China Exposure

Abstract

This study evaluates the China risk on international equity market utilizing an international capital asset pricing model. We provide evidence on the global impacts of Chinese stock market and its determinants. China exposure is relatively modest but not unanimous across countries, evolving and increasing in time. Emerging market economies were more exposed to China than industrialized economies. Size of the exposure was related to the geographical distance from China, to the size of economic relations with China (trade linkages and financial linkages), economic growth relative to China and capital market openness. In effect, we propose that China exposure will increase its importance in the future due to greater economic integration with global economy and because the expected opening and liberalization of the Chinese capital markets.

JEL Classification: G120, G150.

Kari Heimonen[*)]

Heikki Lehkonen

University of Jyväskylä

School of Business and Economics

P.O. BOX 35

FI- 40014 University of Jyväskylä

FINLAND

tel.: + 358-400247414

e-mail: kari.heimonen@jyu.fi

*) Author of correspondence.

We thank seminar participants of the BOFIT seminar, Jenni Pääkkönen and the participants of the Finnish Economic Association XXXIX annual meeting for helpful comments. Part of the paper was written while Mr. Kari Heimonen was a visiting scholar at BOFIT (Bank of Finland, Institute of Transition). Study is part of to the Jyväskylä International Macro Finance research group activities. The group gratefully acknowledge the financial support from the OP Financial Group Research Foundation.

1 Introduction

The role of China in the global economy is important and increasing. Today China is the second largest economy in the world and is rapidly integrating with the global financial system. RMB exchange rate is gaining more flexibility and capital markets are being gradually liberalized. Accordingly, economic stance in China is gaining continuously more global interest. Worries about economic growth, housing market performance and number of non-performing loans in China are under continuous scrutiny generating anxiety for the global economy. Thus there is an urgent call for the relevance of China for the global financial markets. In this study we examine the impacts of Chinese stock market on global stock market (China exposure) and the determinants of the China exposure.

The impact of China on the global stock market is yet largely unknown but expected to increase for several reasons. China has rapidly become the world second largest economy and its currency, RMB, is becoming more international and is already one of the most significant global currencies. Although foreign investments are still restricted with foreign exchange control (the quota, products, accounts, and fund conversions are strictly monitored and regulated), China has started to open its capital flow restrictions and for example Qualified Foreign Institutional Investor (QFII) scheme was introduced in 2002, allowing foreign investors direct access to China's capital market in Shanghai and Shenzhen.[1] All these reasons are expected to increase China's integration on international capital markets. Moreover, official capital flows from China have been extensive and China is today the largest foreign creditor of the US economy. This creates potentially a significant portfolio channel for China exposure since changes in Chinese's portfolios could have consequences on the content of asset and debt portfolios throughout the world.

China exposure can also be transmitted via trade. Forbes and Chinn (2004) point out that trade links are the most significant determinant of cross-country linkages in both stock and bond markets. Evidence for the importance of China trade links for Asian financial linkages is already provided Arslanalp, Liao, Piao and Seneviratne (2016). China is large consumer of commodities and hence news about the economic growth in China could have strong impacts on commodity prices and on economies exporting commodities. A commodity exporting

[1] QFII scheme allows institutional foreign investors who meet certain qualification, to invest in a limited scope of cross-border securities products, in the context of incomplete free flow of capital accounts into the Chinese market.

countries might import technology from industrialized countries and a decrease in the demand for commodities in China may thus be transmitted from commodity exporting country to technology exporting industrialized country's stock market.

Currently international investor's exposure to a repricing risk on Chinese assets is larger than for any other emerging market; see Arslanalp et al. (2016). China exposure on global financial market has been increasing especially after the 2008 financial crises. This proposes that China exposure could be state-depended and it is at its highest during the era of high global risk aversion. Hence, financial shocks can be transmitted from China not only via direct financial linkages but also via indirect links (e.g. common investors in a third country) and global risk aversion. China may thus have indirect financial impacts via the common investor in a third country. For example, a shock in China could be transmitted to Korea because of losses incurred by a large investor in a third country which may force a sale of assets in Korea; see Gong and Kim (2013).

Reasons behind the Chinese stock market integration with other countries may also be related to informational factors. Morck, Yeung and Yu (2000) suggest that stock price co-movement is higher among the emerging market due to lack of firm specific information. Weak property rights discourage informed trading and firm specific information from being incorporated into stock prices. Chan and Hameed (2006) propose that poor information disclosure and lack of corporate transparency increase the costs of collecting firm specific information so that security analysts generate their earnings mostly on macroeconomic information. These propose that China exposure and co-movement of stock market could be especially high among the emerging economies and driven by the macroeconomic factors.

The China exposure could also be transmitted via the Chinese currency RMB exchange rate. RMB depreciation significantly decreases the profits of the US's China exporters. Chen, Lee, Lee and Huang (2015) provide evidence on significant time-varying China RMB exposure on US firms (from 16% up to 50% of firms were exposed) depending on the industry. The managed floating of the RMB conducted by the PBoC allows only marginal changes in the value of the RMB exchange rate but only with respect to USD. This implies that China exposure could be transmitted to other economies via the USD exchange rate change whose currencies are not tightly pegged to the USD. Although the RMB has mainly been connected with the USD, also other world leading currencies (euro or yen) and currencies neighboring

China like Korean won, have increased their importance in the exchange rate targeting of the PBoC; see Frankel (2009).

In summary, the size and the evolution of China exposure on global stock markets has not been carefully examined before. There are studies examining the impact of global factors on emerging market (e.g. Harvey, 1995) and for example Dooley and Hutchinson (2009) indicate that Chinese stock market has been relatively immune to the economic crisis caused by the collapse of the Lehman Brothers. However, we are still lacking studies which would point out the impact of China for the global economy. Among the very few, Arslanalp et al. (2016) provide evidence on the increasing importance of China via all, direct and indirect trade (e.g. commodity prices) and financial linkages but their study focused only on the Asian economies.

Our study contributes the literature on the China role in global economy in two ways. First, we estimated explicitly the global China exposure for individual economies utilizing the ICAPM and provided country and region based evidence on the sign, size and evolution of the China exposure. Second, we examined the determinants of the China exposure utilizing a variant of the gravity model, which considers all the trade and financial linkages as well distance between China and the country exposed. The rest of the paper is organized as follows. The next chapter discusses the Chinese stock market and provides estimates of the China exposure and reveals the determinants behind the China exposure. Chapter three concludes.

2 China and global stock market

A large amount of research examines the international linkages, co-movements and integration of global stock markets. Typically studies find time-variation in integration and changes in the transmission of shocks during the turbulent times; see e.g. Longin and Solnik (1995), Bekaert and Harvey (1997), Bekaert and Harvey (2000), Harvey (1995), Bekaert, Harvey and Ng (2005), Forbes and Rigobon (2001), Karolyi (2003). Different methods to detect the transmission of shocks have been applied: cross-market correlations coefficients, ARCH and GARCH models, cointegration techniques and direct estimation of transmission coefficients. Moreover, inference on dependency might be related to the method in estimating contagion. Forbes and Rigobon (2001) point out that the impact of East Asian crises and

transmission of shocks from Hong Kong to global stock market depend on whether the conditional or unconditional correlation has been used.

Chinese stock markets consist of different markets and various types of shares. The dynamics between these markets has been of particular interest of research. The mainland China stock markets have two types of shares: A- and B-shares are listed in Shanghai and Shenzhen stock exchanges. Originally, the A-shares were available only for mainland Chinese investors and the B-shares for foreign investors as well as for Chinese residents living in Hong Kong, Macau, or Taiwan. However, with the introduction of QFII in 2002, also qualified foreign institutional investors have gained an access to A-shares. The Hong Kong stock markets are available for both, mainland Chinese and foreign investors. Wang and Di Iorio (2007) find integration between Chinese A- and B-share market and between the A-share and Hong Kong market. The overall Chinese stock markets were relatively segmented from the world market in 1994-2004. Jacobsen and Liu (2008) indicate that the Chinese A-share market is more comparable to a developed market than emerging market but in contrasts to that the Chinese B-share market is better categorized as emerging rather than developed market. Cheng and Glascock (2005) find that stock market in Greater China Economic Area, GCEA, (Mainland China, Hong Kong, and Taiwan) are neither informationally weak form efficient or integrated with the US or the Japanese stock market. Among the GCEA market the Hong Kong market was the most influential. There is also evidence that the separate Chinese stock markets (A and B) are related.

Earlier research on Asian stock market integration has utilized cointegration techniques and used the Hong Kong stock market to represent the Chinese stock market. Typically these studies found that Chinese share markets are related to Asian markets. E.g. Chowdhury (1994) reports links between the Hong Kong and Singapore markets and suggest that the markets in Hong Kong, Singapore and Taiwan are influenced by the US market. Hung and Cheung (1995) report increased co-integration in Asian stock market (Hong Kong, Malaysia, Korea, Singapore and Taiwan) after the 1987 stock market crash. Corhay, Rad and Urbain (1995) study stock market dependence among the Pacific-Basin market (Australia, Hong Kong, Japan, Singapore, and New Zealand) and find that Hong Kong, Japan and Singapore are closely linked. Johnson and Soenen (2002) indicate considerable daily dependence among the Asian stock market (China, Hong Kong, Taiwan, Australia, Malaysia, New Zealand and Singapore) and propose high degree of market efficiency and market integration. Boubakri and Guillaumin (2015) provide further evidence on regional integration in East

Asian stock market utilizing ICAMP and multivariate GARCH. They point out three results. First, East Asian integration increased after the Asian financial crisis of 1997-1998 and after the Global financial crisis of 2008-2009. Second, China was the least globally integrated country among the East Asian countries and third, the country-specific risk was of importance throughout the East Asian economies.

There is also evidence that Chinese stock markets are not closely related to other emerging economies stock market either. Among others, Lehkonen and Heimonen (2014) provide evidence that Chinese stock market integration was considerably different from many other major economies and even from the rest of the BRICs (Brasilia, Russia, India and China).

In contrast to the previous studies our focus is not to exam the transmission of shocks from China during the turbulent periods but rather to evaluate the overall exposure of global stock market on Chinese stock market dynamics and exam the determinants of the exposure.

2.1 Estimates of China Exposure

Figure 1 displays the monthly evolution of the MSCI China and MSCI World stock market indices from 2002 to 2015 in terms of USD (1/2002=100). The MSCI China Index captures large and mid-cap representation across China H-shares, B-shares; red chips and P chips with 150 constituents. The index covers about 84% of this China equity universe. The calculation of the index is based on the MSCI Global Investable Indexes (GIMI) Methodology. The B-shares are incorporated in China, trade on the Shanghai and Shenzhen exchanges and quoted in foreign currencies (USD in Shanghai USD and HKD in Shenzhen) and are open to foreign investor. H-shares are incorporated in China and trade on the Hong Kong and other foreign exchanges. Red chips and P chips are incorporated outside of China and trade on the Hong Kong exchange. Red chips are usually controlled by the state or a province or municipality and P chips are run by private sector China businessmen.[2]

[2] For more information about the indices, see www.msci.com.

Figure 1 Chinese stock market performance with respect to world stock market performance.

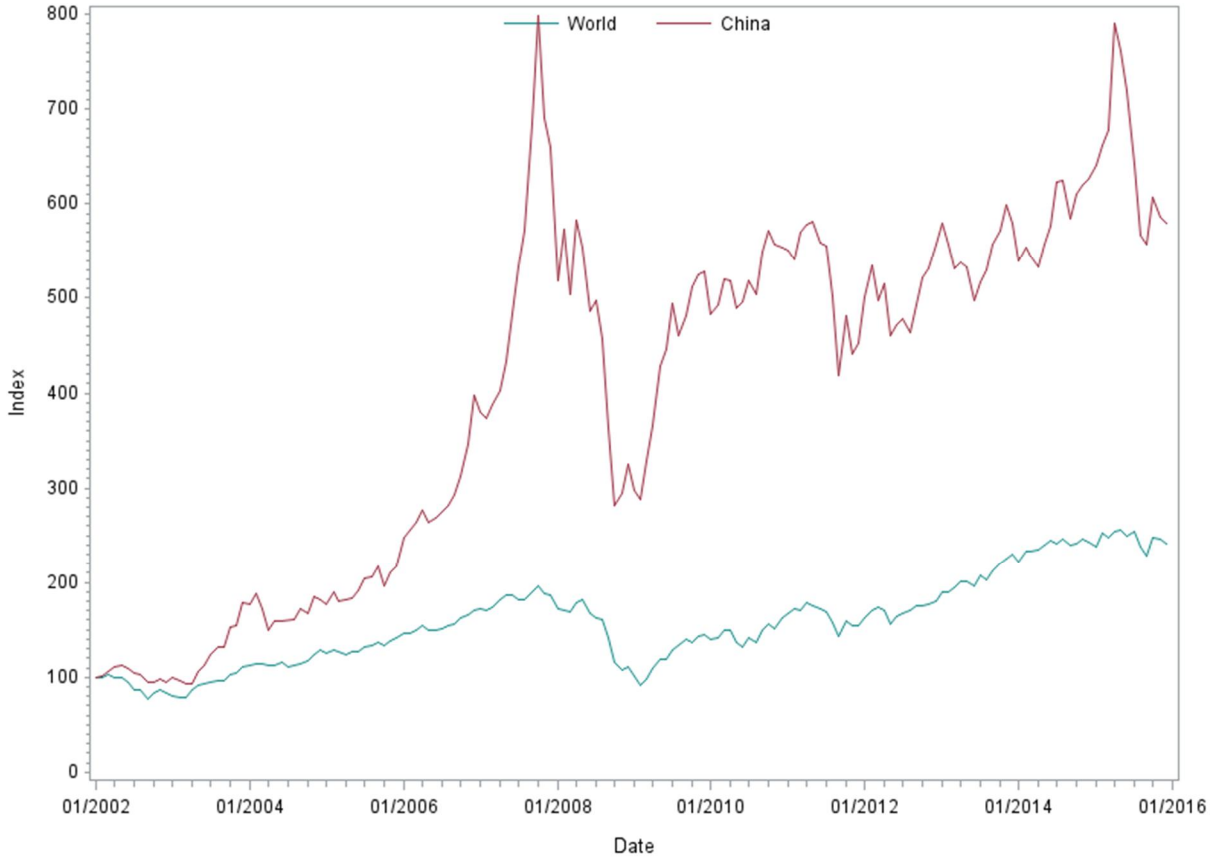


Figure shows the scaled (1/2002=100) price indices with reinvested dividends for Chinese (MSCI China) and global (MSCI World) stock markets in US dollars from the beginning of 2002 till the end of 2015.

Figure 1 shows that, although the Chinese stock market follows loosely the global stock market index, while the global market index has doubled with rather steady growth (excluding the Global financial crisis of 2007-2009), China's market has experienced very turbulent behavior but also grown six- to eightfold during the sample period.

The Chinese stock market performance is measured in terms of USD and hence it is exposed to exchange rate risk. However, RMB exchange rate with respect to USD (RMBUSD) has remained considerably stable during the whole estimation era since China has pegged the value of the RMB with the USD since 1995.[3] Nevertheless, China exposure might be still related to the peg of the RMB as, in case of tight peg with the USD, a part of the exposure may be transmitted via the changes of the USD exchange rate against other currencies. Also, changes in the peg of the RMB currency basket might change the foreign exchange exposure channel of the China exposure.

Our study sample ranges from 1/2002 to 12/2015 and includes 75 countries which present both industrial countries and emerging economies from all the continents; see Data Appendix. Our sample starts from 2002 based on the launch of the Qualified Institutional Investors option to invest on the Chinese market. We utilized monthly data on global stock markets using the MSCI indices for each country and the global MSCI index. All data are measured in US dollars. There are several reason for the use of monthly rather than daily data. First, while using the monthly data we are able to avoid the problem of non-synchronous trading due to open-hours of Chinese stock and global stock market. Second, we were not focusing on volatility spill-overs of stock market volatility across counties for which the daily or weekly data would be more useful. We expect that the volatility of China exposure to be smaller in monthly rather than in daily or weekly data. Third, we were more interested in the evolution and possible trends in China exposure and for this the monthly data could serve better for our purposes.

We estimated the size and the evolution of China exposure in a variant of an unconditional International Capital Asset Pricing Model which allows Errunza and Losq (1985) type of partial segmentation. In effect, it can also be regarded as variant of the Jorion (1990, 1991)

[3] July 2005 onwards, a narrow but widening band was introduced which launched the era of managed float of the RMB. PBoC announced that RMB is pegged with a basket of currencies which includes the USD, euro, Japanese yen and Korean won (The actual weight of the currencies in the basket has never been announced).

residual based model for foreign exchange exposure which we now modify and apply to study the China exposure on national stock market.

There is relatively large literature using the conditional international asset pricing model in studying the integration of emerging market stock market including China; see e.g. Boubakri and Guillaumin (2015), Jacobsen and Liu (2008). Typically these studies examine the integration of national stock market to the world stock market or evaluate the country and currency specific risks of national stock market or equities following e.g. the applications of conditional asset pricing models for advanced economies, see e.g. Ferson and Harvey (1993). To our knowledge no one has applied the ICAMP to evaluate the international risk of a single country internationally while among others e.g. Harvey (1995) provides only estimates about the emerging market specific risks but only with respect to world stock market risks.

First we estimated the China exposure for the world stock market on the basis of following equation (1) which quantifies the size of China exposure on global stock market. Notable, Chinese stock markets are not included into the MSCI index which in principle gives us a possibility to estimate the China exposure correctly.

$$\left[R_{MSCIW,USD,t}\right] = \alpha + \gamma\left[R_{CHINA,USD,t}\right] + \varepsilon_{i,t} \qquad (1)$$

$$\left[R_{MSCIW,USD,t}\right] = \underset{}{0.0092} + \underset{(0.3544)}{0.4069}\left[R_{CHINA,USD,t}\right] + \varepsilon_{i,t}\,,\ R^2 = 0.465 \quad \underset{(12.002)}{}$$

The results from equation (1) suggest that China exposure is a prevalent phenomenon affecting the global stock market. Accordingly, 40 percent of the dynamics in Chinese stock market is related to the global stock market which suggests among others, less than full integration and possible portfolio diversification benefits stemming from investments in China. In effect we interpret this to justify our research hypothesis that the China exposure exists in the global stock markets and motivate our study to exam the China exposure for individual counties.

We assume that the performance of national stock market in country *i* is subject to global stock market risk in an unconditional ICAMP. If the country *i* stock market were fully internationally integrated, the national market risk would constitute only of the global market risk; see Bekaert and Harvey (1995). In this fully integrated stock market the global market risk would be the only relevant risk factor and the price of country specific risk factor would

equal to zero, see DeSantis and Gerard (1997). However, we allow the possibility for stock market segmentation and introduce another risk factor; see Errunza and Losq (1985). We assume that the stock markets are also subject to Chinese risk, i.e. the China exposure according to following model:

$$[R_{i,USD,t}] = \alpha + \beta_{it}[R_{MSCIW,USD,t}] + \gamma_{it}[R_{CHINA,USD,t}] + \varepsilon_{it} \quad (2)$$

In equation (2), β_{it} gives an estimate for the global stock market risk and γ_{it} for the China exposure for country *i* at time *t*. The sizes of the estimated $\beta_{it}s$ provide information about the integration of the national market with the global market. On the other hand, country *i* stock market might be fully integrated with the global market but the structure of industry might differ from the global structure of industry and thus β_{it} does not necessarily equal unity in fully integrated markets; see Heston and Rouwenhorst (1994). Deviation from one might signals less than full integration and market segmentation; see Errunza and Losq (1985). The model includes also a constant, which allows some market segmentation, like differences in tax treatment or other institutional arrangements. Under the Purchasing Power Parity, exchange rate risk would not constitute a separate risk factor while relaxing the PPP introduces the foreign exchange risk, the third risk factor, into the model. In our specification all stock market returns are in common currency, in US dollars and thus the possible exchange rate risk is included in the sizes of β_i 's and γ_i's: $\beta_i[R_{MSCIW,t} + e(i/USD)_t], \gamma_i[R_{CHINA,t} + e(i/USD)_t]$. Moreover, we also estimate the exposure utilizing time-varying estimation methods which enables us to detect the possible time-variation in China exposure $\gamma_{i,t}$; see Bekaert and Harvey (1995).

To take into account the direction of the effects and possible endogeneity (from country *i* to China), we also estimate the lagged version of equation (2) where we use the world stock market and Chinese returns of the previous month to explain current returns for country *i* :

$$[R_{i,USD,t}] = \alpha + \beta_{it}[R_{MSCIW,USD,t-1}] + \gamma_{it}[R_{CHINA,USD,t-1}] + \varepsilon_{it} \quad (3)$$

The Chinese stock markets are not included into the MSCI index which in principle gives us a possibility to estimate the China exposure correctly. Thus, by definition $Cov\left[[R_{MSCIW,USD,t}], [R_{CHINA,USD,t}]\right] = 0$ could be valid if individual economy's China

exposure is zero. Moreover, MSCI could partly absorb the effects of high stock market uncertainty (i.e. VIX) and thus take into account the Arslanalp et al. (2016) evidence of a strong influence of China on Asian financial market especially during the high values of global stock market risk.

We continue by estimating the single market China exposure and quantify the possible determinants of the China exposure.

2.1.1 Country level China exposures

Tables 1-7 present the results of the estimated China exposure from equations (2) and (3) for individual countries. The countries are divided into different groups: Emerging America, Emerging Europe, Emerging Asia, Developed Europe and North America, Developed Asia and Middle East and Africa, Emerging Middle East and Africa and countries neighboring China.[4] Table 1 presents the China exposure Emerging America. In this group the average world market exposure was 0.636 and the China exposure 0.215. Mexico (1.178) and Brazil (1.161) were the most exposed to global stock market. The highest values of China exposure were reported for Peru (0.522), Brazil (0.434) and Colombia (0.334).

TABLE 1 HERE

We also tried to consider the possible endogeneity problem in estimating the ICAPM. We estimated the model with lagged world market and Chinese market returns following equation (3) and used also the IV estimation. Only the results from equation (3) were reported.[5] These estimates suggest that exogenous China exposure would then be much milder than obtained estimates from the OLS indicate. In effect the OLS estimates would contain a substantial amount of information about the interdependence between China and country *i* in addition to exogenous China exposure. Controlling for endogeneity decreased the size of the exposures considerably. The China exposure decreased for all the other countries

[4] We also estimated the China exposure utilizing SURE estimation (Seemingly Unrelated Estimation). In principle the SURE estimation enables the possibility that the countries are subject to same kind of shocks and hence the errors are allowed to be correlated across countries. The SURE estimates were alike the OLS estimates and were not reported but are available upon request.

[5] The IV estimations were performed using three lags as instruments. Results from IV estimation were broadly alike than the results from equation (3) and are available upon request from the authors.

except Mexico whereas the impact of lagged world market exposure on national stock return was in turn highly nonsignificant and small.

Table 2 shows the exposures for emerging European countries. The most exposed countries to global stock market risks were Romania (1.567) and Serbia (1.653) and the lowest figures were reported to Lithuania (0.554), Bosnia (0.585) and Slovenia (0.644). Turkey (0.369), Russia (0.258), Romania (0.264) had the highest contemporaneous China exposure. Estimation with lagged world and China stock market returns did not change dramatically the results. It turned out that Chinese stock market also leads positively the returns in Polish (0.244), Greece (0.352) and Russia (0.270) equity market. The impact of lagged world market return became much smaller and lost its significance except for Hungary and Ukraine. The results between contemporaneous and lagged exposures were not alike. We inferred that this indicated there is some endogeneity in the model which lent support to the interdependency between China and rest of the world rather than just pure exposure.

TABLE 2 HERE

Table 3 reports China exposure in developing Asia. All countries except Bangladesh are significantly exposed to global stock market risk. The mean value for the world stock market risk was 0.57. Highest figures for world market $\beta_i s$ were reported for Indonesia (0.906) and Kazakhstan (0.891). China exposure was relative high across all the estimated countries with the mean 0.297, slightly above the half of the size of world market $\beta_i s$. The highest figures of China exposure were reported for India (0.422), Thailand (0.319) and Taiwan (0.316). Lagging the world market and China return made the exposures for many countries much smaller and insignificant. Overall changes in the estimated exposures were much alike and we thus inferred that the estimated exposures were not significantly subject endogeneity problem but rather lent support to interdependency. Moreover, the change in the estimates were much larger for the world market risk than for China exposure which we inferred to indicate China exposure is probably less likely endogenous than the world market risk.

TABLE 3 HERE

Table 4 reports the China exposure of developed Europe and North America. The world market $\beta_i s$ are higher than one for all countries except US, Canada, Switzerland and UK. The highest figures for world market exposure were reported for small open economies of Finland (1.472) and Ireland (1.447) and large exporting country like Germany (1.441). China

exposure was positive and significant only for Norway (0.264), UK (0.063) Canada (0.199). The positive value of China exposure for Norway and partly for UK could be due to the importance of oil export for those countries. In addition, UK has had close link to China due to history of Hong Kong. Surprisingly the China exposure was negative for USA (-0.071) and Ireland (-0.186). These figures could in part be related to the endogeneity problem and evidence of interdependency. The value of γ_i tuned to positive is in estimation of lagged exposures.

TABLE 4 HERE

Estimates of China exposure for developed Asia, Middle East and Africa indicated high values of βs and close integration of Australia and Korea with the world market. These results are in Table 5. Not surprisingly, the China exposure was highest for Hong Kong (0.472) but it was also high and significant for Singapore (0.299), Korea (0.318) and Australia (0.288). There was no evidence on significant impact of China for Japanese stock market but this could be partly due to possible endogeneity problem. The lagged China exposure provided evidence of China exposure for the Japanese stock market. Israel was exposed to global stock market risk but remained immune to China's effects.

TABLE 5 HERE

For the group of countries in the Middle East and Africa (Table 6), we found statistically significant China exposure only for Egypt (0.267), South Africa (0.389) and Qatar (0.206). The world market βs varied a lot from low of 0.284 (Tunisia) up to 1.099 (UAE). Estimation with lagged terms did not change the inference significantly. Overall the size of world market βs decreased and now the Zimbabwe turned out to be significantly China exposed (0.474).

TABLE 6 HERE

Finally, Table 7 displays the China exposure among the countries neighboring China i.e. countries that have a common border with China. All the neighboring countries were significantly exposed to world stock market performance. The mostly highly exposed was Russia (1.191) whereas Pakistan was the lowest exposed (0.384). The China exposure had values from 0.06 (Japan) up to 0.422 (India) but only India, Russia, Taiwan were statistically significantly exposed. Estimation with lagged returns variable indicated that the size of the world market βs decreased considerably. The mean value changed from 0.749 down to 0.092. The change in the size of China exposure was much lower, from 0.221 down to 0.184.

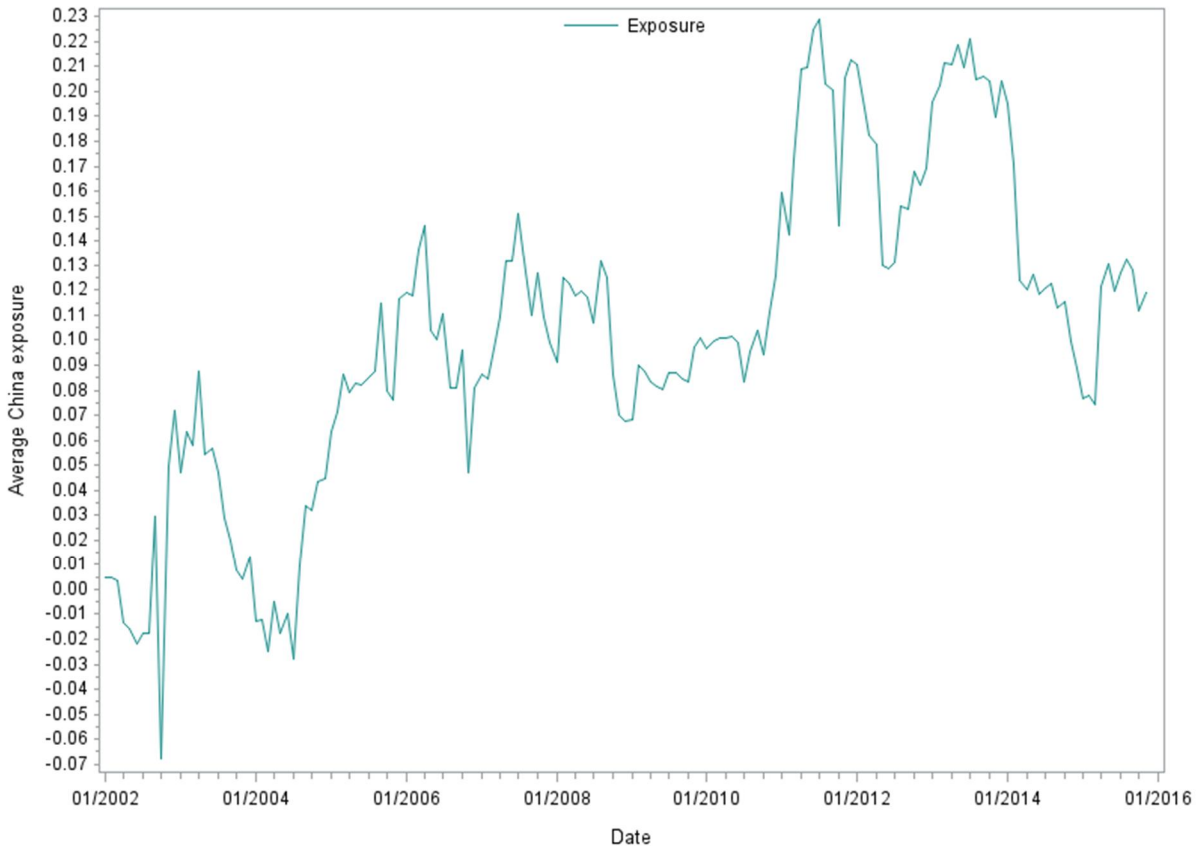
TABLE 7 HERE

To sum up, the results from the ICAPM estimates lent support China exposure is highest in Emerging Asian with the mean exposure of 0.297. The China exposure was also high among the Asian developed economies (0.217) and countries neighboring China (0.221). These figures reinforce the earlier findings of stock market co-dependency in East Asia; see e.g. Hung and Cheung (1999), Corhay et al. (1995), Johnson and Soenen (2002), Cheng and Glascock (2005). They also lent support that the size of China exposure might be strongly related to the geographical location and distance from China. Surprisingly, the US stock market is immune to China exposure. The European countries were not strongly China exposed but highly affected by the performance of world stock market. Based on the estimated βs, the markets with the highest reactions to global stock market movements were Ireland (1.447), Finland (1.472) and Germany (1.441) which are all EMU member countries. The overall mean for China exposure across countries was 0.181. In effect China could provide some benefits of portfolio diversification. In addition, the movements in Chinese stock market even preceded the stock market returns in Russia, Japan, Hong Kong.

2.1.1 Time-varying China exposures

Since Longin and Solnik (1995), correlations of the international equity markets have been treated as time-varying. Figure 2 presents the evolution of the cross-sectional average China exposure measured with a 36 month rolling window. The figure points out two major points. First, the China exposure cannot be regarded to be constant. Second, there has been a positive trend in China exposure since the beginning of the 2002. It started from about zero level and reached 0.22 within fourteen years. The volatility of China exposure seemed to increase strongly after 2011 and the peaks in China exposure (about 0.22) were reached during the years 2011 and 2013.

Figure 2 The evolution of an average of China monthly exposure in rolling regression (OLS) a three-years (36 months) window.



Next we divided the sample in the country groups in order to detect possible country-group dependencies in the size, dynamics and in evolution of the China exposure. For each group, we calculate the mean values of the exposure. In the estimation of these regional values, all the estimated of China exposures were used irrespective of their statistical significance.

Figure 3 displays the average China exposure among the group of developed countries: developed America (DevAmerica), developed Asia (DevAsia) and developed Europe (DevEurope). Figure 3 points out that China exposure has increased especially strongly among the countries of developed Asia while its values for developed European countries have changed from negative up to slightly positive. These results proposed that between 2002 and 2007 China stock market has been negatively related to the performance of the developed

European stock market and has thus provided possibilities for portfolio diversification. For developed American countries (Canada and USA), the exposure has remained mildly positive during the whole sample period. The size of China exposure among developed European and American countries has varied quite steadily around its mean (about 0.05) without any clear trend in its value. Notably, the European and American China exposures seemed to be quite highly correlated 2007 onwards but there was also strong decrease to negative values in European countries China exposure somewhere in 2012. This coincides with the peak of the euro-area sovereign debt crises. The high values of China exposure were reached again at the end of the year 2013. On the other hand, China exposure seemed to be relatively immune to the US sovereign debt crises in 2008 which slightly contrasts e.g. the findings of Dooley and Hutchison (2009). Potentially the impacts of global crisis were captured via the world stock market risk which was included in the estimation of γ.

Figure 3 Average China exposures among the developed economies: developed America, developed Asia and developed Europe. Rolling regression with 36 month window.

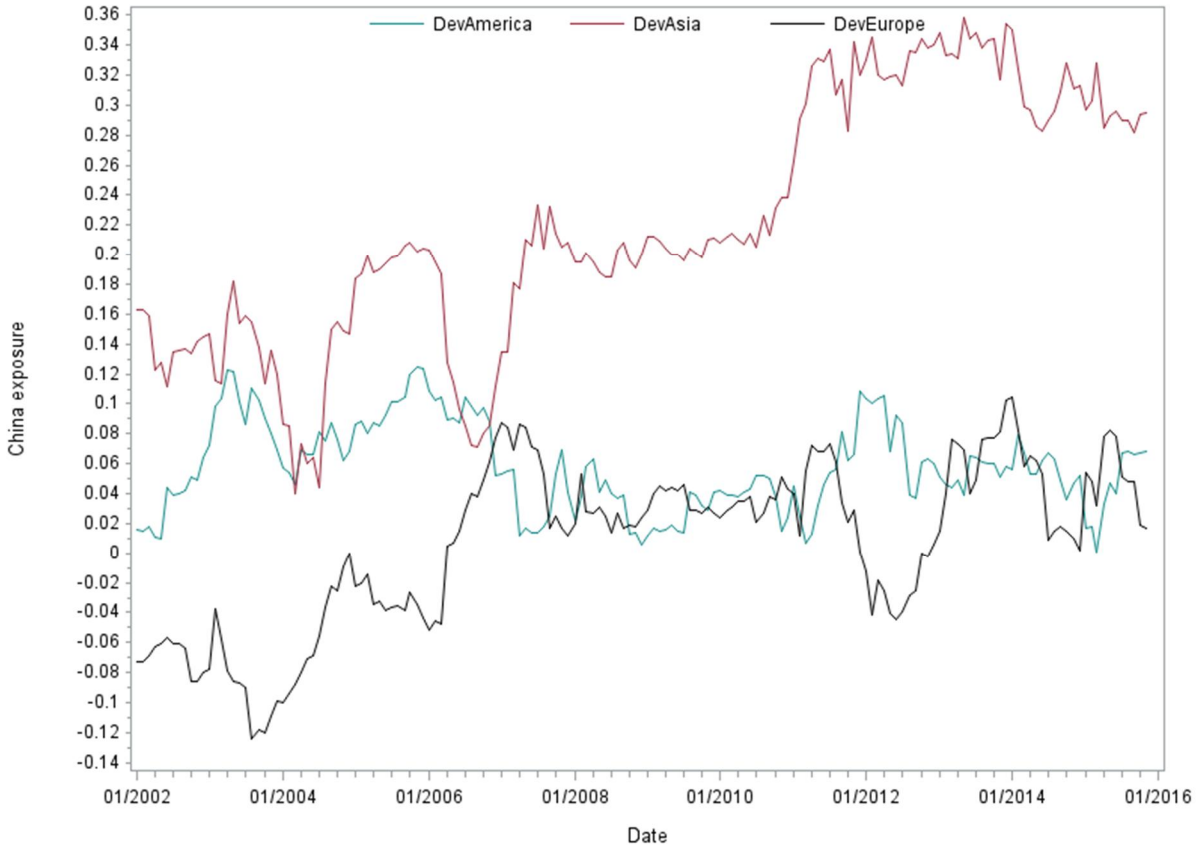


Figure 4 displays the China exposure among the groups of emerging economies: emerging Asia (EmAsia), emerging America (EmAmerica) and emerging Europe (EmEurope). It clearly displays that the China exposure has not been constant and not behaved unanimously among the emerging Economies. However, emerging economies seemed to have been more China exposed than the industrialized countries. China exposure in the emerging Europe slightly differs from the exposures in emerging Asia and emerging America which behaved more alike. There is a notably decrease in China exposure among the European emerging economies somewhere in 2009-2012. Similarly to developed European markets, it takes place much at same time as the culmination of euro area sovereign debt crisis. Overall the European emerging economies have been less exposed to Chinese stock market performance than the markets in other emerging economies especially since 2008.

The highest figures of China exposure were reported for emerging America especially after the year 2010. Overall the size of the China exposure changed dramatically among the emerging economies during the estimation period, from about 0 up to 0.55 and thus being substantially higher exposed than developed countries. The trend was positive and strong but there is also a significant drop in all the exposures during 2014 and 2015. The lowest values of the China exposure were reported in the beginning of the sample year 2002 while the highest values were reached at the end of the sample in 2013.

Figure 4 Average China exposures in emerging economies: emerging America, emerging Asia and emerging Europe. Rolling regression with 36 month window.

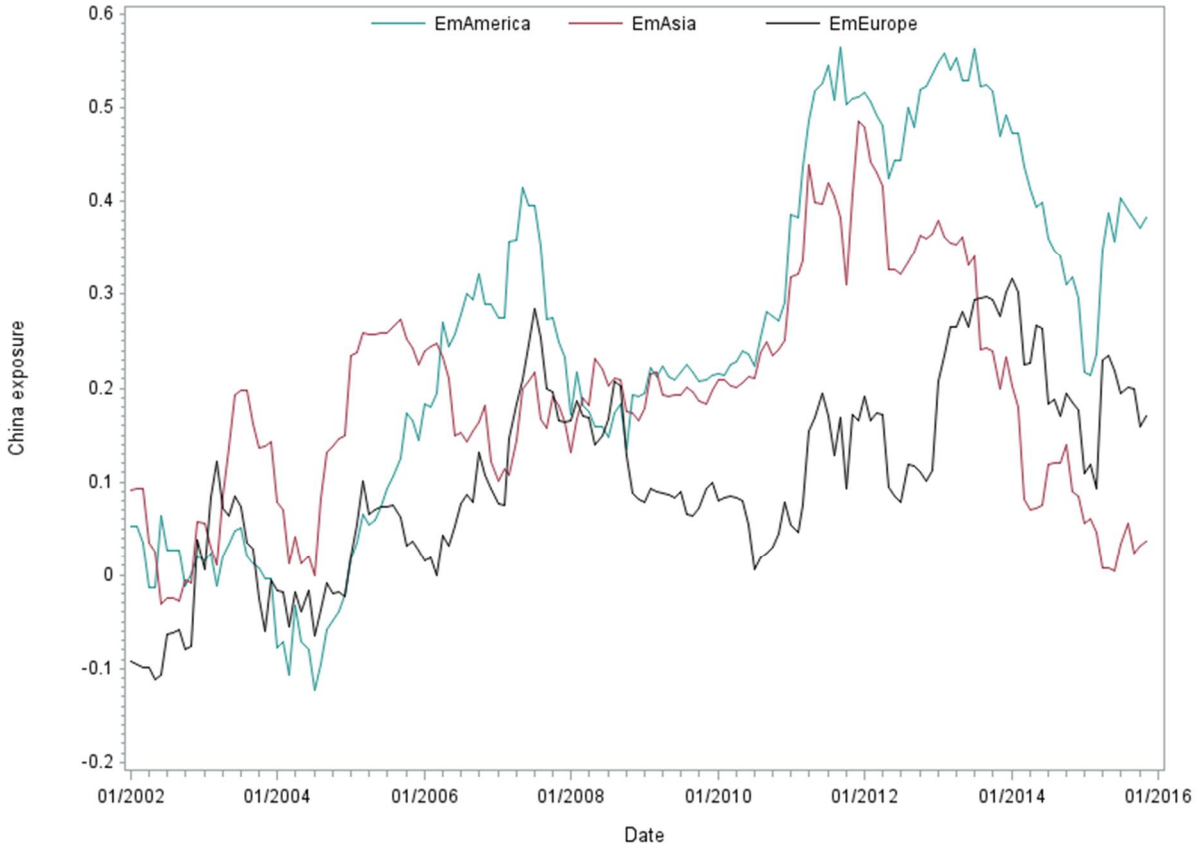
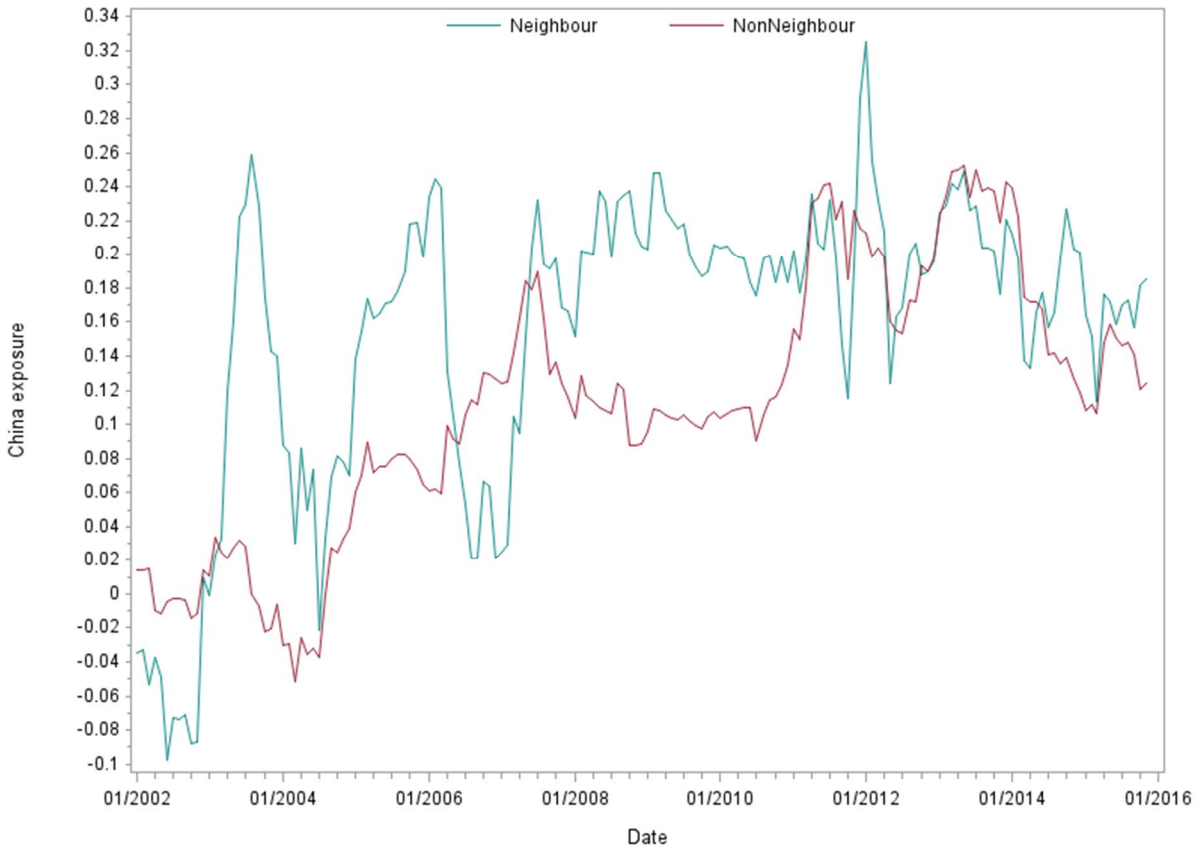


Figure 5 displays the evolution of the average China exposure among the China neighbors and non-neighbors. Broadly, both neighbors and non-neighbors have a similar trend. China exposure had its lowest value around the year 2002 and thereafter the exposure has been increasing in both groups. Typically, the exposure has been more volatile among the countries having a common border with China. The neighboring countries have had abrupt peaks in China exposure somewhere in the beginning of 2004, 2006 and 2012 followed by a rapid decrease. The non-neighbors' and neighbors' China exposure deviated from each other during 2007-2102 but has been highly correlated since then.

Figure 5 Average China exposures in China neighboring and non-neighbors. Rolling regression with 36 month window.



To sum up, the China exposure had been evolving. The size of exposure was increasing 2002 onwards and generally reached the highest figures towards the end of our sample being the highest at the beginning of the decade 2010. Overall, China exposure is relatively modest with respect to world stock market risk. For some countries the global stock market beta reached the values above one and provided evidence on market with strongly exposed to global stock market risk. Moreover, not all countries were equally affected by movements in China's stock markets. Overall the highest figures for China exposure were reported for emerging economies and developed economies neighboring China. The differences in the volatility of the exposure were significant. The highest figures were reported for Asian economies where it varied from -0.10 up to 0.55 in emerging Asia and also high volatility was reported for countries in developed Asia. Low value of China exposure, e.g. among the

developed European countries is interpreted to indicate that the stock market behavior in those countries would be relatively immune to China risk. Hence investing in China related equities or market could provide some benefits from portfolio diversification.

2.2 Determinants of China Exposure

The previous analysis provided evidence about the size and evolution of the China exposure among different countries. Next, we tried to find out the determinants of the China exposure. First, the China exposure is estimated monthly using equation (2) with a rolling regression having an estimation window of 36 months. Second, we explain the determinants of the exposure $\hat{\gamma}_i$ using the equation (4). All the estimated China exposure values were utilized irrespective of their statistical significance.

$$\begin{aligned}\hat{\gamma}_{i,t} = \ & \alpha_{2,i,t} + trend + \ \tau_1 D_i + \tau_2 IMP_{i,t} + \tau_3 EXP_t + \ \tau_4 CP_t + \tau_5 FDI_{i,t} \\ & + \ \tau_6 KAOPEN_{i,t} + \ \tau_7 (\Delta y_{CHINA} - \Delta y_i)_t \\ & + \ \tau_7 \Delta e(USD/i)_{i,t} + \ \tau_8 md_t + \tau_9 yd_t + \ \tau_{10,11,12,13} R_j + \ \tau_{14} EM + \ \omega_{i,t}\end{aligned} \quad (4)$$

The exposures $\hat{\gamma}_i$ *s* were explained with the following variables. D_i is the distance between China and the country *i*, $IMP_{i,t}$ captures the amount of import from China to Country *i;* $IMP_{i,t} = (\ IM_{i,CHINA}\ )_t / GDP_{it})$. $EXP_{i,t}$ stands for the export from country *i* to China; $EXP_{i,t} = (\ EX_{i,CHINA})_t / GDP_{it})$. $FDI_{i,t}$ captures the economic linkages of country *i* in terms of foreign direct investments with respect to China. It sums the foreign direct investments for country *i* to China and from China to country *i*; $FDI_{i,t} = \sum_{t=1}^{n} (\ FDI_{i,t,CHINA,t} + FDI_{CHINA,t,i,t}) / GDP_{i,t}$, CP_t is the index of the commodity prices and $KAOPEN_i$is the value of the Chinn-Ito (2006) index for capital account openness in a country *i*. Since the value of the index was constant for China during the estimation period only the values of country *i* Chinn-Ito index were used. $\Delta e(USD/i)$ is the change in country *i* exchange rate with respect to USD. $(\Delta y_{CHINA} - \Delta y_i)_t$ is the difference between the growth rate of China and country *i*. We expect the growth rate to reflect the expected growth of further dividend yields and stock returns at a national level; see e.g. Fama (1981, 1990), Schwert (1990), Chung and Ng (1998). A higher dividend yield is expected to increase capital inflows which enlarge China exposure. The data is described with details in the data Appendix.

TABLE 8 HERE

Specification also included emerging market dummy EM_i , regional dummies R_i as well as year (yd_t) and monthly (md_t) fixed effects. There is most likely an errors-in-variable problem in the dependent variable of equation (4) which will provide larger standard errors and a possibility for type I-error. Thus, the statistical significance of our results might be underestimated.

The results of the equation (4) are presented in Table 8 where columns (1)-(3) are related to China exposure obtained from contemporaneous model of equation (2) and columns (4)-(6) from the equation (2) which controls the possible endogeneity of China exposure. Columns (1) and (4) use the China exposure measured as in equation (2) while columns (2) and (5) use the China exposure measured without MSCI World portfolio in the estimation. The reason for estimating the China exposure also without the MSCI World index is that since it comprises mostly developed markets using it as a control might bias the results with respect to other markets. Columns (3) and (6) utilize the MSCI Hong Kong as a measure of China's stock market and otherwise use the same model from equation (2).

Model 1 (CHN1) in Table 8 provides our main results. It indicates that export from country *i* to China was significant determinant of the China exposure. An increase in export to China enlarged the China exposure. The aggregated FDI representing the direct financial linkages to China and outwards from China to country *i* had also a positive impact on the size of the China exposure. We thus lent support to the findings of Boubakri and Guillaumin (2015), Arslanalp et al. (2016), Forbes and Chinn (2004) about the significance of trading activities on stock market integration. Capital account openness had a positive impact on China exposure. An increase in the Chinn-Ito measure of capital openness (*KAOPEN*) enlarged the China exposure. The significant and positive coefficient of the time trend proposes a continuous increase in China exposure during the estimation period. This is along the previous findings of the increasing importance of China for the global economy; see e.g. Tyres (2016). The distance (*D*) is expected to take into account the geographic proximity on China exposure. The further away the country is from China, the less it exposed to Chinse equity market. ΔCP was included to capture the impacts of commodity prices on China exposure. We expect that an economic boom in China increases export demand of commodities in commodity exporting countries. In effect these commodity export countries would experience a growth in their export, output and resultant increase in their stock market. We did not obtain any evidence on the commodity price channel and ΔCP was not significantly related to China exposure. Probably commodity price channel is possibly

reflected in our measure for export, EXP. It is also possible that the commodity pricing channel is captured via the country dummies of which Emerging market dummy (EM) and South American country dummies were significant. Among the South American countries especially Chile was strongly exposed to China.

The China exposure on global stock market was estimated in terms of common currency, (USD). $\Delta e(USD/i)_{i,t}$ was used to estimate the possible foreign exchange exposure in China exposure. PBoC officially conducts a basket peg the RMB foreign value has been relatively stable and closely connected to the value of the USD; see e.g. Frankel and Wei (2007), (2008), Frankel (2009), Firmuc and Sidduqui (2014). The volatility of the RMB against the USD is small and thus the China exposure to USA due to RMB exchange rate is not large. However, if the USD devaluates significantly the value of the country *i* stock market could be strongly exposed to RMB due to RMB's peg to USD. This indirect exposure might be of importance but unknown. It turned out that the foreign exchange exposure was then not a significant determinant of China exposure.

We further tested the impact of global financial market uncertainty, VIX, on the size of the China exposure. It turned out to be insignificant (-0.0054 VIX [-0.70]) which lent support our modelling strategy in estimating the size of the China exposure from the ICAMP. This proposes that ICAP model (2) was able to capture the global stock market uncertainty and isolate it from the China exposure. CHN2 explains the determinants of the China exposure which were estimated without the global stock market. Results were changed. Now the measure of the global stock market uncertainty variable, VIX, became significant (0.0018 VIX [3.45]) when included in the model. We interpreted this as final evidence on our successful strategy to quantify and isolate the global financial market uncertainty from the China exposure via the estimation of China exposure from the ICAPM. Other changes in results were that capital market openness became insignificant. Export to China remained its significance but now the import from China had a negative value for the China exposure. That is, the more country *i* is importing from China, the lower value of China exposure it had. Growth differential between China and country *i* became significant determinant for China exposure. Accordingly, a faster economic growth in country *i* with respect to China, $(\Delta y_{CHINA} - \Delta y_i)$ enlarged China exposure. The sign is in accordance with our estimates of IMP and EXP. An increase in export from country *i* to China boosts the output in country *i* and enlarges the expected dividends and stock market returns. South American country

dummy was still significantly positive and now also the European and North American country dummies became significant. Notable, the emerging market dummy (EM) lost its significance. In effect we interpret the changes in country dummies to indicate that now the China exposure captured a part of the global stock market risk involved in North America and European stock markets. The distance lost is significance but the time trend indicated evolving and increasing nature of the China exposure.

HKG (model (3)) displays the determinants of the Hong Kong exposure. Previous studies have indicated Hong Kong equity market to be more integrated to global equity market than the mainland China equity market. We may thus expect to find some differences between determinants of China and Hong Kong exposure. Now an increase in distance decreased the Hong Kong exposure but all the country dummies turned out to be significant. Again RMB exposure or commodity prices had no impact. The import from China to country *i* increased the Hong Kong exposure which might be related to the significant role of Hong Kong harbor for Hong Kong and in Chinese export. The amount of financial linkages in terms of aggregated FDI remained its significance for stock market exposure. Evidence from the determinants of Hong Kong exposure suggested that the Hong Kong market are different compared with the mainland Chinse market which lent support to the previous studies. Similarly the time trend lost is significance as well. This might indicate that the integration of Hong Kong equity market to global market is matured.

L.CHN1 provides the estimates for lagged China exposures estimated using equation (2). L.CHN1 gives the determinants for the lagged China exposure and L.CHN2 lagged China exposure omitting the global stock market risk. L.HKG explains the lagged Hong Kong exposure. These models were estimated in order to control the possible endogeneity of China exposure. Concerning the L.CHN1 the signs of the determinants were all broadly changed. Only the inference from EXP remained unaltered and dummy for Middle East and Africa became negative.

To sum up, the inference on the determinants of China exposure seemed to be partly dependent on the specification of the ICAPM. We inferred that including the world stock market risk would be a more appropriate approach while it enables us to control the global risk aversion among others. Arsnalp et al. (2016) provide evidence that China impact on e.g. Asian stock market was high when the global risk aversion was high. Hence including the global stock market risk in the market model may be able to control the impacts of global risk

aversion. Accordingly a care must be taken while interpreting the results of China exposure and its determinants. We were able to infer that China exposure is most related to trade integration measured in export and import and financial integration measured via FDI and capital market openness. Moreover, along the lines of increasing trade and financial linkages of China, we are expecting the China exposure to increase in the future.

3 Conclusions

The increase of the size of Chinese economy and its increasing world trade has increased the importance of the China for the global economy. However, we are practically lacking any evidence on the impacts of China for the global stock markets and its determinants. This study examined the effects of Chinese market on global equity markets, i.e. the China exposure. First, the China exposure on national stock market is estimated utilizing the International Capital Asset Pricing Model and second, the determinants of the China exposure were examined.

Our estimates suggest that that China exposure is not unanimously distributed across the world equity market. The size of China exposure for an individual country is at maximum about one third of the global stock market exposure. Overall, the China exposure turned out to be relatively volatile and country-depended but we were still able to disentangle groups of countries with similar dynamics of China exposure. The highest volatility of China exposure and highest positive values of China exposure were reported for countries in Emerging Asia, Emerging America (Brazil, Chile, Colombia, Peru), among Eastern European countries (Russia, Turkey, Hungary) and countries neighboring China as well as South Africa and Egypt. The developed European economies (exception of Norway) and the US were in turn only mildly exposed to China. The estimates lent support to Tunaru, Fabozzi and Wu (2006) that for some countries China could provide some portfolio diversification services.

In addition to the size and evolution of China exposure we also estimated the determinants of China exposure. Our panel data analysis was in favor of gravity equation. Overall the China exposure has been increasing over the time. The geographical distance from China, amount of trade (trade linkages), amount of accumulated FDI and capital market openness (financial linkages) were significant determinants of China exposure. Our results about the significance lent support to earlier findings of Forbes and Chinn (2004) and Arslanap et al. (2016). On the other hand, no evidence on currency risk of China exposure or any evidence on commodity

price linkages in our global data were detected. Our results are along the previous findings of the high importance of Chinese economy in Asia (see e.g. Corhay et al. (1995) and Arslanap et al., (2016)). We also detected dependency of the results on the used specifications. For the estimation of the China exposure we propose to utilize an ICAPM which also control the world stock market exposure. These results lent support to the theories of higher stock market co-movement among the transition economies e.g. due to deficiency of firm specific information; see Morck et al. (2000), Chan and Hameed (2006).

To sum up, our study provides new and novel results about the impacts of Chinese stock market on global equity market. We also got evidence of the interdependency of Chinese and global stock market rather than exogenous impacts of China for global markets. This calls for further research using simultaneous equations modelling strategies. China exposure is strongest among the Asian countries and emerging economies neighboring China and its size can be approximate utilizing the determinants of gravity equation. China exposure is evolving, non-constant and strongly country-dependent. Our results propose that the China exposure is by no-means insignificant or unanimous phenomenon in global stock market. Moreover, as a result of the rapid increase of Chinese economy, opening and liberalization of Chinese capital market and continuous increase in the overall economic integration of Chinese economy to the global economy, the China exposure in global capital markets in expected to increase.

Data Appendix

Countries in the sample are: Australia, Austria, Bahrain (EM), Bangladesh (EM), Belgium, Bosnia (EM), Botswana (EM), Brazil (EM), Bulgaria (EM), Canada, Chile (EM), China (EM), Colombia (EM), Croatia (EM), Czech Republic (EM), Denmark, Egypt (EM), Estonia (EM), Finland, France, Germany, Ghana (EM), Greece (EM), Hong Kong, Hungary (EM), India (EM), Indonesia (EM), Ireland, Israel, Italy, Jamaica (EM), Japan, Jordan (EM), Kazakhstan (EM), Kenya (EM), Korea, Kuwait (EM), Lithuania (EM), Malaysia (EM), Mauritius (EM), Mexico (EM), Morocco (EM), Netherlands, New Zealand, Nigeria (EM), Norway, Oman (EM), Pakistan (EM), Peru (EM), Philippines (EM), Poland (EM), Portugal, Qatar (EM), Romania (EM), Russia (EM), Saudi Arabia (EM), Serbia (EM), Singapore, Slovenia (EM), South Africa (EM), Spain, Sri Lanka (EM), Sweden, Switzerland, Taiwan (EM), Thailand (EM), Trinidad (EM), Tunisia (EM), Turkey (EM), United Arab Emirates (EM), UK, Ukraine, USA, Vietnam (EM) and Zimbabwe (EM). (EM) refers to emerging market countries.

$[R_{MSCI,USD,t}]$ is the world stock market returns in USD, MSCI World, monthly observations. Source: Thomson Reuters, Datastream Eikon.

$[R_{CHINA,USD,t}]$ is the MSCI China stock market index, returns in USD, monthly observations. Source: Thomson Reuters, Datastream Eikon.

$[R_{i,USD,t}]$ is the country *i* MSCI stock market index, return in USD, monthly observations, MSCI. Source: Thomson Reuters, Datastream Eikon.

$KAOPEN_{i,t}$ is the value of Chinn-Ito index (2006) for country i. Chinn-Ito index measures the capital account openness. Source: http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

$IM_{i,t} = (IM_{i,CHINA})_t / GNP_{i,t}$; $IM_{i,CHINA}$ is country *i* import from China, current prices in USD. Source: UN Comtrade, https://comtrade.un.org/data/. $GNP_{i,t}$ is country i GNP, current prices in USD, yearly observations. Source: World Bank, in USD dollars, http://data.worldbank.org.

$EX_{i,t} = (EX_{i,CHINA})_t / GNP_{i,t}$ is country *i* export to China current prices in USD. Source: UN Comtrade, https://comtrade.un.org/data/. $GNP_{i,t}$ is country i GNP, current prices in USD, yearly observations. Source: World Bank, in USD dollars, http://data.worldbank.org.

ΔCP_t is a percentage change in commodity price. Source: http://www.imf.org/external/np/res/commod/index.aspx.

$FDI_{i,t} = \sum_{t=1}^{n}(FDI_{i,t,CHINA,t} + FDI_{CHINA,t,i,t})/GNP_i$, where $FDI_{i,t\,,CHINA,t}$ is foreign direct investments from country *i* to China, current prices, in USD at time t, $FDI_{CHINA,t,i,t}$ is the foreign direct investments from China to country i, current prices, in USD at time t. Data for FDIs is from UNCTAD http://unctadstat.unctad.org. GNP_i is country *i* GNP, current prices in USD, yearly observations. Source: World Bank, http://data.worldbank.org.

D_i is the distance between China and the country *i* based on CEPII *dist* variable in thousand kilometers. *dist* uses geodesic distances, which are calculated following the great circle formula, which uses latitudes and longitudes of the most important cities/agglomerations (in terms of population). Source: CEPII database; http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp.

$\Delta e(USD/i)_{i,t}$ is the percentage change in country i exchange rate with respects to USD, monthly observations. Source Thomson Reuters, Datastream Eikon.

R_i is the dummy for emerging market; Africa and Middle East, Europe, North America, South America and Emerging Economics.

VIX is the monthly mean of daily values of CBOE Volatility Index, mean of the implied volatility of S&P 500 index options calculated and published by Chicago Board Options Exchange (CBOE). VIX standardized around its monthly values. $VIX_t = \frac{VIX_{daily} - \mu_{VIX}}{\sigma_{VIX}}$

$\Delta e(RMB/i)_{i,t}$, ΔCP_t, $TR_{i,t}$, $FDI_{i,t}$, are standardized across countries; $x_{st} = \frac{x - \mu_x}{\sigma_x}$.

References

Arslanalp, S., Liao, W., Piao, S., and D., Seneviratne (2016) China's Growing Influence on Asian Financial Markets. IMF Working Paper WP/16/173.

Bekaert, G. and C., R., Harvey (1995) Time Varying World Market Integration. Journal of Finance 50, 403-444.

Bekaert, G. and C., R., Harvey (1997) Emerging Equity Market Volatility. Journal of Financial Economics 43, 29-77.

Bekaert, G. and C., R., Harvey (2000) Foreign Speculators and Emerging Equity Markets. Journal of Finance 55, 565-613.

Bekaert, G., C., R., Harvey and A., Ng (2005) Market Integration and Contagion. Journal of Business 78, 39-70.

Boubakri, S. and C., Guillaumin (2015) Regional Integration of the East Asian Stock Markets: An Empirical Assessment. Journal of International Money and Finance 57, 136-160.

Chan, K. and A., Hameed (2006) Stock Price Synchronicity and Analyst Coverage in Emerging Markets. Journal of Financial Economics 80, 115-147.

Cheng, H., and J.L., Glascock (2005) Dynamic Linkages between the Greater China Economic Area Stock Markets – Mainland China, Hong Kong and Taiwan. Review of Quantitative Finance and Accounting 24, 343-357.

Chen P-F., C-C., Lee, C-C., Lee and J-X., Huang (2015) A Dynamic Analysis of Exchange Rate Exposure: The Impact of China's Renminbi. The World Economy 39(1), 132-157.

Chung, Y-W., and L.K., Ng (1998) International Evidence on the Stock Market and Aggregate Economic Activity. Journal of Empirical Finance 5, 281-296.

Chowdhury, A. R., (1994) Stock Market Interdependencies: Evidence from the Asian NIEs. Journal of Macroeconomics 16, 629-651.

Corhay,A., A, T., Rad and J., Urbain (1995) Long Run Behaviour of Pacific-Basin Stock Market Prices. Applied Financial Economics 5, 11-18.

DeSantis, G. and B. Gerard (1997) International Asset Pricing Portfolio Diversification with Time-Varying Risk. Journal of Finance 52(5), 1881-1912.

Dooley, M. and M., Hutchison (2009) Transmission of the US Subprime Crises to Emerging Market: Evidence on Decoupling-Recoupling Hypothesis. Journal of International Money and Finance 28 (8), 1331-1349.

Errunza, V., and E., Losq (1985) International Asset Pricing under Mild Segmentation: Theory and Test. Journal of Finance 40, 105-124.

Fama, E. (1981) Stock Returns, Real Activity, Inflation and Money. American Economic Review 71, 545-565.

Fama, E. (1990) Stock Returns, Expected Returns and Real Activity. Journal of Finance 45, 1084-1108.

Ferson, W. and C., R., Harvey (1993) The Risk and Predictability of International Equity Returns. Review of Financial Studies 6, 527-415.

Firmuc, J. and M., Siddiqui (2014) Exchange Rate Policy in China after the Financial Crisis: Estimation of the Time Varying Exchange Rate Basket. CES IFO, Conference on Global Economy, 16-17 May 2014.

Forbes, K. and D., Chinn (2004) A Decomposition of Global Linkages in Financial Markets over Time. Review of Economics and Statistics 86(3), 705-722.

Forbes, K. and R., Rigobon (2001) No Contagion, only Interdependence: Measuring Stock Market Comovements. Journal of Finance 57, 2223-2261.

Frankel, J. and S.-J., Wei (2007) Assessing China's Exchange Rate Regime. Economic Policy 51, 575-614.

Frankel, J. and S-J., Wei (2008) Estimating DeFacto Exchange Rate Regimes: Synthesis of the Techniques for Inferring Flexibility and Basket Weights. IMF Staff Papers 55, 384-416.

Frankel, J. (2009) New Estimation of China's Exchange Rate Regime. Pacific Economic Review 14(3), 346-60.

Gong, C. and S., Kim (2013) Economic Integration and Business Cycle Synchronization in Asia. Asian Economic Papers 12(1), 76-99.

Harvey C.,R. (1991) The World Price of Covariance Risk. Journal of Finance 46, 111-157.

Harvey, C., R. (1995) The Risk Exposure of Emerging Equity Market. The World Bank Economic Review 9 (1), 19-50.

Heston, S. and K.,G., Rouwenhorst (1994) Does Industrial Structure Explain the Benefits of International Diversification. Journal of Financial Economics 36, 3-27.

Hung, B. and Y.,L., Cheung (1995) Interdependence of Asian Emerging Equity Markets. Journal of Business Finance and Accounting 22.

Jacobsen, B., J., and X. Liu (2008) China's Segmented Stock Market: An Application of the Conditional International Capital Asset Pricing Model. Emerging Market Review 9, 153-173.

Johnson, R. and L., Soenen (2002) Asian Economic Integration and Stock Market Comovement. Journal of Financial Research 25, 141-157.

Jorion, P. (1990) The Exchange-rate Exposure of U.S. Multinationals. The Journal of Business 63, 331-345.

Jorion, P., (1991) The Pricing of Exchange Rate Risk in the Stock Market. The Journal of Financial and Quantitative Analysis 26, 363-376.

Karolyi, G.,A. (2003) Does International Finance Contagion Really Exists. International Finance 6, 179-199.

Longin, F. and B., Solnik (1995) Is the Correlation in International Equity Returns Constant: 1960-1990. Journal of International Money and Finance 14, 3-26.

Lehkonen, H. and K., Heimonen (2014) Timescale-dependent Stock Market Comovement: BRICs vs. Developed Markets. Journal of Empirical Finance, 28, 90-103.

Morck, R., B. Yeung and W., Yu (2000) The Informational Content of Stock Market Why do Emerging Market have Synchronous Stock Market Movement. Journal of Financial Economics 58, 215-260.

Schwert, G., W. (1990) Stock Returns and Real Activity: A Century of Evidence. Journal of Finance 45, 1237-1257.

Tunaru, R., F., J., Fabozzi and T., Wu (2006) Chinese Equity Market and the Efficient Frontier. Applied Financial Letters 2, 87-94.

Tyres, R. (2016) China and Global Macroeconomic Interdependence. The World Economy 39(11), 1674-1702.

Wang, Y. and A., Di Iorio (2007) Are the China-related Stock Market Segmented with both World and Regional Stock Markets? International Financial Markets Institutions and Money 17, 277-290.

Table1 China exposure: Emerging America.

Emerging America	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Mexico	1.178	0.021	0.016	0.187
	[13.52]	[0.31]	[0.12]	[2.06]
Brazil	1.161	0.434	-0.104	0.223
	[5.17]	[4.39]	[-0.44]	[1.44]
Chile	0.648	0.240	-0.053	0.165
	[4.68]	[3.06]	[-0.40]	[1.86]
Colombia	0.643	0.334	0.081	0.119
	[4.51]	[2.84]	[0.42]	[1.02]
Jamaica	0.285	0.043	0.149	-0.023
	[1.31]	[0.26]	[0.49]	[-0.16]
Peru	0.491	0.522	-0.245	0.182
	[3.53]	[5.63]	[-1.19]	[1.24]
Trinidad	0.045	-0.087	0.170	-0.103
	[0.80]	[-1.95]	[1.75]	[-1.65]
Mean	$\overline{\beta_i[R_{MSCIW,USD,t}]}$ = 0.636	$\overline{\gamma_i[R_{MSCIW,USD,t}]}$ = 0.215	$\overline{\beta_i[R_{MSCIW,USD,t-1}]}$ = 0.002	$\overline{\gamma_i[R_{MSCIW,USD,t-1}]}$ = 0.107

Notes for Tables 1-7: Data are measured in US dollars at monthly frequency. Data varies from 1/2002 to 12/2015. Columns (1) and (2) show the results from equation (1) and measure the contemporaneous exposure to MSCI World and MSCI China and columns (3) and (4) have the causal effects of MSCI World and MSCI China, respectively. Exposures are estimated with OLS regressions with Newey-West standard errors. Numbers in brackets denote t-statistics.

Table 2 China exposure: Emerging Europe.

Emerging Europe	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-}$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Bosnia	0.585	0.082	0.108	-0.074
	[3.11]	[0.78]	[0.45]	[-0.52]
Bulgaria	1.507	-0.027	0.366	0.234
	[4.77]	[-0.23]	[1.54]	[1.44]
Croatia	1.037	0.010	0.261	0.036
	[6.61]	[0.15]	[1.26]	[0.32]
Czech Republic	0.863	0.212	0.051	0.146
	[4.43]	[2.93]	[0.34]	[1.53]
Estonia	1.168	-0.086	0.397	0.074
	[5.68]	[-0.83]	[1.93]	[0.43]
Greece	1.538	0.153	-0.071	0.352
	[6.76]	[1.51]	[-0.27]	[2.39]
Hungary	1.412	0.211	0.360	0.071
	[7.24]	[2.11]	[2.02]	[0.66]
Lithuania	0.554	-0.011	0.068	0.183
	[1.17]	[-0.03]	[0.28]	[1.07]
Poland	1.396	0.171	-0.114	0.244
	[9.44]	[2.26]	[-0.59]	[2.59]
Romania	1.567	0.264	-0.016	0.211
	[6.29]	[2.18]	[-0.07]	[1.42]
Russia	1.191	0.258	0.115	0.270
	[6.94]	[2.77]	[0.51]	[2.16]
Serbia	1.653	0.179	0.811	0.235
	[5.93]	[1.30]	[1.80]	[0.62]
Slovenia	0.644	0.173	0.184	0.084
	[4.42]	[2.09]	[1.10]	[0.93]
Turkey	1.203	0.369	0.048	0.189
	[5.88]	[3.00]	[0.21]	[1.16]
Ukraine	1.027	0.208	0.797	0.093
	[2.69]	[1.19]	[2.78]	[0.50]
Mean	$\overline{\beta_i[R_{MSCIW,USD,t}]}$ = 1.090	$\overline{\gamma_i[R_{MSCIW,USD,t}]}$ = 0.144	$\overline{\beta_i[R_{MSCIW,USD,t-}}$ = 0.224	$\overline{\gamma_i[R_{MSCIW,USD,t-1}}$ = 0.157

Table 3 China exposure: Emerging Asia.

Emerging Asia	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Bangladesh	-0.182	-0.214	0.221	0.107
	[-0.57]	[-1.03]	[0.97]	[0.68]
India	0.767	0.422	-0.004	0.222
	[5.16]	[4.46]	[-0.02]	[1.71]
Indonesia	0.906	0.244	0.259	0.180
	[4.09]	[2.46]	[1.06]	[1.09]
Kazakhstan	0.891	0.286	0.329	0.318
	[4.74]	[1.86]	[1.37]	[1.34]
Malaysia	0.431	0.238	0.071	0.097
	[5.85]	[5.07]	[0.67]	[1.10]
Pakistan	0.384	-0.021	0.244	-0.142
	[2.52]	[-0.18]	[0.87]	[-1.03]
Philippines	0.564	0.159	-0.026	0.118
	[3.9]	[2.07]	[-0.18]	[1.35]
Sri Lanka	0.437	0.105	0.450	0.058
	[2.13]	[0.87]	[1.52]	[0.56]
Taiwan	0.704	0.316	-0.007	0.108
	[6.46]	[5.04]	[-0.05]	[1.01]
Thailand	0.707	0.319	0.154	0.091
	[5.79]	[4.05]	[0.97]	[0.69]
Vietnam	0.663	0.224	-0.095	0.368
	[2.34]	[1.49]	[-0.30]	[1.33]
Mean	$\overline{\beta_i[R_{MSCIW,USD,t}]}$	$\overline{\gamma_i[R_{MSCIW,USD,t}]}$	$\overline{\beta_i[R_{MSCIW,USD,t-1}]}$	$\overline{\gamma_i[R_{MSCIW,USD,t-1}]}$
	= 0.570	= 0.297	= 0.228	= 0.2179

Table 4 China exposure: developed Europe and North America.

Developed Europe	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Austria	1.342	0.142	0.174	0.193
	[6.83]	[1.75]	[1.00]	[1.53]
Belgium	1.297	0.000	0.108	0.176
	[10.39]	[-0.01]	[0.68]	[1.33]
Denmark	1.098	0.015	0.150	0.138
	[15.81]	[0.32]	[1.28]	[1.59]
Finland	1.472	-0.018	-0.170	0.255
	[11.56]	[-0.23]	[-1.13]	[2.53]
France	1.300	0.004	-0.038	0.137
	[21.96]	[0.12]	[-0.28]	[1.66]
Germany	1.441	0.022	0.005	0.156
	[15.59]	[0.60]	[-0.28]	[1.66]
Ireland	1.447	-0.186	0.077	0.128
	[13.93]	[-3.32]	[0.40]	[1.17]
Italy	1.369	-0.035	0.080	0.107
	[16.16]	[-0.80]	[0.49]	[1.09]
Netherlands	1.304	0.004	-0.004	0.137
	[22.38]	[0.16]	[-0.03]	[1.40]
Norway	1.253	0.264	0.171	0.124
	[9.97]	[4.97]	[0.94]	[0.86]
Portugal	1.059	0.085	0.114	0.144
	[11.07]	[1.57]	[0.80]	[1.67]
Spain	1.331	0.033	-0.183	0.223
	[12.29]	[0.64]	[-1.19]	[2.58]
Sweden	1.356	0.072	-0.076	0.131
	[13.36]	[1.45]	[-0.57]	[1.25]
Switzerland	0.915	-0.008	0.019	0.098
	[14.82]	[-0.29]	[0.19]	[1.60]
UK	0.964	0.063	0.105	0.071
	[23.71]	[2.89]	[0.85]	[1.01]
North America	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Canada	0.864	0.199	0.181	0.080
	[11.90]	[4.97]	[1.55]	[0.90]
USA	0.997	-0.071	0.042	0.083
	[41.00]	[-5.56]	[0.44]	[1.41]
Mean	$\overline{\beta_i[R_{MSCIW,USD,t}]}$ = 0.817	$\overline{\gamma_i[R_{MSCIW,USD,t}]}$ = 0.034	$\overline{\beta_i[R_{MSCIW,USD,t-1}]}$ = 0.044	$\overline{\gamma_i[R_{MSCIW,USD,t-1}]}$ = 0.140

Table 5 China exposure: Developed Asia, Middle East and Africa.

Developed Asia	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Australia	0.952	0.228	-0.030	0.119
	[11.15]	[5.67]	[-0.21]	[1.21]
Hong Kong	0.450	0.472	-0.022	0.172
	[7.09]	[9.97]	[-0.17]	[1.89]
Japan	0.641	0.060	0.062	0.142
	[6.85]	[1.10]	[0.59]	[1.94]
Korea	0.954	0.318	0.073	0.106
	[8.13]	[5.30]	[0.41]	[0.80]
New Zealand	0.800	0.129	0.054	0.107
	[8.01]	[2.66]	[0.35]	[1.14]
Singapore	0.765	0.299	0.009	0.163
	[9.63]	[5.71]	[0.06]	[1.76]
Developed Middle East and Africa	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Israel	0.776	0.013	0.169	0.022
	[5.17]	[0.19]	[1.32]	[0.25]
Mean	$\overline{\beta_i[R_{MSCIW,USD,t}]}$ = 0.762	$\overline{\gamma_i[R_{MSCIW,USD,t}]}$ = 0.217	$\overline{\beta_i[R_{MSCIW,USD,t-1}]}$ = 0.045	$\overline{\gamma_i[R_{MSCIW,USD,t-1}]}$ = 0.119

Table 6 China exposure: Emerging Middle East and Africa.

Emerging Middle East and Africa	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
Bahrain	0.560	0.008	0.315	-0.004
	[2.12]	[0.07]	[1.19]	[-0.03]
Botswana	0.469	0.078	0.077	0.184
	[2.67]	[0.47]	[0.32]	[1.25]
Egypt	0.664	0.267	0.276	0.071
	[2.76]	[2.57]	[1.19]	[0.47]
Ghana	0.415	-0.344	0.486	-0.185
	[2.40]	[-1.61]	[1.95]	[-1.09]
Jordan	0.438	-0.075	0.376	0.022
	[2.31]	[-1.09]	[2.47]	[0.22]
Kenya	0.521	0.188	0.074	0.163
	[2.34]	[1.53]	[0.54]	[1.30]
Kuwait	0.774	-0.059	0.265	-0.082
	[4.86]	[-0.73]	[1.22]	[-0.78]
Mauritius	0.564	0.122	0.213	0.116
	[2.08]	[1.33]	[1.18]	[1.10]
Morocco	0.427	0.028	-0.003	0.112
	[3.61]	[0.36]	[-0.04]	[1.74]
Nigeria	0.414	0.153	0.596	-0.149
	[1.87]	[1.32]	[2.60]	[-1.18]
Oman	0.545	0.064	0.180	0.066
	[3.32]	[0.95]	[1.13]	[0.59]
Qatar	0.596	0.206	0.303	-0.026
	[2.37]	[1.99]	[1.51]	[-0.15]
Saudi Arabia	0.621	0.110	0.264	0.039
	[2.71]	[0.94]	[1.17]	[0.21]
South Africa	0.750	0.389	-0.096	0.168
	[8.26]	[6.68]	[-0.63]	[1.55]
Tunisia	0.284	-0.003	-0.133	0.124
	[1.70]	[-0.05]	[-0.97]	[1.71]
UAE	1.099	0.025	0.647	-0.051
	[3.89]	[0.17]	[2.09]	[-0.36]
Zimbabwe	0.771	0.046	-0.559	0.474
	[2.06]	[0.23]	[-1.63]	[2.93]
	$\overline{\beta_i[R_{MSCIW,USD,t}]}$	$\overline{\gamma_i[R_{MSCIW,USD,t}]}$	$\overline{\beta_i[R_{MSCIW,USD,t-1}]}$	$\overline{\gamma_i[R_{MSCIW,USD,t-1}]}$
	= 0.583	= 0.071	= 0.193	= 0.061

Table 7 China exposure: countries neighboring China.

Neighbour countries	(1) $\beta_i[R_{MSCIW,USD,t}]$	(2) $\gamma_i[R_{CHINA,USD,t}]$	(3) $\beta_i[R_{MSCIW,USD,t-1}]$	(4) $\gamma_i[R_{CHINA,USD,t-1}]$
India	0.767	0.422	-0.004	0.222
	[5.16]	[4.46]	[-0.02]	[1.71]
Japan	0.641	0.060	0.062	0.142
	[6.85]	[1.10]	[0.59]	[1.94]
Kazakstan	0.891	0.286	0.329	0.318
	[4.74]	[1.86]	[1.37]	[1.34]
Pakistan	0.384	-0.021	0.244	-0.142
	[2.52]	[-0.18]	[0.87]	[-1.03]
Russia	1.191	0.258	0.115	0.270
	[6.94]	[2.77]	[0.51]	[2.16]
Taiwan	0.704	0.316	-0.007	0.108
	[6.46]	[5.04]	[-0.05]	[1.01]
Vietnam	0.663	0.224	-0.095	0.368
	[2.34]	[1.49]	[-0.30]	[1.33]
Mean	$\overline{\beta_i[R_{MSCIW,USD,t}]}$	$\overline{\gamma_i[R_{MSCIW,USD,t}]}$	$\overline{\beta_i[R_{MSCIW,USD,t-1}]}$	$\overline{\gamma_i[R_{MSCIW,USD,t-1}]}$
	= 0.749	= 0.221	= 0.092	= 0.184

Table 8 Determinants of China exposure.

	CHN1	CHN2	HKG	L.CHN1	L.CHN2	L.HKG
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.001	-1.636***	0.323	-1.562***	-0.827***	-1.731***
	[0.01]	[-17.03]	[1.51]	[-13.44]	[-9.97]	[-2.98]
$\Delta(USD/i)$	0.003	-0.002	0.004	-0.003	0.003	0.002
	[0.47]	[-0.39]	[0.32]	[-0.43]	[0.82]	[0.04]
ΔCP	0.002	-0.004	-0.002	0.007	-0.002	0.019
	[0.37]	[-0.84]	[-0.21]	[1.19]	[-0.56]	[0.70]
$KAOPEN$	0.026***	-0.007	-0.027*	-0.064***	-0.016***	-0.021
	[2.81]	[-0.98]	[-1.68]	[-7.75]	[-2.74]	[-0.48]
IMP	-0.036	-0.051**	0.068***	0.031	0.014	0.137***
	[-1.14]	[-2.17]	[4.69]	[1.10]	[0.68]	[3.49]
EXP	0.147***	0.099***	0.019	0.073**	0.065***	-0.053
	[4.72]	[4.23]	[1.38]	[2.57]	[3.22]	[-1.43]
FDI	0.366***	0.363***	0.034***	-0.430***	-0.280***	-0.012
	[3.79]	[5.02]	[2.64]	[-4.92]	[-4.49]	[-0.33]
$Growth\ Diff$	-0.009	-0.013**	-0.001	-0.018***	0.002	0.000
	[-1.31]	[-2.44]	[-0.09]	[-2.70]	[0.52]	[-0.01]
$Africa\ \&\ Middle\ East$	0.023	-0.212***	0.205***	-0.295***	-0.108***	0.009
	[0.69]	[-8.56]	[3.60]	[-9.87]	[-5.05]	[0.06]
$Europe$	-0.020	0.149***	0.193***	0.020	0.018	0.210
	[-0.68]	[6.81]	[3.81]	[0.74]	[0.97]	[1.53]
$North\ America$	0.044	0.069**	0.241***	-0.059	0.009	0.057
	[0.94]	[1.94]	[2.94]	[-1.37]	[0.30]	[0.26]
$South\ America$	0.341***	0.212***	0.711***	-0.235***	-0.081*	0.020
	[4.94]	[4.10]	[5.96]	[-3.75]	[-1.81]	[0.06]
EM	0.043**	-0.001	0.062*	-0.049***	0.069***	-0.034
	[2.21]	[-0.09]	[1.85]	[-2.82]	[5.56]	[-0.38]
D	-0.016***	-0.003	-0.034***	0.018***	-0.004	0.019
	[-3.43]	[-0.84]	[-4.36]	[4.40]	[-1.26]	[0.90]
$Trend$	0.000	0.000***	0.000	0.000***	0.000***	0.000**
	[1.54]	[22.69]	[-0.71]	[14.01]	[12.21]	[2.66]
R^2	0.04	0.20	0.02	0.10	0.06	0.01
No.obs	6231	6231	6231	6216	6216	6231

Notes: CHN1 explains the value of the estimated China exposure, γ, for a country i, estimated in an ICAP market model: $[R_{i,USD,t}] = \alpha + \beta_{it}[R_{MSCIW,USD,t}] + \gamma_{it}[R_{CHINA,USD,t}] + \varepsilon_{i,t}$. CHN2 refers to the estimated China exposure γs form a market model without global stock market: $[R_{i,USD,t}] = \alpha + \gamma_{it}[R_{CHINA,USD,t}] + \varepsilon_{i,t}$. HKG refers to the determinants of the Hong Kong exposure γs : $[R_{i,t,USD}] = \alpha + \beta_{it}[R_{MSCIW,USD,t}] + \gamma_{it}[R_{HONG\ KONG,USD\ t}] + \varepsilon_{i,t}$. L.CHN1 refers to γs from $[R_{i,USD,t}] = \alpha + \beta_{it}[R_{MSCIW,USD,t-1}] + \gamma_{it}[R_{CHINA,USD,t-1}] + \varepsilon_{i,t}$, L.CHN2 refers to γs from $[R_{i,USD,t}] = \alpha + \gamma_{it}[R_{CHINA,USD,t-1}] + \varepsilon_{i,t}$ L.HKG refers to γs from $[R_{i,t,USD}] = \alpha + \beta_{it}[R_{MSCIW,USD,t-1}] + \gamma_{it}[R_{HONG\ KONG,USD,-1\ t}] + \varepsilon_{i,t}$. Figures in brackets are t-statistics.