variations in the linkages and its determinants at country level. In contrast, our study uses industry level data for an individual country, i.e. Korea. As there are cross-sectional variations as well as time-series variations in terms of beta, trade to sales ratio and proportion of foreign stock investment across industry, we can examine the issue for an individual country in more depth with industry level data. In this regard, we expect that our study at industry level for individual country will complement previous studies at country level for a group of countries.

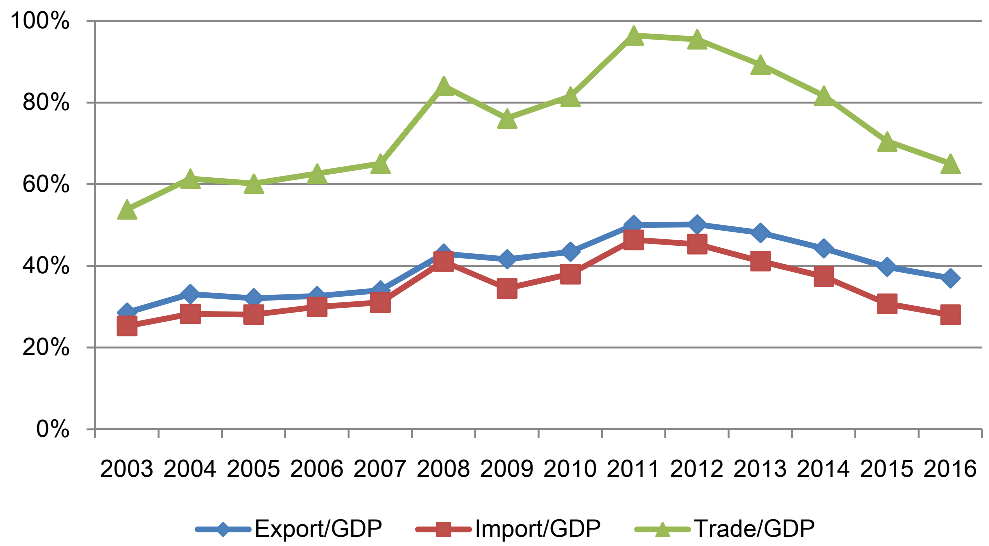
The rest of the paper is organized as follows. In Section II, we explain the trends of trade and stock market in Korea. We provide literature review in Section III. In Section IV, we describe the data and introduce the methodology for our analysis. We report the empirical results of our analysis in Section V. We conclude in Section VI.

Ⅱ. Trends of Trade and Stock Market in Korea

Korea's trade (exports plus imports) seems to reflect the overall conditions as well as the evolvement of the global economy. Figure 1 shows the share of exports, imports and trade in Korea's GDP from 2003 to 2016. The trade share continued to rise until 2008 mainly on the back of favorable global economy. However, it declined sharply in 2009 in the aftermath of the global financial crisis (GFC). From 2010, it again increased and recorded at 96%, the highest ratio, in 2011. It has been falling since 2012, which may be attributed to sluggish investment due to delayed global economic recovery from the crisis. The share of trade in GDP was 65% as of 2016, similar to the level in 2007.

Both exports and imports show similar trends. In 2016, the share of exports and imports in GDP accounted for 37% and 28%, respectively. As shown in Figure 1, trade surplus (exports – imports) has increased after the crisis, which is mainly attributable to a decrease in the price of crude oil and strong exports of Korea's flagship products such as semiconductors and automobiles.

<Figure 1> Share of Exports, Imports and Trade in Korea's GDP



Note: Data are based on normal amount, goods and Korean won standards.
Source: Bank of Korea (ECOS)

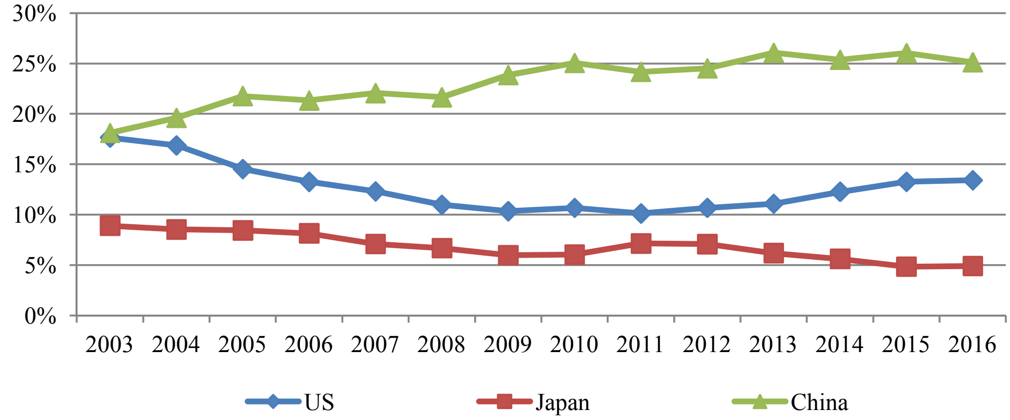
Figure 2 shows the shares of exports, imports and trade with three major trading partners of Korea (the US, Japan and China) for the period from 2003 to 2016. In case of the US, the shares of export and import continued to decline until 2011. The uptrend in recent years is presumably due to the Korea-US FTA which came into effect on March 15, 2012. For Japan, both the export and import shares showed declining trends throughout the period. As of 2016, the share of imports was 11.7%, whereas the share of exports was 4.9%. In case of China, contrary to the US and Japan, the shares of exports and imports have increasing trends. The shares of exports and imports were 25.1% and 21.4% in 2016, which account for the largest portion among Korea's trade partners. Consequently, the share of China in Korea's trade is much higher than those of the US and Japan and recorded at the highest level in 2016. This indicates that China may become a more dominant player in Korea's trade dynamics and thus may have a bigger impact on Korean economy than before in both real and financial aspects.

The stock market in Korea continues to advance together with the growth of its real economy. Figure 3 represents the ratio of market capitalization to GDP and foreigners' share of stock market capitalization in Korea. The ratio of market capitalization to GDP rose from 48% in 2003 to 101% in 2007. During the crisis, the ratio plunged to 56% in 2008. Then, the ratio resumed to increase and maintained at the level of around 90%. On the other hand, the foreigners' share of stock market capitalization in Korea reached around 40% in 2003 and in 2004, and then declined gradually to 27% in 2008. Afterwards, the foreigners' share tends to increase and reached 32% in 2016. However, the share of foreigners is still lower than that in 2003.

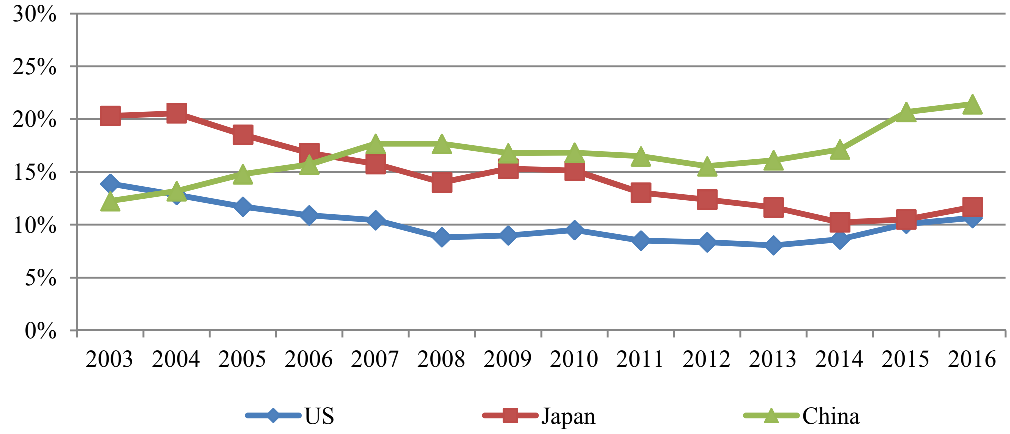
Figure 4 reports the share of foreign investors from the US, Japan and China. As of 2016, the US accounted for 49%, whereas the shares of Japan and China were only 3% and less than 1%, respectively. The US portion has been much larger than those of Japan and China throughout the entire period. This implies that the influence of the US investors on Korean stock market may be more evident than those of the other two countries.

<Figure 2> Shares of Korea’s Export, Import and Trade with the US, Japan and China

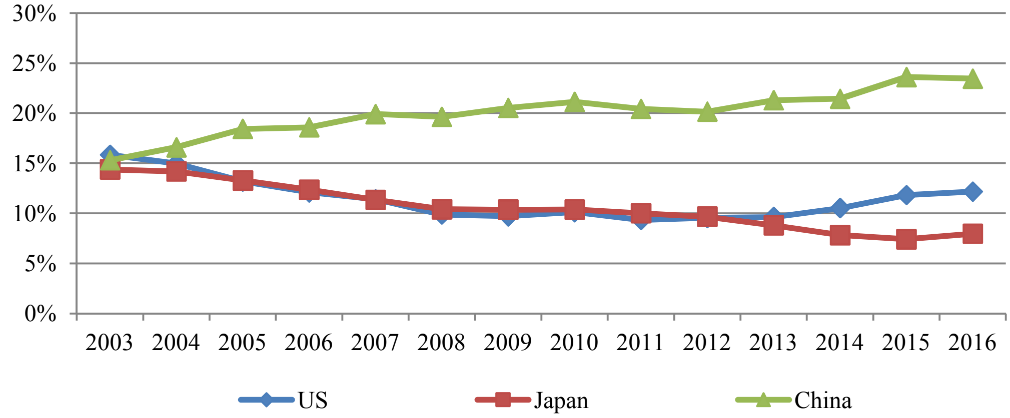
[Panel A: Export]



[Panel B: Import]

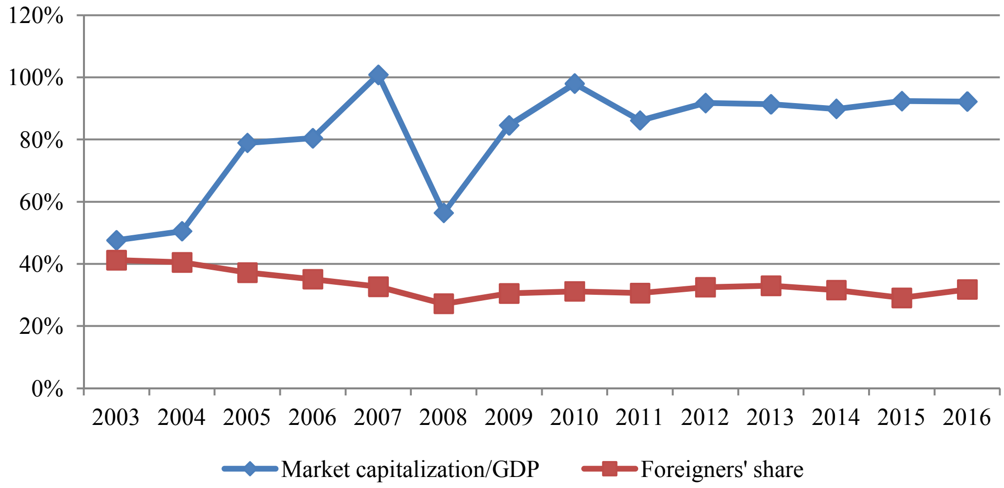


[Panel C: Trade]



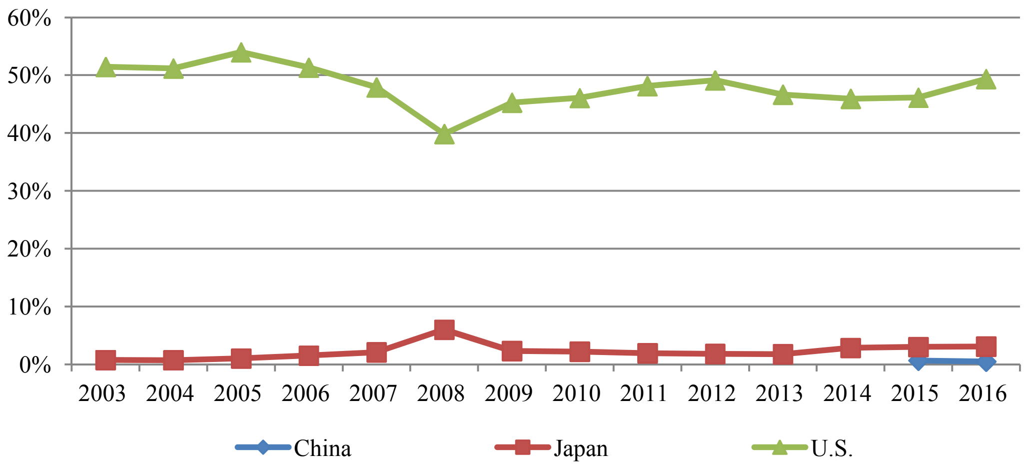
Note: Data are based on normal amount, goods and the US dollar standards.
Sources: Korea Customs Service and Bank of Korea (ECOS)

<Figure3> Market Capitalization/ GDP and Foreigners’ Share in Korean Stock Market



Note: Market capitalization is measured by Kospi plus Kosdak.
Sources: Bank of Korea (ECOS), Koscom and Financial Supervisory Services

<Figure 4> Shares of the US, Japan and China in Korean Stock Market



Note: The equity ratio was measured by the stock and investment fund shares.
Source: IMF (Coordinated Portfolio Investment Survey)

Ⅲ. Literature Review

Our paper basically follows the methodology used by Forbes and Chinn (2004), Elekdag et al. (2012), and Arslanalp et al. (2016). Forbes and Chinn (2004) investigate how trade and financial linkages between five big countries (France, Germany, Japan, UK and US) and 38 sample countries affect their comovement in the stock and bond market returns from 1986 to 2000. They first estimate the impacts of bilateral, global and sectoral factors on each country's asset returns using a factor model. [2] In the second stage, the bilateral factor loadings also known as "betas" are regressed on trade-related and financial variables such as trade flows (import to center countries), trade competition in third markets, bank lending and foreign investment. They find that trade linkage variables are more significant than financial ones in explaining the factor loadings.

Elekdag et al. (2012) analyze the evolution of stock market linkages between five center countries (France, Germany, Japan, UK and US) and 12 Asian countries[3] in the period of 1992-2011. They document that the Asian countries' financial sensitivities to the center economies increased, and both trade and financial linkages were key determinants of the sensitivities. They also argue that the Asian countries' macroeconomic policies such as reduction in government debt and increases in foreign reserves had limited contribution to mitigating these sensitivities.

Arslanalp et al. (2016) explore comovements in stock markets between Asian countries and four center countries (China, Japan, euro area and the US). They build two-stage model based on Forbes and Chinn (2004) consisting of four center economies and nine Asian countries[4] during the period of 2001-2014 (pre-GFC period: 2001-2007, GFC period: 2008-2009 and post-GFC period: 2010-2014). Their empirical results indicate that the spillover effect from China to Asian stock markets

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[2] The bilateral factors refer to returns for the five center countries in the asset markets; the global and sectoral factors include world market returns, global interest rates, oil prices, gold prices and commodity prices, and asset returns for 14 sectoral indexes.

[3] Twelve Asian countries include Australia, China, Hong Kong, India, Indonesia, Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan and Thailand.

[4] The four center countries include China, Japan, euro area, and the US, and the nine sample countries are Australia, India, Indonesia, Korea, Malaysia, New Zealand, Philippines, Taiwan and Thailand.

has increased since the global financial crisis, although the level of its impact is still lower than those of the US and Japan. They also report that the main driver of spillovers from the two center economies in the region (China and Japan) to other Asian stock markets is trade linkages (trade linkages for China and trade competition in third markets for Japan) rather than financial linkage.

In addition to these studies, there are other studies which examine interdependence in stock market returns between countries with different methodologies. Tavares (2009) examines 40 developed and emerging markets from the 1970s to 1990s and finds that bilateral trade intensity increases the correlation of stock market returns between countries while real exchange rate volatility, asymmetry in output growth and dissimilarity in export decrease the correlation. Eiling and Gerard (2015) find that there are significant time trends in cross-country correlations in 32 emerging markets for the period from 1991 to 2009. They argue that official market liberalization, equity market openness, equity market development and trade openness drive these trends. Paramati et al. (2015) and Paramati et al. (2016) find that trade intensity drives stock market interdependence between Australia and its trading partners.

All of the above-mentioned papers use aggregate and macro-level data. In contrast to these studies, our study uses industry-level data for an individual country. As there are cross-sectional variations as well as time-series variations in real and financial linkages across industry for an individual country, we can use such variations in order to examine comovement in stock returns between the individual country and foreign countries in more depth.

The literature on stock return comovements and variations across countries using industry and/or firm level data can be traced back to Roll (1992), Heston and Rouwenhorst (1994), and Griffin and Karolyi (1998).

Roll (1992) documents that industry factor such as difference or similarity of industrial composition is the main factor in explaining stock return correlations across countries. In the analysis, he uses daily stock indexes for 24 countries from April 1988 to March 1991. However, Heston and Rouwenhorst (1994) argue that variation in country stock returns is mainly due to country-specific factor rather than industry one. Their sample includes 829 firms in 12 European countries for the period from 1978 to 1992. Griffin and Karolyi (1998) find that industry effect is relatively larger for traded-goods industries than for nontraded-goods industries in explaining the stock return variations for 25 countries for the period from 1992 to 1995.

More recently, Brooks and Del Negro (2006) and Faias and Ferreira (2016) explore international stock market commonality using firm level data. Brooks and Del Negro (2006) analyze the relationship between international stock market return comovement and the degree of internationalization of firms such as firm's international sales, assets and income as well as sector affiliation (traded versus non-traded). They use firm level data composed of 1,239 firms in 20 developed and emerging countries for the period from 1985 to 2002. They find that the higher the degree of globalization of a firm, the higher the sensitivity of stock return from global shocks, indicating internationally operating firms have a stronger linkage with global stock market. Faias and Ferreira (2016) find that the stock return variation can be better explained by industry and global factors rather than country factor, using monthly stock return data from 45 countries for the period from 2001 to 2010.

There are also several studies on stock return comovement of Korean companies using firm-level data. Park (2007) examines the impacts of analysts and foreign investors on stock return synchronicity of Korean individual firms with the market from 2000 to 2003. The author finds that the synchronicity is bigger as the number of financial analysts for a firm increases, while the impact of foreign investors measured by the equity share of foreigners in the firm is not significant. The author argues that foreign investors rely on firm-specific financial information based on firm's intrinsic value rather than market wide information whereas analysts provide investors with more market-related information. Kim et al. (2015) and Cho and Mooney (2015) investigate comovement of stock returns for firms belonging to business groups (*known as chaebol*) and its key determinants of the comovement during the period of 1980-2009 and 2002-2011, respectively. Both papers report the same result that companies affiliated to business groups exhibit more salient comovement in stock returns with other companies in the same business groups than with companies not affiliated to the business groups.

Ⅳ. Data and Methodology

In this paper, we measure comovements in stock returns between Korea and three countries, which are the US, Japan, and China, using stock returns at industry level in the first stage and examine what drives the comovements between Korea and the three countries in the second stage. The three countries are chosen based on the fact that they are major trading partners of Korea. From 2003 to 2016, the proportion of trade with China for Korea (20.5%) was the highest one, following by the US (11.0%), Japan (10.0%), Saudi Arabia (3.7%), Hong Kong (3.2%), and Taiwan (3.0%).[5] We choose three countries as major trading partners of Korea as each of their proportions in Korean trade was larger than 5% for the period.

In the first stage, in order to measure the comovements in stock returns between Korea and the three countries at industry level, we use two alternative specifications, (1) and (2).

$$R_{i,t} = \alpha_i + \beta_{us,i}R_{us,t} + \beta_{Japan,i}R_{Japan,t} + \beta_{China,i}R_{China,t} + \varepsilon_{i,t} \tag{1}$$

$$\begin{aligned} R_{i,t} = \alpha_i &+ \beta_{us,i}R_{us,t} + \beta_{Japan,i}R_{Japan,t} + \beta_{China,i}R_{China,t} \\ &+ \beta_{CRB,i}R_{CRB,t} + \beta_{USTN,i}\Delta Y_{USTN,t} + \beta_{VIX,i}\Delta VIX_t + \beta_{CDS,i}\Delta CDS_t + \varepsilon_{i,t} \end{aligned} \tag{2}$$

In (1), $R_{i,t}$ represents the return of industry *i* during the week of t for Korea. $R_{us,t}$, $R_{Japan,t}$ and $R_{China,t}$ denote the market returns of the US, Japan and China during the week of t, respectively. In the first specification, we follow the spirit of international capital asset pricing model (ICAPM), where the expected return of a country's stock market is influenced by global stock market returns. We use three market returns of major countries as proxies for global stock market returns.

In (2), following Arslanalp et al. (2016), we add four control variable in addition to the market returns of the US, Japan and China. The four control variables are the returns computed by CRB index ($R_{CRB,t}$), change in the yield of US 2-year Treasury Note ($\Delta Y_{USTN,,t}$), changes in the VIX (ΔVIX_t), and change in the CDS premium on Korea 5-year bond from the week of t-1 to the week of t. We collect the CRB index and VIX from Bloomberg, yield of US 2-year Treasury Note from Federal Reserve

[5] The proportions of trade with foreign countries for Korea are computed by authors using the data from the Bank of Korea (ECOS).

Economic Data and CDS premium on Korea 5-year bond from Korea Center for International Finance. As the CDS premium is regularly available from 2003, we begin our sample period from 2003.

In our sample, we include Korean manufacturing companies of which the stocks were traded for the period from 2003 to 2016. We compute weekly stock returns from Wednesday to next Wednesday for each of the stocks using their stock prices adjusted for any distribution to stockholders such as stock split and dividend payments. The adjusted stock prices are provided by DataGuide. We compute weekly value-weighted stock returns for each industry using all the stock returns of individual companies included in the industry. We use the market capitalization of each stock in order to compute the value-weighted stock returns for the industry. The information on industry to which each company is affiliated and the market capitalization of the company are also provided by DataGuide. For the classification of industry for Korea, we use the Korean Standard Industrial Classification (KSIC, revision 9) provided by Korea National Statistical Office.[6] There are 24 divisions (industries) for manufacturing in the Korean Standard Industrial Classification (revision 9). Table 1 reports the codes and names for the 24 divisions (industries). For the US, Japan and China, we compute stock market returns using the stock market return index provided by the Datastream. The stock market returns are also computed weekly from Wednesday to next Wednesday for the period from 2003 to 2016. All the returns are computed in terms of local currencies.

In both (1) and (2), we run a regression for each year in our sample period and estimate the coefficients yearly in order to measure the comovements of stock returns for industry *i* with respect to the US, Japan and China for the year.

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[6] The Korean Standard Industrial Classification is based on the International Standard Industrial Classification (ISIC) by the U.N. The KSIC was first introduced in 1963. There have been 10 revisions since its introduction. The 10^{th} revision has been effective from July 2017. The 9^{th} revision, which was effective in 2008, was the latest revision in our sample period. The KSIC has a hierarchical five digit system. The KSIC (revision 9) was divided into 21 sections and each section is broken down into divisions (denoted by 2 digits). The divisions are further broken down into groups (3 digits), into classes (4 digits) and then into subclasses (5 digits). There were 76 divisions, 228 groups, 487 classes and 1,145 subclasses for the KSIC (revision 9). (source: https://unstats.un.org/unsd/cr/ctryreg/ctrydetail.asp?id=1161)

<Table 1> Korean Standard Industrial Classification (revision 9) for Manufacturing

Division code	Name of Division
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles, except apparel
14	Manufacture of wearing apparel, clothing accessories and fur articles
15	Tanning and dressing of leather, manufacture of luggage and footwear
16	Manufacture of wood and of products of wood and cork, except furniture
17	Manufacture of pulp, paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke, hard-coal and lignite fuel briquettes and refined petroleum products
20	Manufacture of chemicals and chemical products, except pharmaceuticals and medicinal chemicals
21	Manufacture of pharmaceuticals, medical chemicals and botanical products
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metal products
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of electronic components, computer, radio, television and communication equipment and apparatuses
27	Manufacture of medical, precision and optical instruments, watches and clocks
28	Manufacture of electrical equipment
29	Manufacture of other machinery and equipment
30	Manufacture of motor vehicles, trailers and semi-trailers
31	Manufacture of other transport equipment
32	Manufacture of furniture
33	Other manufacturing

Source: Korea National Statistical Office, Korean Standard Industrial Classification, 2008

In the second stage, in order to examine what determines the comovements in stock returns between Korea and the three countries at industry level, we use three main explanatory variables, such as (i) the ratio of trade to sales as proxy for trade linkage (ii) the proportion of foreign stock investment as proxy for financial linkage and (iii) export competition in third markets as Arslanalp et al. (2016). In addition, the stock returns between Korea and the three countries may commove more or less during the global financial crisis, following Arslanalp et al. (2016), we add a dummy variable for the period of global financial crisis in alternative specification. The ratio of trade to sales and export competition in third markets are computed yearly for each division (industry) of Korean manufacturing for each of the three countries (the US, Japan and China). The proportion of foreign stock investment is computed for each division (industry) of Korean manufacturing for a given year. In the regression, we use the natural log of (1 + trade to sales ratio x 100) and the natural log of (1 + proportion of foreign stock investment x 100). The specification with the dummy variable for the second stage can be shown as follows:

$$\beta_{us,i} = \delta_{us,trade}\text{Trade}_{us,i} + \delta_{us,finance}\text{Finance}_{i} + \delta_{us,xc}\text{ExportCompetition}_{us,i} + \delta_{us,crisis}\text{Crisis} + \varepsilon_{us,i} \tag{3-1}$$

$$\beta_{Japan,i} = \delta_{Japan,trade}\text{Trade}_{Japan,i} + \delta_{Japan,finance}\text{Finance}_{i} + \delta_{Japan,xc}\text{ExportCompetition}_{Japan,i} + \delta_{Japan,crisis}\text{Crisis} + \varepsilon_{Japan,i} \tag{3-2}$$

$$\beta_{China,i} = \delta_{China,trade}\text{Trade}_{China,i} + \delta_{China,finance}\text{Finance}_{i} + +\delta_{China,xc}\text{ExportCompetition}_{China,i} + \delta_{China,crisis}\text{Crisis} + \varepsilon_{China,i} \tag{3-3}$$

Specifically, the ratio of trade to sales for industry i for a certain year for each of the three countries ($\text{Trade}_{us,i}$, $\text{Trade}_{Japan,i}$, and $\text{Trade}_{China,i}$) is computed as follows. We collect the annual export and import between Korea and each of the three countries in US dollar from UN Comtrade database at the level of HS 6-digit code under HS 1996. Next, we convert HS 6-digit code under HS 1996 to HS 6-digit code under HS 2002 using a correspondence table provided by UN Statistics Division.[7] Then, we use two correspondence tables for 2010 Input-Output Statistics of Korea.[8] The first one is a correspondence table between HS 6-digit code under HS 2002 and I-O commodity

[7] https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp

[8] The Bank of Korea (2014)

code for 2010 Input-Output Statistics of Korea. The second one is a correspondence table between I-O commodity code and KSIC (revision 9) code. By combining two correspondence tables, we convert HS 6-digit code under HS 2002 to KSIC (revision 9) code. Next, we sum up the annual trade for all the HS 6-digit codes in each industry so that we can compute the annual trade for the industry. For the sales of each industry, we collect the annual sales in Korean won for a company from DataGuide and compute the annual sales in Korean won for an industry by adding up the annual sales for all the companies in the industry. Then, we divide the annual sales for the industry in Korean won by the average exchange rate between Korean won and US dollar for the year[9] and thus compute the annual sales for the industry in US dollar. Lastly, we compute the ratio of trade to sales for the industry using the annual trade and sales in US dollar for the industry.

For the proportion of foreign stock investment each year in a Korean industry, we collect the proportion of foreign stock investment for a company in the industry at the end of each month during the sample period from DataGuide and compute the value-weighted mean of the proportions for all the companies in the industry at the end of the month. Then, we calculate the annual average of monthly proportions for the industry.

Following Arslanalp et al. (2016), we compute export competition in third markets for industry i each year for each of the three countries ($\text{ExportCompetition}_{us,i}$, $\text{ExportCompetition}_{Japan,i}$, and $\text{ExportCompetition}_{China,i}$) as the minimum between the share of industry i in total export for Korea and that for each of the three countries. We also define a dummy variable of global financial crisis, which takes one when the year is either 2008 or 2009 and zero, otherwise.

Table 2 reports the averages of trade to sales ratio, proportion of foreign stock investment and export competition for 24 Korean manufacturing divisions before the global financial crisis (2003-2007), during the global financial crisis (2008-2009), and after the global financial crisis (2010-2016). The average of trade to sales ratio for the US decreased from 39.7% before the crisis to 26.4% after the crisis. The average of trade to sales ratio for Japan also decreased from 45.7% before the crisis to 27.9%

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[9] We collect the annual average exchange rate between Korean won and US dollar from the Bank of Korea (ECOS).

after the crisis. On the other hand, the average of trade to sales ratio for China increased from 53.4% before the crisis to 72.1% after the crisis. For the average proportion of foreign stock investment, it was 20.3% before the crisis and changed to 19.8% after the crisis. For export competition, the three countries have similar level of competition with Korea and show little change over time.

<Table 2> Trade to Sales Ratio and Proportion of Foreign Stock Investment for Korea (Average for 24 Manufacturing Divisions)

Category	Country	2003-2007 (A, %)	2008-2009 (B, %)	2010-2016 (C, %)	(C-A, %p)
Export to Sales	US	21.4	13.7	13.2	-8.2
	Japan	14.8	11.1	9.8	-5.0
	China	22.0	23.1	24.7	2.7
Import to Sales	US	18.3	14.6	13.2	-5.1
	Japan	30.9	23.6	18.1	-12.8
	China	31.5	44.9	47.4	16.0
Trade to Sales	US	39.7	28.2	26.4	-13.3
	Japan	45.7	34.7	27.9	-17.9
	China	53.4	68.0	72.1	18.7
Foreign Stock Investment	All countries	20.3	17.7	19.8	-0.5
Export Competition	US	2.8	2.7	2.7	-0.1
	Japan	2.9	2.9	2.9	0.0
	China	2.8	2.8	2.8	0.0

Ⅴ. Empirical Results

Table 3 reports the estimates of betas from the specification (1), such as regression without control variables, in Section IV. Panel A of Table 3 provides the estimates of betas for 24 Korean manufacturing divisions (industries) with respect to the US and their averages for three sub-periods: before the global financial crisis (2003-2007), during the global financial crisis (2008-2009), and after the global financial crisis (2010-2016). For the US, the average betas before and after the global financial crisis are estimated to be 0.270 and 0.218, respectively. Also, the beta after the crisis is smaller than that before the crisis for 18 out of 24 divisions. Thus, we conclude that the comovement between Korean and the US stock markets becomes smaller over time. Interestingly, the average beta during the crisis was -0.163 and the beta was negative for 22 out of 24 divisions. This suggests that Korean and the US stock markets might have moved in the opposite direction during the crisis, when we controlled for the effect from the other two major markets, Japan and China.

Panel B of Table 3 provides the estimates of betas for 24 Korean manufacturing divisions (industries) with respect to Japan and their averages for three sub-periods. For Japan, the average betas before and after the global financial crisis are estimated to be 0.365 and 0.114, respectively. In addition, the beta after the crisis is smaller than that before the crisis for 23 out of 24 divisions. Thus, the comovement between Korean and Japanese stock markets also becomes smaller over time. The average beta during the crisis was 0.494, which suggests that Korean and Japanese stock markets might have moved further in the same direction during the crisis when we controlled for the effect from the other two major markets.

Panel C of Table 3 provides the estimates of betas for 24 Korean manufacturing divisions (industries) with respect to China and their averages for three sub-periods. For China, the average betas before and after the global financial crisis are estimated to be 0.129 and 0.229, respectively. Besides, the beta after the crisis is larger than that before the crisis for 20 out of 24 divisions. Thus, we conclude that the comovement between Korean and Chinese stock markets becomes larger over time. The average beta during the crisis was 0.249. This suggests that Korean and Chinese stock markets might have moved further in the same direction during the crisis when we controlled for the effect from the other two major markets.

<Table 3> Estimates of Betas for Korean Manufacturing Industry with respect to the US, Japan and China's Stock Market Returns (without Control Variables)

[Panel A : US]

Industry	2003-2007 (A)	2008-2009 (B)	2010-2016 (C)	(C-A)
10	0.228	-0.143	0.025	-0.203
11	0.192	-0.168	0.100	-0.092
12	0.294	-0.081	0.153	-0.140
13	0.061	-0.151	0.278	0.217
14	0.310	-0.114	0.119	-0.191
15	-0.006	-0.316	0.543	0.549
16	0.397	-0.030	0.225	-0.171
17	0.259	-0.233	0.194	-0.065
18	0.666	0.040	0.232	-0.434
19	0.273	-0.029	0.257	-0.016
20	0.402	-0.087	0.259	-0.143
21	0.226	-0.220	-0.061	-0.288
22	0.217	-0.155	0.286	0.070
23	0.213	-0.287	0.214	0.002
24	0.334	0.265	0.289	-0.046
25	0.164	-0.440	0.412	0.248
26	0.265	-0.011	0.202	-0.063
27	0.462	-0.336	0.230	-0.231
28	0.400	-0.135	0.231	-0.169
29	0.375	-0.350	0.337	-0.038
30	0.166	-0.173	0.104	-0.062
31	0.147	-0.225	0.381	0.234
32	0.326	-0.080	0.122	-0.204
33	0.110	-0.446	0.089	-0.021
Average	0.270	-0.163	0.218	-0.052

<Table 3> Estimates of Betas for Korean Manufacturing Industry with respect to the US, Japan and China's Stock Market Returns (without Control Variables, cont')

[Panel B : Japan]

Industry	2003-2007 (A)	2008-2009 (B)	2010-2016 (C)	(C-A)
10	0.322	0.306	0.133	-0.189
11	0.329	0.116	0.116	-0.213
12	0.039	0.168	0.012	-0.026
13	0.323	0.403	0.158	-0.165
14	0.303	0.284	0.226	-0.077
15	0.278	0.199	0.059	-0.218
16	0.271	1.037	0.153	-0.118
17	0.134	0.483	0.058	-0.075
18	0.172	0.556	0.073	-0.099
19	0.170	0.296	-0.080	-0.249
20	0.388	0.517	0.053	-0.335
21	0.269	0.440	0.272	0.003
22	0.405	0.580	0.118	-0.287
23	0.426	0.636	0.115	-0.311
24	0.711	0.454	0.030	-0.681
25	0.414	0.744	0.126	-0.288
26	0.614	0.487	0.277	-0.338
27	0.391	0.655	0.104	-0.287
28	0.354	0.604	0.103	-0.251
29	0.569	0.788	0.184	-0.385
30	0.715	0.437	-0.015	-0.729
31	0.545	0.722	0.195	-0.350
32	0.198	0.201	0.061	-0.136
33	0.424	0.754	0.197	-0.227
Average	0.365	0.494	0.114	-0.251

<Table 3> Estimates of Betas for Korean Manufacturing Industry with respect to the US, Japan and China's Stock Market Returns (without Control Variables, cont')

[Panel C : China]

Industry	2003-2007 (A)	2008-2009 (B)	2010-2016 (C)	(C-A)
10	0.102	0.205	0.053	-0.049
11	0.138	0.207	0.060	-0.078
12	-0.042	0.021	-0.003	0.039
13	0.162	0.215	0.130	-0.032
14	0.061	0.280	0.060	-0.001
15	0.043	0.512	0.120	0.077
16	0.030	0.286	0.201	0.171
17	0.038	0.224	0.179	0.141
18	0.105	-0.129	0.210	0.105
19	0.239	0.251	0.578	0.339
20	0.255	0.222	0.392	0.138
21	0.113	0.244	0.117	0.004
22	0.129	0.181	0.170	0.041
23	0.145	0.312	0.213	0.069
24	0.226	0.421	0.440	0.214
25	0.130	0.387	0.240	0.110
26	0.191	0.066	0.330	0.138
27	0.111	0.363	0.264	0.154
28	0.137	0.067	0.278	0.141
29	0.166	0.466	0.304	0.138
30	0.183	0.224	0.348	0.165
31	0.267	0.556	0.419	0.152
32	0.109	0.154	0.139	0.029
33	0.062	0.232	0.247	0.185
Average	0.129	0.249	0.229	0.100

Table 4 reports the estimates of betas from the specification (2), such as regression with control variables, in Section IV. Panel A of Table 4 provides the estimates of betas for 24 Korean manufacturing divisions (industries) with respect to the US and their averages for three sub-periods. For the US, the average betas before and after the global financial crisis are estimated to be 0.479 and 0.006, respectively. Also, the beta after the crisis is smaller than that before the crisis for 21 out of 24 divisions. Panel B of Table 4 provides the estimates of betas for 24 Korean manufacturing divisions (industries) with respect to Japan and their averages for three sub-periods. For Japan, the average betas before and after the global financial crisis are estimated to be 0.304 and 0.124, respectively. The beta after the crisis is smaller than that before the crisis for 20 out of 24 divisions. Panel C of Table 4 provides the estimates of betas for 24 Korean manufacturing divisions (industries) with respect to China and their averages for three sub-periods. For China, the average betas before and after the global financial crisis are estimated to be 0.112 and 0.192, respectively. The beta after the crisis is larger than that before the crisis for 19 out of 24 divisions. The results from specification (2) are very much similar to those from specification (1).

Thus, together with the results from Table 3 and Table 4, we conclude that the comovement in stock returns between Korea and the US becomes smaller over time. Also, the comovement in stock returns between Korea and Japan becomes smaller over time. In contrast, the comovement in stock returns between Korea and China becomes larger over time.

<Table 4> Estimates of Betas for Korean Manufacturing Industry with respect to the US, Japan and China's Stock Market Returns (with Control Variables)

[Panel A : US]

Industry	2003-2007 (A)	2008-2009 (B)	2010-2016 (C)	(C-A)
10	0.300	-0.301	-0.204	-0.504
11	0.087	-0.401	-0.161	-0.248
12	0.300	-0.217	0.071	-0.229
13	0.378	-0.084	-0.144	-0.522
14	0.460	0.004	-0.136	-0.596
15	0.272	0.177	0.201	-0.071
16	0.711	-0.056	-0.352	-1.063
17	0.429	-0.086	-0.044	-0.474
18	1.662	0.310	-0.112	-1.774
19	0.265	-0.141	0.410	0.145
20	0.581	0.108	0.169	-0.412
21	0.389	-0.085	-0.249	-0.638
22	0.283	0.110	0.255	-0.029
23	0.167	-0.274	0.031	-0.136
24	0.775	0.453	-0.040	-0.815
25	0.466	-0.310	0.030	-0.436
26	0.584	0.349	0.134	-0.450
27	1.036	-0.104	-0.214	-1.250
28	0.620	0.179	0.026	-0.594
29	0.743	0.110	0.179	-0.564
30	0.078	0.762	0.254	0.176
31	0.091	0.260	0.406	0.315
32	0.410	-0.151	-0.160	-0.570
33	0.407	-0.539	-0.197	-0.604
Average	0.479	0.003	0.006	-0.473

<Table 4> Estimates of Betas for Korean Manufacturing Industry with respect to the US, Japan and China's Stock Market Returns (with Control Variables, cont')

[Panel B : Japan]

Industry	2003-2007 (A)	2008-2009 (B)	2010-2016 (C)	(C-A)
10	0.265	0.169	0.140	-0.125
11	0.247	0.051	0.171	-0.076
12	0.057	0.184	0.060	0.003
13	0.295	0.227	0.150	-0.145
14	0.163	0.088	0.192	0.029
15	0.299	-0.087	0.036	-0.263
16	0.223	0.689	0.198	-0.025
17	0.059	0.361	0.082	0.023
18	0.130	0.519	0.060	-0.070
19	0.116	0.134	-0.051	-0.167
20	0.276	0.313	0.081	-0.195
21	0.202	0.457	0.327	0.125
22	0.367	0.312	0.121	-0.246
23	0.379	0.476	0.123	-0.256
24	0.578	0.149	0.080	-0.499
25	0.321	0.398	0.145	-0.176
26	0.587	0.317	0.255	-0.332
27	0.362	0.491	0.070	-0.291
28	0.282	0.434	0.100	-0.183
29	0.500	0.512	0.183	-0.317
30	0.656	0.040	-0.028	-0.684
31	0.420	0.309	0.232	-0.188
32	0.182	0.185	0.058	-0.124
33	0.336	0.545	0.189	-0.148
Average	0.304	0.303	0.124	-0.180

<Table 4> Estimates of Betas for Korean Manufacturing Industry with respect to the US, Japan and China's Stock Market Returns (with Control Variables, cont')

[Panel C : China]

Industry	2003-2007 (A)	2008-2009 (B)	2010-2016 (C)	(C-A)
10	0.083	0.096	0.041	-0.043
11	0.130	0.163	0.016	-0.114
12	-0.033	-0.032	-0.001	0.032
13	0.169	0.065	0.107	-0.061
14	0.033	0.125	-0.023	-0.055
15	0.042	0.396	0.058	0.016
16	-0.017	0.101	0.147	0.164
17	0.008	0.150	0.141	0.133
18	0.097	-0.155	0.140	0.043
19	0.263	0.149	0.533	0.270
20	0.209	0.142	0.338	0.129
21	0.126	0.174	0.110	-0.016
22	0.112	0.035	0.157	0.045
23	0.106	0.191	0.166	0.060
24	0.165	0.348	0.396	0.231
25	0.112	0.235	0.188	0.076
26	0.186	-0.007	0.320	0.135
27	0.081	0.228	0.231	0.150
28	0.107	0.000	0.278	0.171
29	0.131	0.380	0.270	0.139
30	0.162	0.173	0.344	0.182
31	0.272	0.411	0.331	0.059
32	0.086	0.142	0.114	0.029
33	0.048	0.055	0.212	0.163
Average	0.112	0.149	0.192	0.081

Table 5 reports the results of regression analysis where we examine the drivers of comovements in stock returns between Korea and the three countries. In Panel A of Table 5, we use betas for 24 Korean manufacturing divisions (industries) with respect to the US from the specification (1) and (2) in Section IV, such as regression without and with control variables, as dependent variables. When we use beta from the specification (1), i.e. without control variables, as dependent variable and variables on trade and foreign stock investment as independent variables, the variable of trade is positive and significant at the 5% level, but the variables of foreign stock investment and export competition are not significant at any conventional level. When we add a dummy variable of global financial crisis, neither of the three variables is significant. When we use beta from the specification (2), i.e. with control variables, as dependent variable, the variable of trade is positive and significant at the 5% level, but the variables of foreign stock investment and export competition are not statistically significant. When we add a dummy variable of global financial crisis, the variable of trade is still positive and significant at the 5% level. However, the variables of foreign stock investment and export competition are not significant. Thus, in case of the US, we conclude that the variable of trade has a positive relationship with beta, but the variables of foreign stock investment and export competition have no relationship with beta.

In Panel B of Table 5, we use betas for 24 Korean manufacturing divisions (industries) with respect to Japan from the specification (1) and (2) as dependent variables. When we use beta from the specification (1) as dependent variable, the variable of trade is positive and significant at the 1% level, but the variables of foreign stock investment and export competition are not significant. When we add a dummy variable of global financial crisis, the variable of trade is still positive and significant at the 1% level, but the variables of foreign stock investment and export competition are not significant. When we use beta from the specification (2) as dependent variable and variables on trade and foreign stock investment as independent variables, the variable of trade is still positive and significant at the 5% level, but the variables of foreign stock investment and export competition are not significant. When we add a dummy variable of global financial crisis, the variable of trade is still positive and significant at the 5% level. However, the variable of foreign stock investment and export competition are not significant. Thus, overall, in case of Japan, we conclude that the variable of trade has a positive relationship with beta, but the variables of foreign stock investment and export competition have no relationship with beta.

In Panel C of Table 5, we use betas for 24 Korean manufacturing divisions (industries) with respect to China from the specification (1) and (2) as dependent variables. When we use beta from the specification (1) as dependent variable, the variable of trade is positive and significant at the 1% level, but the variables of foreign stock investment and export competition are not statistically significant. When we add a dummy variable of global financial crisis, the variable of trade is still positive and significant at the 1% level, but the variables of foreign stock investment and export competition are not significant. When we use beta from the specification (2) as dependent variable, the variable of trade is still positive and significant at the 10% level, but the variables of foreign stock investment and export competition are not significant. When we add a dummy variable of global financial crisis, the variable of trade is still positive and significant at the 10% level. However, the variables of foreign stock investment and export competition are not significant. Therefore, in case of China, we conclude that the variable of trade has a positive relationship with beta, but the variables of foreign stock investment and export competition have no relationship with beta.

Together with the results for the US, Japan and China, we conclude that trade linkage is the main driver of comovements in stock returns between Korea and the three major countries. We don’t find evidence that neither financial linkage proxied by foreign stock investment nor export competition is related to comovements in stock returns between Korea and the three countries.

<Table 5> Regression of Beta on Trade, Foreign Stock Investment and Export Competition for Korean Manufacturing Industry

[Panel A : US]

Independent Variables	Dependent Variable: Beta of Korean Manufacturing Industry			
	Without Control Variables		With Control Variables	
Ln(Trade with U.S./Sales)	0.161** (2.11)	0.082 (1.12)	0.335** (2.44)	0.301** (2.20)
Ln(Foreign Stock Investment/Market Capitalization)	0.007 (0.09)	-0.031 (-0.45)	-0.068 (-0.63)	-0.084 (-0.78)
Export Competition	-0.009 (-0.34)	-0.006 (-0.24)	-0.008 (-0.18)	-0.006 (-0.15)
Crisis Dummy		-0.395*** (-7.55)		-0.169** (-2.17)
Industry Effect	Yes	Yes	Yes	Yes
N	336	336	336	336
F-statistic	0.81	3.35***	0.83	1.03
R^2	0.054	0.166	0.079	0.087

Note: Numbers in parentheses are heteroscedasticity-robust t-statistics. ***, **, and * denote statistical significance at the level 1%, 5% and 10%, respectively.

<Table 5> Regression of Beta on Trade, Foreign Stock Investment and Export Competition for Korean Manufacturing Industry (cont')

[Panel B : Japan]

Independent Variables	Dependent Variable: Beta of Korean Manufacturing Industry			
	Without Control Variables		With Control Variables	
Ln(Trade with Japan/Sales)	0.225*** (3.70)	0.230*** (4.02)	0.123** (2.10)	0.128** (2.17)
Ln(Foreign Stock Investment/Market Capitalization)	0.057 (0.95)	0.074 (1.35)	0.022 (0.41)	0.029 (0.55)
Export Competition	-0.012 (-0.72)	-0.010 (-0.63)	0.005 (0.28)	0.006 (0.33)
Crisis Dummy		0.279*** (7.10)		0.105*** (2.73)
Industry Effect	Yes	Yes	Yes	Yes
N	336	336	336	336
F-statistic	2.18***	4.27***	1.50*	1.75**
R^2	0.143	0.240	0.102	0.118

Note: Numbers in parentheses are heteroscedasticity-robust t-statistics. ***, **, and * denote statistical significance at the level 1%, 5% and 10%, respectively.

<Table 5> Regression of Beta on Trade, Foreign Stock Investment and Export Competition for Korean Manufacturing Industry (cont')

[Panel C : China]

Independent Variables	Dependent Variable			
	Beta of Korean Manufacturing Industry			
	Without Control Variables		With Control Variables	
Ln(Trade with China/Sales)	0.134*** (3.11)	0.132*** (2.98)	0.087* (1.95)	0.087* (1.96)
Ln(Foreign Stock Investment/Market Capitalization)	0.019 (0.70)	0.022 (0.83)	0.023 (0.77)	0.022 (0.75)
Export Competition	-0.014 (-1.06)	-0.013 (-1.03)	-0.004 (-0.32)	-0.005 (-0.33)
Crisis Dummy		0.060 (1.69)		-0.011 (-0.33)
Industry Effect	Yes	Yes	Yes	Yes
N	336	336	336	336
F-statistic	4.65***	4.47***	3.77***	3.69***
R^2	0.239	0.248	0.212	0.212

Note: Numbers in parentheses are heteroscedasticity-robust t-statistics. ***, **, and * denote statistical significance at the level 1%, 5% and 10%, respectively.

Ⅵ. Conclusion

This paper measures the extent of comovements in stock returns between Korea and three major countries (China, Japan and the US) using the industry level data for Korea from 2003 to 2016, in the spirit of international capital asset pricing model (ICAPM). It also examines what drives the comovements between Korea and the three countries.

From our analysis, we find that the comovements of Korean stock market with the US and Japanese stock markets after the global financial crisis become smaller than those before the crisis. In contrast, the comovement in stock returns between Korea and China after the global financial crisis becomes larger than that before the crisis.

Next, we examine the drivers of comovements in stock returns between Korea and the three countries. Specifically, we use betas for 24 Korean manufacturing divisions (industries) with respect to the US, Japan and China as dependent variables and variables on trade and foreign stock investment as independent variables, so that we can examine whether either trade or financial linkage between Korea and the three countries may explain the degrees of comovements in stock returns between Korea and the three countries. From our analysis, we find that trade linkage is the main driver of comovements in stock returns between Korea and the three countries. On the other hand, we don’t find evidence that financial linkage proxied by foreign stock investment is related to comovements in stock returns between Korea and the three countries.

Our finding that trade linkage with foreign countries has an effect on domestic financial market suggests that the concentration of trade with some trading partners may become a destabilizing factor in domestic financial market, if there is a negative shock in trade with those partners. Thus, it is also important to diversify trade with foreign countries to keep our country’s financial market more stable.

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