

China's Financial Linkages with Asia and the Global Financial Crisis

November 21, 2012

Reuven Glick
Economic Research Department
Federal Reserve Bank of San Francisco
reuven.glick@sf.frb.org

Michael Hutchison
Department of Economics
University of California, Santa Cruz
hutch@ucsc.edu

Abstract:

This paper discusses recent steps China has taken to open its capital account and presents empirical evidence on asset market linkages between China and Asia. We find only weak cross-country linkages in longer-term interest rates, but much stronger linkages in equity markets. Moreover, we find that the strength of the correlation of equity prices changes between China and other Asia countries increased markedly during the global financial crisis and has remained high in recent years.

The views expressed below do not represent those of the Federal Reserve Bank of San Francisco or the Board of Governors of the Federal Reserve System. We thank Jeremy Pearce for research assistance.

1. Introduction

China's pace of real economic growth and transformation into a global trading power over the past three decades has been unprecedented. However, development of its financial sector has been more gradual and irregular. Despite evident progress in the size and depth of the financial sector, state-controlled banks and institutions dominate financial markets, many asset prices are heavily managed, and a myriad of regulations and controls still affect international financial transactions. This uneven pattern of development raises the question of whether liberalization of China's financial sector and the "internationalization" of its currency, the renminbi, will ever catch up with the real side of the economy, allowing China to stand among other major economic powers as a world financial center.

"Internationalization" of a currency generally involves permitting its use by domestic and foreign agents in international trade and financial transactions both inside and outside of a country's borders. Full internationalization of the renminbi (rmb) is a tall order for a country that currently maintains numerous financial controls and heavily regulates domestic and cross-border financial transactions. Nonetheless, Chinese leaders have made concerted efforts to encourage greater international use of the rmb since the G-20 summit in November 2008 when Chinese President Hu Jintao called for "a new international financial order that is fair, just, inclusive, and orderly," and China subsequently began to encourage more use of its currency in international trade, swap arrangements between central banks, and bank deposits and bond issuances in Hong Kong.¹ Though Prasad and Ye (2012a) view the effects of these efforts on use of the rmb as modest in size so far, they regard them as symbolically important in signaling the shift in China's

¹ According to Mallaby and Wethington (2012), during the first six months of 2011, trade transactions settled in rmb totaled around \$146 billion, a 13-fold increase over the same period during the previous year. By mid-2011, rmb deposits in Hong Kong equaled \$85 billion, a roughly tenfold jump since Hu's 2008 statement. The yuan is already accepted as a form of payment in Mongolia, Pakistan, Thailand, and Vietnam. Chinese authorities have indicated that as soon as 2015, they want the yuan to be included in the basket of major currencies that determines the value of Special Drawing Rights.

ambitions for the renminbi's future role in the global economy and international monetary system.

Views about the prospects for internationalization of the rmb vary. Some analysts (Ito, 2011) argue that an rmb currency bloc will soon emerge in Asia within which the rmb would be used widely as a transactions currency for trade and finance as well as treated as a reserve currency by other central banks. Other analysts predict a more gradual and slower pace for internationalization of the rmb in regional and global transactions. McCauley (2011), for example, maintains that the Chinese authorities have only just begun the process of permitting the rmb to become an international currency, in terms of allowing residents and non-residents alike to use the currency to trade, invest, borrow, and invoice outside of China. Prasad and Ye (2012b) analyze the growing internationalization of the rmb through its use in the denomination and settlement of cross-border trade and financial transactions, the likelihood and timing of its convertibility, and the prospects for its greater utilization as a reserve currency. They also describe how rmb trade settlement in Hong Kong has expanded rapidly, the issuance of renminbi-denominated bonds both in Hong Kong and the Mainland is picking up, and signs that some central banks are holding rmb-denominated assets in their foreign exchange reserve portfolios. Nonetheless, they conclude that while internationalization of the rmb is steadily growing, it is a long way from attaining full convertibility or meeting other prerequisites for achieving reserve currency status.

Still others see relatively little internationalization of the rmb to date and are pessimistic about further developments, as it would undermine China's highly managed financial and monetary system. In this view, rmb internationalization cannot be undertaken without domestic financial reforms that more closely link the domestic financial system as well as domestic monetary and exchange rate policies to the international financial system.

A large body of literature has addressed various aspects of the policy challenges faced by China as it seeks to sequence capital-account opening and currency internationalization with other policies, such as exchange-rate flexibility and financial market development (Glick and Hutchison, 2009). Less well discussed is how the gradual process of financial liberalization and the China's drive toward internationalization of the rmb has affected its Asian neighbors. Given the sheer size and dynamism of China's economy, greater financial openness and internationalization of the rmb inevitably will have repercussions for the global economy and, of course, even more so for its regional trade and financial partners in Asia.

2. Capital Control Liberalization in China

China has pursued a cautious path towards greater financial openness. Although tax benefits and other incentives have been used to promote inward foreign direct investment, other forms of inflows, particularly portfolio capital and external debt, have been traditionally discouraged. Capital controls have also played a role in protecting the banking system from external competition by restricting the entry of foreign banks and by making it harder for capital to flow out of the country.

As China slowly liberalizes its capital account, it faces a key challenge of maintaining domestic monetary and price stability.² Large balance of payments surpluses through both the current and financial accounts have put upward pressure on the currency. To limit appreciation of the renminbi, Chinese monetary authorities have intervened in the foreign exchange market and accumulated massive amounts of foreign reserve. As a result, China's holdings of foreign reserves have risen from \$140 billion in 1997 to over \$3.2 trillion at the end of 2011.

² For example, China in recent years has permitted limited expansion of portfolio capital flows through "qualified investment" programs. Moreover, unofficial flows into and out of China have grown over time.

This reserve buildup has raised concerns about monetary and inflation stability in China, as both money aggregates and prices have grown faster. A not-so-distant memory is the excessive expansion of the monetary base, money, and credit between 1991 and 1994 – when these aggregates grew at times by over 40 percent per annum -- resulting in high inflation, with CPI rising near 30 percent at its peak.³ The foreign reserve boom over the past decade has similarly led to periods of very large increases in the monetary base, threatening at times a return of higher inflation (Glick and Hutchison, 2009).

As long as China continues to place a higher priority on exchange rate stability than on using monetary policy as tool for macroeconomic control, China's scope for an autonomous monetary policy is constrained. Chinese monetary authorities have addressed this challenge by aggressive open market sterilization operations as well as by raising reserve requirement ratios and employing window guidance measures⁴. As reserve accumulation continues, the conflict between monetary and exchange rate objectives will become increasingly harder to resolve, particularly as remaining controls on capital flow become more difficult to maintain.

Capital controls, which prevent money from moving in and out of an economy easily, have helped to insulate domestic monetary policy from balance of payments surpluses. Since the start of China's reform and open-door policies, foreign direct investment (FDI) inflows have been encouraged, while other inflows and capital outflows were initially heavily controlled.⁵ Non-bank Chinese residents and institutions had been prohibited from directly investing in overseas securities, though banks were permitted to invest their own dollar assets in fixed income instruments

³ This episode was also characterized by a sharp deterioration of asset quality, resulting in substantial increases in non-performing bank loans.

⁴ See Ma, Xiandong, and Xi (2011) for a detailed discussion of the use of reserve requirement changes as a tool of monetary policy in China.

⁵ The rmb has been convertible for current account transactions since December 1996, when China satisfied the IMF's Article VIII criteria for membership.

In recent years, China has liberalized controls on non-FDI capital flows very slowly. Authorized banks were allowed to transact cross-border to accommodate onshore non-bank depositors and borrowers wishing to deposit and borrow in foreign currency. China has sought to institutionalize the management of two-way portfolio flows through programs for so-called “qualified foreign institutional investors” (QFIIs) for portfolio inflows and “qualified domestic institutional investors” (QDIIIs) for portfolio outflows.⁶ Both programs involve pre-approval procedures, quota management, foreign exchange conversion rules, instrument restrictions, and intensive reporting requirements. With the introduction of the QDII plan in 2006, China opened an official channel for Chinese households and firms to gain access to global financial markets. Appreciation pressures on the rmb have led China to encourage outflows through other channels, for example, by relaxing restrictions on currency conversion by domestic residents.⁷ In addition, firms and banks have been given flexibility to issue foreign-exchange denominated bonds in local markets and to raise their direct overseas investment.

Though China had tightly controlled portfolio flows and most external debts for a long time, there is evidence that these capital controls were leaky and had tended to become less effective over time even before the recent relaxation of capital controls.⁸ The sheer magnitude of net and gross portfolio capital and “hot money” inflows clearly casts doubt on the effectiveness

⁶ In December 2002, QFIIs were allowed to invest in A shares and other domestic securities, subject to requirements of at least \$10 billion in assets under management and prior experience. Repatriation was limited by lock-up periods on stocks of as long as one-year. New rules in September 2006 lowered the asset under management criteria to \$5 billion, reduced the lock-up period to three months, lessened experience requirements, and also raised the quotas for investment in Chinese equities. The QDII program, launched in July 2006, permitted qualified commercial banks, securities firms, and insurance companies in China to make limited offshore investments in foreign-currency denominated assets (restricted to fixed income securities in the case of banks and insurance companies). More recently, in response to concerns about increased capital outflows as the economy has slowed, China has accelerated its approval process to allow more capital inflows into its stock and bond markets via the QFII program.

⁷ In 2007 the PBOC raised to \$50 thousand the ceiling on the conversion between rmb and foreign currency by Chinese individuals.

⁸ Prasad and Wei (2007) provide an extensive chronology of capital controls over the period 1980 - January 2005; Prasad and Ye (2012b) update the chronology to 2011. They document the increasing openness of China's capital account in both de jure and de facto terms through selective and cautious changes, consistent with the active promotion of the rmb as an international currency. However, in most cases, they argue that constraints on capital inflows and outflows have been merely relaxed rather than eliminated entirely.

of China's capital control regime. Moreover, as the evidence presented in Glick and Hutchison (2009) and Ma and MacCauley (2007) illustrate, despite the existence of remaining capital controls, there are many indications that China's capital account flows respond to market conditions, suggesting limits to the effectiveness of these controls. "Hot money" flows have apparently been responsive to expectations of rmb appreciation. Similarly, foreign exchange deposits held by Chinese households and firms onshore with banks in China have tracked exchange rate expectations, rising as a share of total bank deposits when the rmb was expected to depreciate and falling when the rmb was expected to appreciate.

Although, as pointed out above, permitted cross-border flows have reduced the effectiveness of China's remaining capital controls, they have not been large enough to eliminate onshore/offshore rmb yield differences. For example, McCauley (2011) examines the growing role of offshore markets for the rmb in China's strategy for financial development, arguing that policymakers are seeking to internationalize the renminbi before fully liberalizing China's capital account. He argues that rmb are building up outside of Mainland China via "carefully drilled holes" in China's capital controls. However, currency, bond, and equity markets show that these controls nonetheless continue to bind. For example, the Chinese government in 2011 successfully issued rmb-denominated bonds in Hong Kong at rates lower than those offered onshore. The differential in the prices of Chinese shares between the mainland and Hong Kong also points to the effectiveness of capital controls.

Hutchison, Pasricha, and Singh (2012) measure the effectiveness of capital controls in China by covered interest parity deviations, using China's interbank offer rate (CHIBOR), the London Interbank Offer Rate (LIBOR for the dollar), the spot exchange rate, and the non-deliverable forward exchange rate (NDF) for the rmb. These parity deviations are frequently large and indicate that a lack of integration between China's domestic (short-term) financial markets and international financial markets. Other work also shows that sizable onshore-offshore

yield gaps persist and provides evidence on the relationships between implied forward rates, interest rates, and equity prices that indicates Chinese capital controls have been effective in partly “decoupling” Chinese financial markets from those in the U.S., Hong Kong, and elsewhere (see Cheung et al., 2005; Ma and McCauley, 2007; and Otani, Fukomoto, and Tsuyaguchi, 2011; Lee, Huh, and Donghyun 2011, McCauley, 2011; Prasad and Ye, 2012b).

3. Empirical Literature on China’s Financial Linkages with East Asia

China’s growing role in global trade and financial markets has affected its East Asian regional neighbors. Given the sheer size and dynamism of China’s economy, greater financial openness and internationalization of the rmb has repercussions for the global economy, and of course even more so for its regional trade and financial partners in East Asia. Several studies have investigated how these developments have affected asset price linkages in the region.

Jang (2011), for example, analyzes the degree of financial integration of China, Japan, Korea, and the United States by examining correlations of money and bond market rates as well as stock market changes using data from the early or mid-1990s through mid-2010. He finds that the correlations of monthly Asian money market rates with United States rates increased after the Asian financial crisis, though China’s correlation is the lowest in the group. Correspondingly, the correlation of money rates of Japan and Korea with that of China, which was negative before the Asian financial crisis, turned positive after the crisis, as rates in the region have moved more closely with each other in recent years. He finds that the correlations of Japan and Korean government bond rates also increased with United States rates after the Asian financial crisis. In contrast, China’s bond rate (with data available only since 2005) does not show a significant correlation with the United States after the crisis, though it does display positive correlations with Japan and Korea, particularly with the latter. In addition, he finds that stock markets in Japan, Korea, and China move more tightly with the U.S. stock market, though less so for China,

after the Asian financial crisis and also show positive correlations among themselves. The correlations in stock price indices in other East Asian countries also suggest a tighter interrelationship with the U.S. stock market following the Asian financial crisis. The relatively low correlations of U.S. and Chinese asset price changes in recent years are consistent with their differences in economic recovery rates and inflation concerns.⁹ Jang concludes that in the last decade Asian countries have achieved remarkable progress in economic integration. However, the degree of integration financial integration lags significantly behind the degree of trade and real economy integration. Moreover, inter-regional links appear to be stronger than intra-regional links in East Asian countries.¹⁰

A number of papers focus on co-movements of exchange rates in the region. For example, Balasubramaniam, Patnaik, and Shah (2011), following the methodology of Frankel and Wei (1994) and Frankel (2009), estimate the effects of changes in the dollar, euro, yen, and rmb on individual East Asian currencies over the period October 2005 to February 2011, using the Swiss Franc as the numeraire. They find that the effect of the rmb is significant only for Malaysia (from 2005 to 2007), Viet Nam (after 2009) and Taiwan (through the entire sample).¹¹ These results suggest that while China has made strides in terms of achieving a major role for the rmb in international trade through the establishment of rmb settlement mechanisms and swap lines, there is relatively limited evidence of an independent effect of the rmb on the exchange rate policies of neighboring economies.

Ma and McCauley (2010) argue that it is important to consider the frequency of the data when analyzing correlations. For example they find that the co-movement of the renminbi with

⁹ He also examines deviations from uncovered interest parity, with the expected exchange rate change used in these calculations proxied by the previous period's actual change. For a related exercise analyzing real interest linkages among Pacific Basin countries, see Glick and Hutchison (1990).

¹⁰ Quantity-based measures include measurement of openness and restrictiveness in trade and financial transactions, cross-border movement of capital, output and consumption correlations, and savings-investment correlations. They yield similar conclusions; see Jang (2011).

¹¹ Somewhat ironically they find that the rmb mattered more outside of East Asia, including India and Pakistan, as well as many countries in Africa.

major currencies other than the dollar is greater at lower frequency, i.e. at weekly or monthly intervals rather than at a daily frequency.

4. China and Asian Financial Linkages and Global and Country Financial Turbulence

Our review of the literature on China's capital controls and increasing international financial integration suggests that China's domestic financial development is proceeding slowly in tandem with some modest steps toward liberalization of the capital account and very limited exchange rate flexibility. In this context, some authors have found that China's financial markets are becoming more integrated with its Asian neighbors despite pervasive capital controls, while others argue that China's financial role in East Asia is minimal, not approaching its role in regional trade and importance as a regional source of economic growth. In this section we analyze the extent of China's asset market linkages with its Asian neighbors and how they have changed over time. We also investigate how global financial factors and national financial turbulence, particularly during the recent global financial crisis (GFC), may influence how interest rate and equity price changes from China may be transmitted across Asia.

More specifically, we investigate linkages for five-year government bond interest rates and equity prices—between China and eight Asian countries—Indonesia, Korea Malaysia, Philippines, Singapore, Taiwan, Thailand, and India—using daily data. Evidence of linkages in bond rate assets would indicate that China has a significant effect on corporate and government costs of finance. Linkages among equity prices could represent either direct financial linkages through capital flows and arbitrage or trade linkages through product competitiveness effects and export and import flows. Our full sample period extends from June 2, 2005, when daily asset price data for China are available, through October 24, 2012. We also consider three sub-periods

corresponding to (1) the “tranquil” period before the GFC, June 2005 - June 2008; (2) the GFC period, July 2008 – May 2010; and (3) the post-GFC period, June 2010 – October 2012.¹²

4.1 Basic Linkages

Our objective is to investigate how Asian financial linkages with China have evolved over time and through periods of global and home-market financial turbulence.

Figure 1a plots bond rates for the U.S. and China, and Figure 1b adds the bond rates of the Asian countries in our sample. Observe that U.S. and China bond rates appear largely decoupled, sometimes moving together, but frequently moving in opposite directions. With the exception of a rise at the peak of the financial crisis in late 2008, bond markets in Asian countries do not appear tightly linked with China, apparently moving in response to domestic inflation and other domestic macroeconomic conditions.

Figures 2a and 2b present analogous plots of equity prices. Similar to the case for bond rates, Figure 2a suggests very little co-variation between U.S. and China equity prices except for the sharp decline at the beginning of the GFC in late 2008, while in the post-GFC period U.S. equities rose very gradually, with Chinese equities rebounding more rapidly. Figure 2b indicates a pattern linking China with other Asia countries not only during the GFC, but after as well. In particular, the world-wide drop in equity markets affected other Asia countries during the GFC period, but in the post-GFC period there was a wide-spread robust upturn in Asia equity markets, suggesting a greater coupling of equity prices in China and other Asian economies.

We confirm these visual impressions with simple correlations of daily changes in Chinese and Asian country bond rates (first differences in percentage points) and equity prices (first differences in logs) for the full sample period and three sub-samples. Correlations of Asian bond

¹² The GFC period roughly corresponds to the time span over which China responded to the crisis by halting the appreciation of the rmb against the U.s. dollar.

rates and equity price changes with the U.S. are also presented for purposes of comparison. . U.S. market changes are lagged one day to account for timing differences in market opening and closing across time zones.

Table 1 presents the correlation results. . The cross-country correlations are positive in almost every case, but generally much stronger for the United States than for China. The bond correlations with China are generally quite low, indicating almost no medium-term (5-year) arbitrage in debt markets between China and the other Asian markets.¹³

Table 1 also indicates that cross-country equity return correlations with both the United States and China are much stronger than the bond correlations. High values are found almost entirely in the equity Correlations with U.S. equity markets are quite strong in all periods, with some variation across countries, but almost all well above 0.30. Most noteworthy, however, is the perceptible shift in the correlations with China, which were relatively low in the pre-crisis period, but rose markedly during the crisis. This is consistent with the GFC acting as a common financial shock which was transmitted globally. However, the high equity correlations of the GFC period carried over to the post-GFC crisis period (mid 2010 to late 2012), indicating the newfound importance of China's markets may be a permanent institutional feature in equity pricing in Asian.

Figures 3a and 3b illustrate this point with bar charts by showing the correlations for China and the U.S., respectively, with the eight Asian countries in our sample over the three sub-samples. The sharp rise in correlations between China and the Asian region across the three sub-samples is clearly evident Figure 3a. By contrast, continuously high equity market correlations across U.S. and Asian equity markets is observed in Figure 3b with no evidence of a systematic

¹³ Note that though low, many of the correlation coefficients are significant given the large sample sizes. The sample size of the four three samples are, respectively, 1637, 662, 434 and 541, so the approximate 5% critical values (absolute value) of statistically significant correlations are, respectively, 0.024, 0.039, 0.048, and 0.043.

increase or decrease before, during, or after the GFC. This finding is consistent with visual inspection of the equity market movements over time presented in Figures 2a and 2b.

4.2 Country Regression Analysis

Visual presentations of the data and simple correlations may mask the influence of other variables. In this section, we present regression results of the influence of Chinese asset prices – both bond interest rates and equity returns -- on analogous prices in other Asian countries, while controlling for developments in the U.S. as well as global and country-specific risk.¹⁴ Global risk in the context is proxied by the VIX rate, measuring the implied volatility of S&P 500 index options., and, country-specific risk is proxied by the credit default swap (CDS) rate on national sovereign debt for those countries where this variable is available (data is unavailable for Singapore, Taiwan, and India). We abstract from other possible determinants, such as exchange rate policy and capital controls in other countries. As in our correlation analysis, bond rate changes are expressed as first differences of the daily rate levels, while equity returns are expressed as logged first differences of daily price levels, with U.S. markets lagged one day to account for timing differences in market opening and closing across time zones.¹⁵

The question investigated then is, after controlling for the common shock of U.S. financial market movements, global risk, and country-specific risk, to what extent are changes in China's asset prices transmitted to other Asian countries? And, how has the strength of transmission/linkage changed with the advent of the GFC?

Figures 4a and 4b show the movements of the VIX rate (basis points) and country-specific sovereign CDS spreads (basis points) for the five most important emerging markets in Asia (other than China). It is evident that VIX and CDS spreads moved closely during the GFC

¹⁴ We treat U.S. asset price movements as capturing the effects of global shocks on Asian markets. The more recent European crisis might be regarded as another global shock.

¹⁵ We do not report the effects of including any additional lags of the dependent or explanatory variables in our analysis, since doing so did not affect results.

but in other periods there is considerable “decoupling,” indicating that idiosyncratic country-risk characteristics are important.

Table 2a, 2b, and 2c show results for various specifications of the bond interest rate regressions for the eight Asia countries in our sample, while Tables 3a, 3b, and 3c show results for analogous equity price regressions. Again, the results for four sample periods are shown—full sample, pre-GFC, GFC and post-GFC. Table 2a (3a) shows the baseline regression with only China and U.S. bond rates (equity return) as the explanatory variables. Table 2b (3b) includes the VIX in the regression as an additional explanatory variable, and Table 2c (3c) adds the CDS spread to the list of regressors. Statistically significant coefficients on the Chinese explanatory variable of interest at the 90% level of confidence or higher are highlighted.

In Table 3a, observe that the Chinese bond interest rate coefficients are statistically significant in only one of eight cases in the pre- and post-GFC samples (Taiwan in the pre-GFC period and Korea in the post-GFC period, , while in the GFC sample there are three significant cases (for Indonesia, Korea, and Singapore, though the coefficient is statistically negative in the latter case). Tables 2b and 2c indicate that this pattern of a limited association of China and Asian bond rate changes is robust to the inclusion of additional controls. By contrast, U.S. bond rate changes are positively and significantly correlated with other Asian countries in almost every case and specification. The VIX is statistically significant and positive during the pre- and post-GFC periods but, surprisingly, not generally significant during the GFC period. Country-specific risk, as modeled by the CDS spread, is only occasionally significant as a determinant of bond interest rates.

Turning to equity price change regressions, the results in Table 3a, 3b, and 3c are consistent with the correlation analysis in finding a large and robust association of Chinese equity price changes with other Asian countries during all sub-samples and formulations. The pattern across the three sub-periods is also remarkably consistent—the importance of Chinese

equity price transmission evidently grew during the GFC and remained at a much higher level (compared to the first sub-sample) for all eight countries in every formulation of the model except one instance (out of 24 regressions reported in Tables 3a, 3b, and 3c). The rise in the Chinese connection to Asian markets is clearly illustrated in Figure 5, which reports the eight coefficient estimates in the pre- and post-GFC periods from Table 3b, which includes the Vix rate, but not the CDS rate, so that results for all countries may be reported. (Note that for Singapore and Thailand the coefficients were virtually zero in the pre-GFC period and display as missing bars in the chart.).

U.S. equity returns are also significant in almost every case, and usually much higher in magnitude than the corresponding China transmission effect, though there is evidence that it has declined in importance over time. Although the VIX is an important determinant of equity prices changes in several cases, CDS spreads have much more pronounced effects on national equity price changes in Asian countries.

We also consider another measure of financial transmission that may not be captured by movements in Chinese equity prices—changes in Chinese reserve requirement changes. Table 4 shows the response of Asian equity prices to dummy variables for days of increases (China RR incr) and decreases (China RR decr) in reserve requirements on banks set by the People’s Bank of China (PBOC), one its operating instruments of monetary policy.¹⁶ The expected effect of these announcements is unclear. On the one hand, we would expect loosening (tightening) of monetary policy and credit in China, captured by decreases (increases) in reserve requirements, to strengthen (weaken) equity prices elsewhere in Asia. On the other hand, the announcements of loosening may also have a signaling effect of how weak is the Chinese economy, implying a negative effect on other its trading partners.

¹⁶ The PBOC typically makes such announcements during weekdays after markets are closed or on weekends. We adjust the dating to the next day when asset markets are open.

In fact, in the post-GFC period we do find that China's reserve rate decreases had a negative effect on equity prices in four of five countries, though this effect is significant for only two countries (Singapore, Taiwan, and India are excluded because of the lack of data on the CDS rate, included as a control variable). However, on balance, these results are quite mixed and do not show a discernible pattern, either in terms of the sign of the effector significance across countries or sub-sample periods. Hence, it does not appear that substantial and rising equity market linkages between China and its Asian neighbors are attributable to monetary policy actions in China.

4.3 Panel Regressions: Direct tests of Financial Turbulence and Transmission

To further explore how financial turbulence—global and idiosyncratic—has influenced the transmission of Chinese bond and equity prices to other Asian countries, we consider several panel regressions, reported in Tables 5, 6, and 7 for bond interest rates and Tables 8, 9, and 10 for equity returns.

Table 5 reports panel regressions of the “baseline” bond rate model in the first column (with U.S. and Chinese bond rates included) and subsequently adding the VIX and CDS spreads to the regressions reported in the second and third columns, respectively. Again, we consider the full sample and three sub-samples. Tables 6 and 7 also report bond rate regressions that add, respectively, VIX and CDS terms interacting with the Chinese bond rates. This allows us to test whether the strength of transmission of Chinese bond rate changes across Asia is influenced by global or idiosyncratic risk.

Although not strong, the transmission of Chinese bond interest rate changes across Asia is more evident in Table 5 than in the individual country regressions in Tables 2a, 2b, and 2c. The strength of the transmission mechanism appears fairly consistent between the two tranquil periods (pre- and post-GFC) but appears to weaken during the GFC period. Moreover, the

strength of the transmission does not appear to increase when either global risk (proxied by VIX, reported in Table 6) or local idiosyncratic risk (proxied by CDS, reported in Table 7) rises. That is, the interactive effects between China asset price fluctuations and the risk measures are generally insignificant.

Table 8 reports the baseline regression results for equity price changes. These results are very similar to the individual country regressions in Tables 3a, 3b, and 3c: the transmission of Chinese interest rates rose markedly during the GFC and has remained high through the end of the sample. This result is robust to the inclusion of the VIX and CDS as control variables. In addition, the strength of transmission of U.S. equity prices to Asian countries declined sharply during the GFC and appears to have remained at this new level. Again, these results are consistent with our earlier findings.

The main result in this section—that the strength of transmission of Chinese equity prices across Asia has increased markedly during the GFC and remained strong—proves to be very robust across specifications of the model and holds also in the extended panel regressions where interactive terms are included (Tables 9 and 10). In addition, the VIX interaction terms (Table 9) indicate that higher global risk increases the strength of the transmission mechanism for Chinese equities across Asia during the GFC and post-GFC periods, but not during the tranquil period prior to the GFC. That is, our results imply that a higher VIX, associated with greater global turbulence translates into a stronger transmission across Asia of a given equity price change in China. This result holds during the GFC and afterwards. By contrast, country-specific risk measured by CDS spreads does not appear to influence the strength of the transmission mechanism during the GFC, but does so during the pre- and post-GFC periods and in the direction again of increasing the strength of the transmission effect. This is shown in Table 10. The interactive term is not statistically significant during the GFC, but in the early and late sub-sample periods, the main result holds—China is playing an increasing important role in

determining equity prices in the region and the strength of this linkage increases during periods of global or national financial turbulence.

5. Conclusion

This paper evaluates how changes in China's financial system, liberalization of capital controls and the process of financial "internationalization" have affected financial markets in other Asian economies. In particular, we examine how financial market changes in China's economy—whether driven by policy changes, market-driven developments, institutional changes, or the growing importance in the region—have influenced financial asset prices of its Asian neighbors.

Our main conclusion is that domestic financial development in China as of late 2012 have been modest and internationalization of the currency and liberalization of capital controls has been very limited. Consequently, substantial divergences remain between interest rates in China and its neighbors. In particular, only weak linkages were detected in longer-term interest rates (five-year bond rates). The strongest linkages appear in equity markets. We argue that equity market arbitrage working through capital markets was not the force driving these linkages between China and Asia. Rather, the emergence of China as the clear regional economic power, the sheer size and dynamism of its economic activity and trading relationships, have played the dominant role in linking equity markets across the region.

Moreover, we find that the strength of the transmission of equity prices changes from China across Asia increased markedly during the GFC and have stayed at this heighter level in recent years. By contrast, the strength of equity price linkages between the U.S. and Asia economies decreased during the GFC and remains lower at present. Rising global uncertainty, measured by the VIX, appears to increase the importance of China in transmitting equity price changes abroad. When country-specific idiosyncratic risk (measured by CDS spreads) increases,

the transmission of Chinese equity price shocks to other Asian countries also appears to rise. China's role in the region is increasing, and seems to rise further during periods of global or country-specific uncertainty.

References

- Balasubramaniam, Vimal, Ila Patnaik, and Ajay Shah (2011). "Who Cries about the Chinese Yuan?" National Institute of Public Finance and Policy, New Delhi, Working Paper 2011-89, May.
- Cheung, Yin-Wong, Menzie Chinn, and Eiji Fuji (2005). "Dimensions of Financial Integration in Greater China: Money Markets, Banks and Policy Effects," *International Journal of Finance and Economics*, 10, 117–132.
- Frankel, Jeffrey. (2009). "New Estimation of China's Exchange Rate Regime," *Pacific Economic Review*, 14:3, 346-360.
- Frankel, Jeffrey and Shang-Jin Wei (1994). "Yen Bloc or Dollar Bloc? Exchange Rate Policies of the East Asian Countries," in Takatoshi Ito and Anne Krueger (eds.) *Macroeconomic Linkage: Savings, Exchange Rates, and Capital Flows*, University of Chicago Press.
- Glick, Reuven and Michael Hutchison (1990). "Financial Liberalization in the Pacific Basin: Implications for Real Interest Rate Linkages," *Journal of the Japanese and International Economies*, March.
- Glick, Reuven and Michael Hutchison (2009). "Navigating the Trilemma: Capital Flows and Monetary Policy in China," *Journal of Asian Economics* 20:3 (May), 205–224.
- Hutchison, Michael, Gurnain Kaur Pasricha, and Nirvikar Singh (2012). "Effectiveness of Capital Controls in India: Evidence from the Offshore NDF Market," *IMF Economic Review* 60, 395–438.
- Ito, Takatoshi (2011). "The Internationalization of the RMB: Opportunities and Pitfalls," Council of Foreign Relations Working Paper, November.
- Jang, Hong Bum (2011). "Financial Integration and Cooperation in East Asia: Assessment of Recent Developments and Their Implications," Bank of Japan IMES Discussion Paper No. 2011-E-5.
- Lee, Hyun-Hoon and Hyeon-seung Huh and Donghyun Park (2011). "Financial Integration in East Asia: An Empirical Investigation," ADB Economics Working Paper Series No. 259 (May).
- Ma, Guan'an and Robert McCauley (2007). "Do China's Capital Controls Still Bind? Implications for Monetary Autonomy and Capital Liberalization," BIS Working Paper No. 233

Ma, Guonan and Robert McCauley (2010). “The Evolving Renminbi Regime and Implications for Asian Currency Stability,” BIS Working Papers No 32.

Ma, Guonan, Yan Xiandong, and Liu Xi (2011). “China’s Evolving Reserve Requirements,” BOFIT Discussion Papers No. 30, Bank of Finland Institute for Economies in Transition.

Mallaby, S. and O. Wethington (2012). “The Future of the Yuan,” *Foreign Affairs*, 91(1), 135-146.

McCauley, Robert. (2011). “Renminbi Internationalisation and China's Financial Development,” Bank for International Settlements *Quarterly Review* (December), 41-56

Ogawa, E. and J. Simizu (2011). “Asian Monetary Unit and Monetary Cooperation in Asia,” Asian Development Bank Institute (ADBI) Working Paper No. 275 (April).

Otani, Ichiro, Tomoyuki Fukumoto, and Yosuke Tsuyuguchi (2011). “China’s Capital Controls and Interest Rate Parity: Experience during 1999 – 2010 and Future Agenda for Reforms,” BOJ Working Paper No.11-E-8, August.

Prasad, Eswar, and Shang-Jin Wei (2007). “China’s Approach to Capital Inflows: Patterns and Possible Explanations,” in Sebastian Edwards (ed.) *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices, and Consequences*, University of Chicago Press for National Bureau of Economic Research.

Prasad, Eswar and Lei Ye (2012a). “Will the Renminbi Rule?” IMF *Finance and Development* (March), 26-29.

Prasad, Eswar and Lei Ye (2012b). “The Renminbi’s Role in the Global Monetary System,” in R. Glick and M.M. Spiegel (eds.), *Asia’s Role in the Post-Crisis Global Economy*, Federal Reserve Bank of San Francisco.

Table 1. Correlation of daily changes

		Bond rates		Equity prices	
		US	China	US	China
Full sample, 6/2/05- 10/24/12	China	-0.012		0.167	
	Indonesia	-0.070	0.083	0.388	0.267
	Korea	0.234	0.083	0.395	0.326
	Malaysia	0.182	0.022	0.396	0.294
	Philippines	-0.062	0.027	0.555	0.202
	Singapore	0.294	-0.023	0.399	0.338
	Taiwan	0.215	0.043	0.423	0.304
	Thailand	0.164	0.001	0.283	0.226
	India	0.127	0.035	0.244	0.249
6/2/05- 7/9/08	China	0.002		0.138	
	Indonesia	-0.041	0.041	0.393	0.186
	Korea	0.278	0.016	0.446	0.256
	Malaysia	0.159	0.003	0.438	0.253
	Philippines	0.006	0.004	0.568	0.136
	Singapore	0.331	0.022	0.524	0.269
	Taiwan	0.258	0.079	0.454	0.234
	Thailand	0.131	0.029	0.281	0.090
	India	0.133	0.021	0.386	0.194
7/10/08- 6/20/10	China	-0.022		0.188	
	Indonesia	-0.118	0.132	0.384	0.310
	Korea	0.235	0.116	0.345	0.381
	Malaysia	0.203	0.015	0.396	0.352
	Philippines	-0.171	0.059	0.629	0.280
	Singapore	0.243	-0.132	0.341	0.391
	Taiwan	0.129	0.011	0.407	0.337
	Thailand	0.193	-0.011	0.266	0.331
	India	0.126	0.046	0.188	0.308
6/21/10- 10/24/12	China	-0.022		0.224	
	Indonesia	0.035	0.018	0.439	0.397
	Korea	0.150	0.126	0.500	0.393
	Malaysia	0.180	0.067	0.489	0.317
	Philippines	-0.009	0.015	0.469	0.229
	Singapore	0.317	0.051	0.457	0.420
	Taiwan	0.367	0.010	0.462	0.421
	Thailand	0.175	-0.033	0.359	0.351
	India	0.143	0.043	0.255	0.269

Note: Bond rates are expressed as first differences in percentage points; equity prices are first differences in logs. US rates lagged one day.

Table 2a. Bond rate regressions

		Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	India
Full sample, 6/8/05-10/24/12	US bond t-1	-.206** (.1028)	.1890*** (.0268)	.0804*** (.0166)	-.121** (.0529)	.1725*** (.0203)	.0934*** (.0132)	.1374*** (.0281)	.1185*** (.0258)
	China bond t	.3985* (.2048)	.1347** (.0598)	.0206 (.0270)	.0912 (.0778)	-.022 (.0285)	.0350* (.0211)	.0045 (.0456)	.0596 (.0463)
	Adj. R2	.0119	.0537	.0272	.0036	.0815	.0493	.0241	.0175
	N	1637	1646	1543	1576	1650	1450	1499	1501
Pre-GFC 6/8/05-7/9/08	US bond t-1	-.126 (.0923)	.2181*** (.0384)	.0800*** (.0208)	-.011 (.0650)	.2203*** (.0370)	.1157*** (.0201)	.0927** (.0439)	.0897*** (.0286)
	China bond t	.1502 (.1066)	.0181 (.0592)	.0015 (.0359)	.0155 (.0886)	.0254 (.0545)	.0649** (.0266)	.0437 (.0717)	.0224 (.0399)
	Adj. R2	.0032	.0770	.0227	-.003	.1043	.0659	.0107	.0150
	N	662	675	616	649	682	596	618	651
GFC 7/10/08-6/20/10	US 5yr bond t-1	-.421* (.2365)	.1960*** (.0501)	.0835** (.0336)	-.251** (.1050)	.1224*** (.0279)	.0676*** (.0242)	.1598*** (.0426)	.1551*** (.0529)
	China 5yr bond t	.9058* (.5425)	.2301* (.1361)	.0166 (.0560)	.1785 (.1782)	-.137*** (.0484)	.0125 (.0543)	-.008 (.1017)	.1174 (.1364)
	Adj. R2	.0270	.0500	.0227	.0213	.0627	.0182	.0328	.0158
	N	434	446	425	420	440	405	408	409
Post-GFC 6/21/10-10/24/12	US 5yr bond t-1	.0516 (.0805)	.1180*** (.0402)	.0740*** (.0210)	-.070 (.0874)	.1752*** (.0351)	.0989*** (.0149)	.1864*** (.0703)	.0966*** (.0287)
	China 5yr bond t	.0425 (.1027)	.1601** (.0718)	.0430 (.0341)	.0468 (.1183)	.0461 (.0357)	.0096 (.0194)	-.042 (.0404)	.0426 (.0372)
	Adj. R2	-.002	.0344	.0381	-.002	.1016	.1304	.0300	.0206
	N	541	525	502	507	528	449	473	441

Note: all variables are in first differences. Robust standard errors in parentheses. Significance at 1, 5, 10% indicated by ***, **, *

Table 2b. Bond rate regression, with Vix

		Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	India
Full sample, 6/8/05- 10/24/12	US bond t-1	-.020 (.1072)	.1736*** (.0288)	.0905*** (.0170)	.0316 (.0451)	.1838*** (.0224)	.0928*** (.0136)	.1439*** (.0299)	.1078*** (.0284)
	China bond t	.3807** (.1935)	.1344** (.0589)	.0194 (.0271)	.0655 (.0719)	-.023 (.0285)	.0350* (.0210)	.0039 (.0457)	.0612 (.0456)
	VIX t-1	1.643*** (.5067)	-.136 (.1183)	.0889 (.0692)	1.379*** (.3905)	.1034 (.0699)	-.004 (.0462)	.0607 (.0749)	-.091 (.1267)
	Adj. R2	.0443	.0550	.0295	.0469	.0833	.0486	.0239	.0177
	N	1637	1646	1543	1576	1650	1450	1499	1501
Pre-GFC 6/8/05- 7/9/08	US bond t-1	-.055 (.1109)	.2207*** (.0403)	.1134*** (.0231)	.0798 (.0699)	.2449*** (.0384)	.1205*** (.0236)	.1024** (.0454)	.1112*** (.0315)
	China bond t	.1427 (.1077)	.0179 (.0593)	-.000 (.0358)	-.000 (.0896)	.0234 (.0541)	.0646** (.0267)	.0429 (.0717)	.0198 (.0399)
	VIX t-1	.8742 (.6122)	.0310 (.1559)	.4278*** (.1222)	1.136*** (.4358)	.3050** (.1316)	.0565 (.1283)	.1159 (.1582)	.2593* (.1543)
	Adj. R2	.0088	.0757	.0446	.0049	.1092	.0648	.0097	.0181
	N	662	675	616	649	682	596	618	651
GFC 7/10/08- 6/20/10	US bond t-1	-.123 (.2385)	.1716*** (.0533)	.0939*** (.0332)	-.010 (.0722)	.1240*** (.0312)	.0668*** (.0239)	.1708*** (.0471)	.1330** (.0589)
	China bond t	.8082 (.4976)	.2354* (.1322)	.0131 (.0564)	.0968 (.1510)	-.137*** (.0488)	.0128 (.0538)	-.011 (.1022)	.1285 (.1324)
	VIX t-1	2.206*** (.8368)	-.182 (.1804)	.0769 (.1088)	1.862*** (.6111)	.0119 (.1032)	-.006 (.0635)	.0924 (.0990)	-.154 (.2020)
	Adj. R2	.0715	.0521	.0232	.1625	.0606	.0158	.0319	.0154
	N	434	446	425	420	440	405	408	409
Post-GFC 6/21/10- 10/24/12	US bond t-1	.1418 (.0890)	.0954** (.0433)	.0667*** (.0231)	-.020 (.0936)	.1975*** (.0412)	.0907*** (.0170)	.1840*** (.0709)	.0750** (.0307)
	China bond t	.0621 (.1021)	.1503** (.0712)	.0416 (.0340)	.0510 (.1177)	.0512 (.0350)	.0078 (.0199)	-.043 (.0401)	.0381 (.0373)
	VIX t-1	.6784*** (.1882)	-.175 (.1303)	-.054 (.0426)	.3794* (.2289)	.1905** (.0914)	-.061 (.0623)	-.017 (.1403)	-.159* (.0904)
	Adj. R2	.0185	.0365	.0384	-.000	.1115	.1340	.0280	.0258
	N	541	525	502	507	528	449	473	441

Note: All variables are in first differences. Robust standard errors in parentheses. Significance at 1, 5, 10% indicated by ***, **, *

Table 2c. Bond rate regressions, with Vix and CDS

		Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	India
Full sample, 6/8/05-10/24/12	US bond t-1	-.031 (.1182)	.1738*** (.0288)	.0909*** (.0171)	.0505 (.0471)	.1838*** (.0224)	.0928*** (.0136)	.1444*** (.0302)	.1078*** (.0284)
	China bond t	.3835** (.1834)	.1341** (.0587)	.0190 (.0270)	.0633 (.0732)	-.023 (.0285)	.0350* (.0210)	.0033 (.0456)	.0612 (.0456)
	CDS t	.2502* (.1464)	.0035 (.0298)	.0038 (.0139)	.1621** (.0814)			.0074 (.0224)	
	VIX t-1	.8435 (.7026)	-.141 (.1196)	.0853 (.0697)	1.159*** (.3035)	.1034 (.0699)	-.004 (.0462)	.0570 (.0754)	-.091 (.1267)
	Adj. R2	.1085	.0545	.0290	.0643	.0833	.0486	.0232	.0176
	N	1637	1646	1543	1576	1650	1449	1498	1500
Pre-GFC 6/8/05-7/9/08	US bond t-1	-.025 (.1096)	.2383*** (.0402)	.1171*** (.0227)	.0990 (.0697)	.2449*** (.0384)	.1205*** (.0237)	.1025** (.0451)	.1110*** (.0315)
	China bond t	.1537 (.1080)	.0105 (.0594)	-.003 (.0358)	.0069 (.0856)	.0234 (.0541)	.0646** (.0267)	.0425 (.0717)	.0198 (.0399)
	CDS t	.2090** (.1056)	.2694*** (.1037)	.0695 (.0585)	.2161 (.1654)			.0258 (.0509)	
	VIX t-1	.5499 (.6700)	-.083 (.1566)	.4023*** (.1219)	.7664* (.4561)	.3050** (.1316)	.0565 (.1284)	.0983 (.1607)	.2587* (.1543)
	Adj. R2	.0175	.0915	.0462	.0111	.1092	.0648	.0080	.0180
	N	662	675	616	649	682	595	617	650
GFC 7/10/08-6/20/10	US bond t-1	-.171 (.2687)	.1718*** (.0532)	.0946*** (.0338)	.0157 (.0752)	.1240*** (.0312)	.0668*** (.0239)	.1723*** (.0479)	.1330** (.0589)
	China bond t	.8107* (.4807)	.2351* (.1318)	.0125 (.0561)	.0865 (.1562)	-.137*** (.0488)	.0128 (.0538)	-.013 (.1021)	.1285 (.1324)
	CDS t	.2418 (.1657)	.0017 (.0323)	.0030 (.0165)	.1479 (.0898)			.0074 (.0246)	
	VIX t-1	1.053 (1.221)	-.185 (.1846)	.0731 (.1125)	1.607*** (.4884)	.0119 (.1032)	-.006 (.0635)	.0890 (.0992)	-.154 (.2020)
	Adj. R2	.1428	.0500	.0209	.1983	.0606	.0158	.0296	.0154
	N	434	446	425	420	440	405	408	409
Post-GFC 6/21/10-10/24/12	US bond t-1	.1603* (.0876)	.0876** (.0434)	.0661*** (.0231)	-.019 (.0943)	.1975*** (.0412)	.0907*** (.0170)	.1817** (.0732)	.0750** (.0307)
	China bond t	.0914 (.1016)	.1475** (.0710)	.0399 (.0341)	.0519 (.1181)	.0512 (.0350)	.0078 (.0199)	-.044 (.0404)	.0381 (.0373)
	CDS t	.2895*** (.0987)	-.102** (.0519)	-.019 (.0228)	.0179 (.0723)			-.025 (.0942)	
	VIX t-1	.4674*** (.1546)	-.132 (.1345)	-.045 (.0460)	.3732 (.2282)	.1905** (.0914)	-.061 (.0623)	-.013 (.1459)	-.159* (.0904)
	Adj. R2	.0508	.0434	.0374	-.002	.1115	.1340	.0262	.0258
	N	541	525	502	507	528	449	473	441

Note: All variables are in first differences. Robust standard errors in parentheses. Significance at 1, 5, 10% indicated by ***, **, *

Table 3a. Equity price regressions

		Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	India
Full sample, 6/2/05-10/24/12	US equity t-1	.3771*** (.0375)	.3770*** (.0473)	.2024*** (.0183)	.5301*** (.0283)	.3122*** (.0331)	.3642*** (.0316)	.2431*** (.0413)	.2518*** (.0414)
	China equity t	.1684*** (.0247)	.2240*** (.0242)	.1096*** (.0150)	.0711*** (.0231)	.2012*** (.0217)	.1833*** (.0203)	.1484*** (.0263)	.1993*** (.0267)
	Adj. R2	.1875	.2268	.2030	.3242	.2222	.2323	.1069	.0989
	N	1534	1614	1572	1537	1615	1622	1529	1574
Pre-GFC 6/2/05-7/9/08	US equity t-1	.5927*** (.0741)	.5849*** (.0562)	.4180*** (.0462)	.8714*** (.0647)	.6223*** (.0523)	.5652*** (.0552)	.3758*** (.0500)	.6639*** (.0785)
	China equity t	.0763** (.0311)	.1272*** (.0250)	.0894*** (.0225)	.0197 (.0266)	.1113*** (.0260)	.1088*** (.0231)	.0371 (.0267)	.1047*** (.0329)
	Adj. R2	.1592	.2293	.2224	.3301	.2942	.2336	.0721	.1567
	N	645	675	673	648	685	679	647	668
GFC 7/10/08-6/20/10	US equity t-1	.3087*** (.0539)	.2703*** (.0710)	.1407*** (.0227)	.4776*** (.0374)	.2203*** (.0464)	.2937*** (.0450)	.1841*** (.0620)	.1384** (.0599)
	China equity t	.2350*** (.0476)	.3207*** (.0529)	.1323*** (.0228)	.1309*** (.0484)	.3023*** (.0431)	.2345*** (.0415)	.2593*** (.0572)	.3244*** (.0535)
	Adj. R2	.2119	.2227	.2327	.4305	.2190	.2310	.1458	.1102
	N	397	427	410	400	423	429	404	407
Post-GFC 6/21/10-10/24/12	US equity t-1	.3561*** (.0572)	.4726*** (.0614)	.2047*** (.0214)	.3819*** (.0453)	.2859*** (.0456)	.3704*** (.0517)	.2495*** (.0440)	.1938*** (.0436)
	China equity t	.3182*** (.0483)	.3043*** (.0399)	.1060*** (.0241)	.1081*** (.0392)	.2497*** (.0321)	.3018*** (.0390)	.2624*** (.0415)	.2075*** (.0424)
	Adj. R2	.2743	.3278	.2585	.2264	.2892	.3087	.1834	.1045
	N	492	512	489	489	507	514	478	499

Note: Equity prices are in logged first differences. Robust standard errors in parentheses. Significance at 1, 5, 10% indicated by ***, **, *

Table 3b. Equity price regressions, with Vix

		Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	India
Full sample, 6/2/05-10/24/12	US equity t-1	.2598*** (.0617)	.2830*** (.0724)	.1378*** (.0292)	.3837*** (.0439)	.2538*** (.0539)	.3101*** (.0490)	.1816*** (.0683)	.1050 (.0659)
	China equity t	.1663*** (.0247)	.2226*** (.0240)	.1092*** (.0148)	.0680*** (.0226)	.2006*** (.0216)	.1822*** (.0203)	.1479*** (.0262)	.1982*** (.0265)
	VIX t-1	-.031*** (.0103)	-.025** (.0101)	-.017*** (.0055)	-.040*** (.0094)	-.015* (.0090)	-.014* (.0079)	-.016* (.0098)	-.039*** (.0114)
	Adj. R2	.1963	.2323	.2121	.3415	.2249	.2342	.1092	.1093
	N	1534	1614	1572	1537	1615	1622	1529	1574
Pre-GFC 6/2/05-7/9/08	US equity t-1	.3784*** (.1385)	.4811*** (.0941)	.3660*** (.0937)	.5066*** (.0997)	.5544*** (.1020)	.6200*** (.0982)	.3360*** (.1020)	.4417*** (.1362)
	China equity t	.0788** (.0312)	.1282*** (.0251)	.0902*** (.0222)	.0241 (.0246)	.1123*** (.0258)	.1085*** (.0231)	.0377 (.0266)	.1073*** (.0329)
	VIX t-1	-.034** (.0175)	-.017 (.0123)	-.008 (.0126)	-.060*** (.0164)	-.011 (.0132)	.0093 (.0127)	-.006 (.0138)	-.036* (.0190)
	Adj. R2	.1663	.2307	.2225	.3554	.2945	.2333	.0710	.1622
	N	645	675	673	648	685	679	647	668
GFC 7/10/08-6/20/10	US equity t-1	.2795*** (.0920)	.2207** (.0976)	.1153*** (.0360)	.4170*** (.0558)	.2507*** (.0758)	.2389*** (.0673)	.1229 (.0952)	.0493 (.0931)
	China equity t	.2336*** (.0481)	.3196*** (.0531)	.1320*** (.0229)	.1268*** (.0477)	.3027*** (.0433)	.2331*** (.0417)	.2583*** (.0570)	.3226*** (.0539)
	VIX t-1	-.011 (.0238)	-.019 (.0200)	-.009 (.0082)	-.024 (.0160)	.0118 (.0178)	-.021 (.0165)	-.024 (.0208)	-.034 (.0231)
	Adj. R2	.2107	.2228	.2335	.4333	.2180	.2324	.1473	.1129
	N	397	427	410	400	423	429	404	407
Post-GFC 6/21/10-10/24/12	US equity t-1	.2339*** (.0816)	.5060*** (.0964)	.2024*** (.0375)	.3025*** (.0701)	.3001*** (.0523)	.3972*** (.0847)	.2608*** (.0745)	.2210*** (.0787)
	China equity t	.3144*** (.0483)	.3052*** (.0399)	.1060*** (.0242)	.1044*** (.0392)	.2501*** (.0322)	.3027*** (.0390)	.2628*** (.0418)	.2082*** (.0426)
	VIX t-1	-.024** (.0111)	.0067 (.0136)	-.000 (.0054)	-.016 (.0100)	.0029 (.0093)	.0054 (.0122)	.0022 (.0112)	.0056 (.0125)
	Adj. R2	.2797	.3269	.2570	.2287	.2880	.3077	.1818	.1030
	N	492	512	489	489	507	514	478	499

Note: Equity prices are in logged first differences; other variables are in differences. Robust standard errors in parentheses. Significance at 1, 5, 10% indicated by ***, **, *

Table 3c. Equity price regressions, with Vix and CDS

		Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	India
6/2/05-10/24/12	US equity t-1	.1707*** (.0546)	.1926*** (.0712)	.0841*** (.0289)	.3433*** (.0441)	.2498*** (.0547)	.3069*** (.0500)	.1205* (.0682)	.1025 (.0666)
	China equity t	.1366*** (.0235)	.1870*** (.0230)	.0958*** (.0142)	.0618*** (.0238)	.1974*** (.0216)	.1841*** (.0210)	.1295*** (.0273)	.1958*** (.0262)
	CDS i,t	-.119*** (.0151)	-.091*** (.0204)	-.047*** (.0090)	-.063*** (.0147)			-.070*** (.0154)	
	VIX t-1	-.024*** (.0092)	-.024** (.0096)	-.018*** (.0052)	-.038*** (.0094)	-.017* (.0090)	-.015* (.0081)	-.016* (.0095)	-.040*** (.0115)
	Adj. R2	.2817	.3045	.2682	.3695	.2219	.2313	.1576	.1093
	N	1496	1563	1526	1495	1573	1567	1481	1531
Pre-GFC 6/2/05-7/9/08	US equity t-1	.2444* (.1366)	.4034*** (.1038)	.3125*** (.0933)	.4201*** (.0988)	.5256*** (.1004)	.6163*** (.1010)	.2611** (.1159)	.4043*** (.1326)
	China equity t	.0627** (.0297)	.1226*** (.0252)	.0868*** (.0222)	.0263 (.0249)	.1039*** (.0245)	.1127*** (.0240)	.0299 (.0267)	.0971*** (.0307)
	CDS i, t	-.097*** (.0247)	-.029* (.0153)	-.033** (.0166)	-.058*** (.0215)			-.035** (.0172)	
	VIX t-1	-.032* (.0169)	-.020 (.0127)	-.010 (.0127)	-.060*** (.0168)	-.015 (.0126)	.0085 (.0131)	-.008 (.0143)	-.041** (.0183)
	Adj. R2	.2035	.2410	.2430	.3804	.2961	.2325	.0856	.1629
	N	629	653	653	630	667	656	627	649
GFC 7/10/08-6/20/10	US equity t-1	.1907** (.0779)	.0730 (.0870)	.0494 (.0349)	.3793*** (.0549)	.2508*** (.0764)	.2323*** (.0682)	.0156 (.0878)	.0492 (.0937)
	China equity t	.1936*** (.0448)	.2051*** (.0461)	.1038*** (.0225)	.1197** (.0519)	.3067*** (.0440)	.2328*** (.0426)	.2061*** (.0604)	.3306*** (.0545)
	CDS i, t	-.125*** (.0214)	-.185*** (.0251)	-.058*** (.0086)	-.051** (.0249)			-.117*** (.0236)	
	VIX t-1	-.003 (.0198)	-.011 (.0167)	-.010 (.0084)	-.025 (.0167)	.0121 (.0180)	-.021 (.0167)	-.032* (.0192)	-.034 (.0233)
	Adj. R2	.3374	.4340	.3498	.4547	.2188	.2266	.2369	.1159
	N	388	415	400	391	414	415	391	398
Post-GFC 6/21/10-10/24/12	US equity t-1	.1649** (.0779)	.4588*** (.0957)	.1803*** (.0371)	.2967*** (.0730)	.3004*** (.0534)	.4230*** (.0865)	.1996** (.0803)	.2353*** (.0818)
	China equity t	.2589*** (.0459)	.2552*** (.0417)	.0804*** (.0231)	.0842** (.0402)	.2495*** (.0331)	.3021*** (.0403)	.2148*** (.0398)	.2123*** (.0439)
	CDS i,t	-.120*** (.0332)	-.075*** (.0183)	-.053*** (.0106)	-.051** (.0253)			-.121*** (.0203)	
	VIX t-1	-.021* (.0111)	.0059 (.0135)	.0008 (.0052)	-.014 (.0102)	.0033 (.0095)	.0095 (.0123)	.0022 (.0115)	.0074 (.0129)
	Adj. R2	.3446	.3546	.3177	.2419	.2803	.3076	.2551	.1052
	N	479	495	473	474	492	496	463	484

Note: Equity prices are in logged first differences; other variables are in differences. Robust standard errors in parentheses. Significance at 1, 5, 10% indicated by ***, **, *

Table 4. Equity price regressions, with Chinese reserve requirement changes

		Indonesia	Korea	Malaysia	Philippines	Thailand	Panel
6/2/05-10/24/12	China RR incr	.1101 (.2456)	-.213 (.1644)	-.177 (.1088)	-.517*** (.1729)	.1290 (.2233)	-.137 (.1099)
	China RR decr	-.535** (.2094)	.5411 (.8066)	.0025 (.2417)	-.043 (.4250)	.1604 (.7849)	.0415 (.2493)
	US equity t-1	.1857*** (.0560)	.2061*** (.0717)	.1083*** (.0316)	.3400*** (.0452)	.1335** (.0679)	.1943*** (.0147)
	VIX t-1	-.023** (.0100)	-.023** (.0099)	-.016*** (.0054)	-.039*** (.0094)	-.021** (.0098)	-.024*** (.0030)
	CDS i,t	-.126*** (.0148)	-.102*** (.0212)	-.051*** (.0093)	-.070*** (.0141)	-.076*** (.0156)	-.085*** (.0032)
	Adj. R2	.2637	.2568	.2296	.3579	.1417	.2310
	N	1480	1603	1574	1557	1542	7756
Pre-GFC 6/2/05-7/9/08	China RR incr	.3839 (.3791)	-.184 (.2244)	-.294** (.1494)	-.703*** (.2558)	.1765 (.2503)	-.090 (.1357)
	China RR decr						
	US equity t-1	.2907** (.1338)	.4790*** (.1057)	.3657*** (.0897)	.4693*** (.0957)	.3251*** (.1099)	.3946*** (.0382)
	VIX t-1	-.024 (.0175)	-.015 (.0129)	-.004 (.0123)	-.051*** (.0165)	-.004 (.0137)	-.020*** (.0051)
	CDS i,t	-.098*** (.0253)	-.032** (.0162)	-.032* (.0167)	-.064*** (.0214)	-.034** (.0169)	-.043*** (.0046)
	Adj. R2	.2097	.2110	.2098	.3594	.0946	.2006
	N	603	705	713	695	690	3406
GFC 7/10/08-6/20/10	China RR incr	-.171 (.4486)	-.656*** (.2391)	.0868 (.2205)	.1984 (.1608)	-.248 (.8701)	-.154 (.4514)
	China RR decr	-.318 (.2931)	-.003 (1.325)	.0982 (.4841)	.3355 (.6370)	.4951 (.9690)	.0901 (.4001)
	US equity t-1	.1954** (.0780)	.1010 (.0867)	.0772** (.0381)	.3741*** (.0562)	.0154 (.0871)	.1521*** (.0234)
	VIX t-1	-.005 (.0201)	-.008 (.0171)	-.006 (.0085)	-.024 (.0174)	-.037* (.0198)	-.015** (.0068)
	CDS i,t	-.133*** (.0205)	-.196*** (.0241)	-.064*** (.0086)	-.064*** (.0229)	-.138*** (.0227)	-.120*** (.0062)
	Adj. R2	.2881	.3770	.2934	.4226	.1953	.2760
	N	427	453	439	426	433	2178
Post-GFC 6/21/10-10/24/12	China RR incr	-.333 (.2398)	-.377 (.3201)	.0239 (.1578)	-.350 (.2174)	-.131 (.4058)	-.251* (.1514)
	China RR decr	-.696*** (.2133)	.9464** (.4556)	-.294** (.1270)	-.526 (.4040)	-.480 (.9390)	-.201 (.3111)
	U.S. equity t-1	.2058** (.0852)	.4497*** (.1075)	.1836*** (.0400)	.3254*** (.0785)	.2275** (.0929)	.2792*** (.0320)
	VIX t-1	-.023* (.0121)	.0041 (.0153)	.0005 (.0059)	-.014 (.0113)	-.004 (.0131)	-.007 (.0054)
	CDS i,t	-.149*** (.0332)	-.103*** (.0191)	-.060*** (.0105)	-.063*** (.0245)	-.139*** (.0220)	-.103*** (.0071)
	Adj. R2	.3086	.3108	.3194	.2551	.2309	.2644
	N	450	445	422	436	419	2172

Note: Panel regression in last column has fixed effects, errors clustered by country. Singapore, Taiwan, and India are dropped from the panel because of N/A data on CDS rates.

Table 5. Panel bond regressions

		(1)	(2)	(3)
Full sample, 6/2/05-10/24/12	US bond t-1	.0564 (.0525)	.1009*** (.0256)	.1002*** (.0343)
	China bond t	.0917* (.0488)	.0875* (.0470)	.1148 (.0701)
	VIX t-1		.3945 (.2561)	.3776 (.2698)
	CDS i,t			.1804*** (.0582)
	Adj. R2	.0031	.0104	.0548
	N	12502	12502	7323
6/2/05-7/9/08	US bond t-1	.0851** (.0419)	.1181*** (.0338)	.1158*** (.0385)
	China bond t	.0425*** (.0162)	.0393** (.0159)	.0285* (.0160)
	VIX t-1		.4024*** (.1422)	.3446** (.1621)
	CDS i,t			.2061*** (.0349)
	Adj. R2	.0056	.0092	.0176
	N	5149	5149	3131
7/10/08-6/20/10	US bond t-1	.0124 (.0811)	.0784** (.0366)	.0779 (.0625)
	China bond t	.1715 (.1198)	.1497 (.1088)	.2140 (.1523)
	VIX t-1		.4938 (.3449)	.4630 (.3542)
	CDS i,t			.1782*** (.0577)
	Adj. R2	.0024	.0141	.0813
	N	3387	3387	2123
6/21/10-10/24/12	US bond t-1	.0893*** (.0288)	.1042*** (.0253)	.1058*** (.0355)
	China bond t	.0429** (.0206)	.0462** (.0209)	.0575* (.0333)
	VIX t-1		.1141 (.1123)	.1713 (.1492)
	CDS i,t			.0815 (.0965)
	Adj. R2	.0074	.0084	.0086
	N	3966	3966	2069

Note: Panel regression with fixed effects, errors clustered by country. Robust standard errors in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively. Singapore, Taiwan, and India are dropped from regression (3) because of N/A data on CDS rates.

Table 6. Panel bond regressions with interactive Vix

		(1)	(2)
Full sample, 6/2/05-10/24/12	US bond t-1	.0992*** (.0269)	.0983*** (.0364)
	China bond t	.0868* (.0461)	.1137* (.0684)
	VIX t-1	.3691* (.2232)	.3386 (.2425)
	US bond*VIX t-1	-.004 (.0113)	-.009 (.0151)
	China bond*VIX t-1	-.017 (.0153)	-.019 (.0223)
	CDS i,t		.1796*** (.0569)
	Adj. R2	.0107	.0551
	N	12502	7323
Pre-GFC 6/2/05-7/9/08	US bond t-1	.1176*** (.0333)	.1165*** (.0379)
	China bond t	.0387** (.0161)	.0289 (.0180)
	VIX t-1	.3955*** (.1295)	.2975** (.1388)
	US bond*VIX t-1	.0003 (.0060)	-.010 (.0101)
	China bond*VIX t-1	.0191 (.0233)	.0632 (.0415)
	CDS i,t		.2109*** (.0365)
	Adj. R2	.0089	.0178
	N	5149	3131
GFC 7/10/08-6/20/10	US bond t-1	.0731* (.0410)	.0708 (.0681)
	China bond t	.1583 (.1102)	.2235 (.1525)
	VIX t-1	.4322 (.2938)	.3896 (.3212)
	US bond*VIX t-1	-.015 (.0184)	-.019 (.0238)
	China bond*VIX t-1	-.038 (.0316)	-.047 (.0416)
	CDS i,t		.1752*** (.0542)
	Adj. R2	.0166	.0839
	N	3387	2123
Post-GFC 6/21/10-10/24/12	US bond t-1	.1057*** (.0253)	.1114*** (.0380)
	China bond t	.0465** (.0217)	.0667* (.0351)
	VIX t-1	.1646 (.1356)	.2700 (.1761)
	US bond*VIX t-1	.0115*** (.0036)	.0150*** (.0047)
	China bond*VIX t-1	-.000 (.0097)	.0148 (.0125)
	CDS i,t		.0774 (.0955)
	Adj. R2	.0087	.0093
	N	3966	2069

Table 7. Panel bond rate regressions with Interactive CDS

(1)		
Full sample, 6/2/05-10/24/12	US bond t-1	.1032*** (.0311)
	China bond t	.1231*
		(.0719)
	VIX t-1	.3825 (.2742)
	US bond*CDS i,t	-.008*** (.0019)
	China bond*CDS i,t	-.017 (.0141)
	CDS i,t	.1315*** (.0347)
	Adj. R2	.0700
	N	7323
Pre-GFC 6/2/05-7/9/08	US bond t-1	.1117*** (.0395)
	China bond t	.0573*
		(.0323)
	VIX t-1	.3377** (.1578)
	US bond*CDS i,t	-.007* (.0041)
	China bond*CDS i,t	.0373**
		(.0161)
	CDS i,t	.2052*** (.0373)
	Adj. R2	.0210
	N	3131
GFC 7/10/08-6/20/10	US bond t-1	.0956** (.0486)
	China bond t	.2291 (.1549)
	VIX t-1	.4890 (.3648)
	US bond*CDS i,t	-.008*** (.0018)
	China bond*CDS i,t	-.019 (.0142)
	CDS i,t	.1171*** (.0318)
	Adj. R2	.1075
	N	2123
Post-GFC 6/21/10-10/24/12	US bond t-1	.1087*** (.0362)
	China bond t	.0425 (.0415)
	VIX t-1	.1726 (.1543)
	US bond*CDS i,t	-.003 (.0050)
	China bond*CDS i,t	.0101 (.0100)
	CDS i,t	.0863 (.0963)
	Adj. R2	.0083
	N	2069

Table 8. Panel equity regressions

		(1)	(2)	(3)
Full sample, 6/2/05- 10/24/12	US equity t-1	.3320*** (.0363)	.2401*** (.0327)	.1784*** (.0450)
	China equity t	.1640*** (.0180)	.1628*** (.0180)	.1246*** (.0219)
	VIX t-1		-.025*** (.0036)	-.024*** (.0033)
	CDS i,t			-.079*** (.0124)
	Adj. R2	.1805	.1871	.2579
	N	12597	12597	7226
Pre-GFC 6/2/05- 7/9/08	US equity t-1	.5860*** (.0530)	.4606*** (.0350)	.3405*** (.0395)
	China equity t	.0844*** (.0135)	.0859*** (.0132)	.0695*** (.0186)
	VIX t-1		-.020*** (.0075)	-.025*** (.0094)
	CDS i,t			-.044*** (.0091)
	Adj. R2	.1949	.1982	.2127
	N	5320	5320	3191
GFC 7/10/08- 6/20/10	US equity t-1	.2537*** (.0386)	.2132*** (.0409)	.1451** (.0667)
	China equity t	.2438*** (.0264)	.2427*** (.0265)	.1709*** (.0228)
	VIX t-1		-.015*** (.0048)	-.014*** (.0047)
	CDS i,t			-.108*** (.0255)
	Adj. R2	.1955	.1968	.3186
	N	3297	3297	2028
Post-GFC 6/21/10- 10/24/12	US equity t-1	.3152*** (.0348)	.3043*** (.0374)	.2388*** (.0633)
	China equity t	.2341*** (.0295)	.2338*** (.0296)	.1839*** (.0419)
	VIX t-1		-.002 (.0040)	-.008 (.0068)
	CDS i,t			-.083*** (.0140)
	Adj. R2	.2314	.2313	.2904
	N	3980	3980	2007

Note: Panel regression with fixed effects, errors clustered by country. Robust standard errors in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively. Singapore, Taiwan, and India are dropped from regression (3) because of N/A data on CDS rates.

Table 9. Panel equity price regressions with Interactive Vix

		(1)	(2)
Full sample, 6/2/05-10/24/12	US equity t-1	.2385*** (.0325)	.1777*** (.0445)
	China equity t	.1604*** (.0178)	.1223*** (.0214)
	VIX t-1	-.023*** (.0038)	-.023*** (.0035)
	US equity*VIX t-1	.0033*** (.0008)	.0033*** (.0008)
	China equity*VIX t-1	.0029*** (.0008)	.0029*** (.0010)
	CDS i,t		-.078*** (.0125)
	Adj. R2	.1903	.2613
	N	12597	7226
Pre-GFC 6/2/05-7/9/08	US equity t-1	.4700*** (.0348)	.3516*** (.0401)
	China equity t	.0870*** (.0131)	.0707*** (.0183)
	VIX t-1	-.017** (.0069)	-.021** (.0086)
	US equity*VIX t-1	.0066*** (.0012)	.0065*** (.0016)
	China equity*VIX t-1	.0001 (.0007)	.0003 (.0009)
	CDS i,t		-.043*** (.0091)
	Adj. R2	.2014	.2160
	N	5320	3191
GFC 7/10/08-6/20/10	US equity t-1	.2085*** (.0411)	.1448** (.0648)
	China equity t	.2431*** (.0254)	.1721*** (.0204)
	VIX t-1	-.009** (.0048)	-.009** (.0043)
	US equity*VIX t-1	.0028*** (.0008)	.0022** (.0010)
	China equity*VIX t-1	.0107*** (.0019)	.0083** (.0033)
	CDS i,t		-.105*** (.0253)
	Adj. R2	.2062	.3245
	N	3297	2028
Post-GFC 6/21/10-10/24/12	US equity t-1	.3056*** (.0376)	.2418*** (.0632)
	China equity t	.2321*** (.0294)	.1810*** (.0412)
	VIX t-1	.0009 (.0043)	-.004 (.0070)
	US equity*VIX t-1	.0017* (.0010)	.0020** (.0008)
	China equity*VIX t-1	.0097*** (.0019)	.0107*** (.0033)
	CDS i,t		-.084*** (.0145)
	Adj. R2	.2390	.2995
	N	3980	2007

Table 10. Panel equity price regressions with Interactive CDS
(1)

Full sample, 6/2/05-10/24/12	US equity t-1	.1774*** (.0462)
	China equity t	.1218*** (.0210)
	VIX t-1	-.024*** (.0033)
	US equity*CDS i,t	.0045** (.0017)
	China equity*CDS i,t	.0020 (.0016)
	CDS i,t	-.077*** (.0122)
	Adj. R2	.2593
	N	7226
Pre-GFC 6/2/05-7/9/08	US equity t-1	.3385*** (.0400)
	China equity t	.0650*** (.0178)
	VIX t-1	-.025*** (.0092)
	US equity*CDS i,t	.0116*** (.0037)
	China equity*CDS i,t	.0077*** (.0028)
	CDS i,t	-.038*** (.0100)
	Adj. R2	.2175
	N	3191
GFC 7/10/08-6/20/10	US equity t-1	.1496** (.0689)
	China equity t	.1673*** (.0212)
	VIX t-1	-.013*** (.0049)
	US equity*CDS i,t	.0029 (.0028)
	China equity*CDS i,t	-.001 (.0031)
	CDS i,t	-.107*** (.0244)
	Adj. R2	.3189
	N	2028
Post-GFC 6/21/10-10/24/12	US equity t-1	.2435*** (.0662)
	China equity t	.1627*** (.0427)
	VIX t-1	-.008 (.0060)
	US equity*CDS i,t	-.001 (.0094)
	China equity*CDS i,t	.0221*** (.0066)
	CDS i,t	-.080*** (.0144)
	Adj. R2	.2972
	N	2007

Figure 1a. Government bond rates, U.S. and China
(percent)

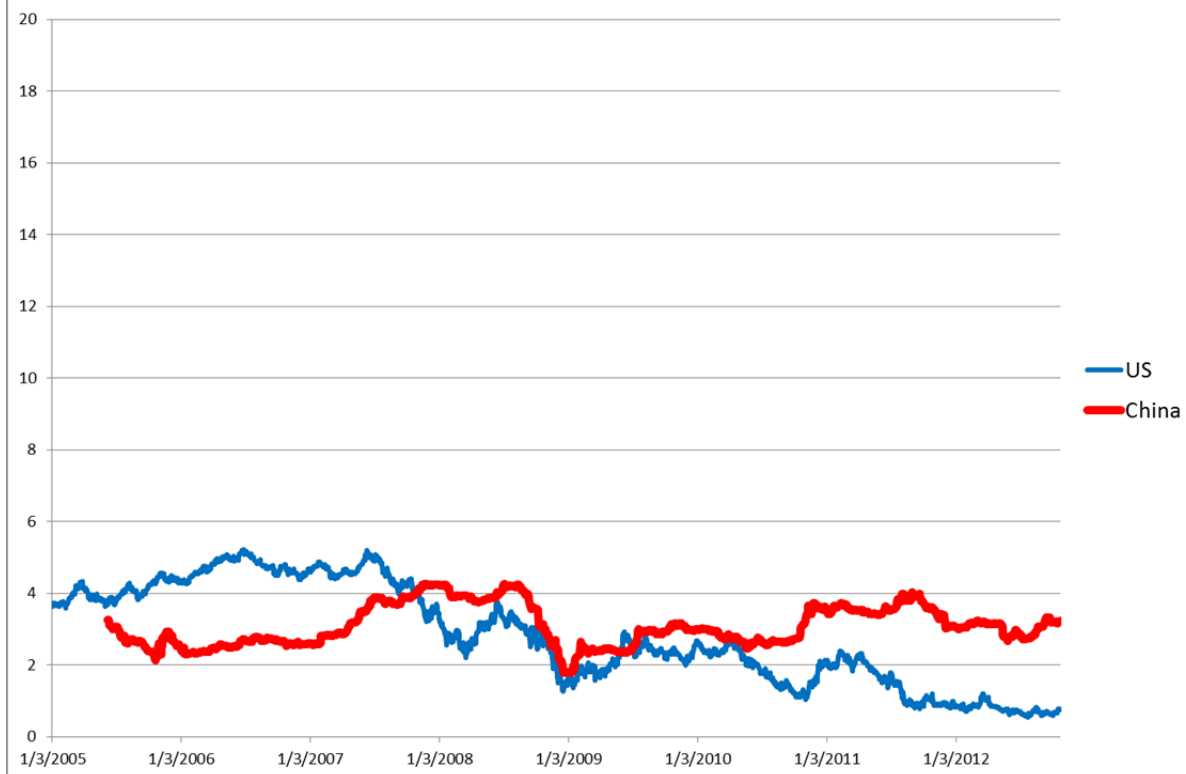


Figure 1b. Government bond rates, Asia
(percent)

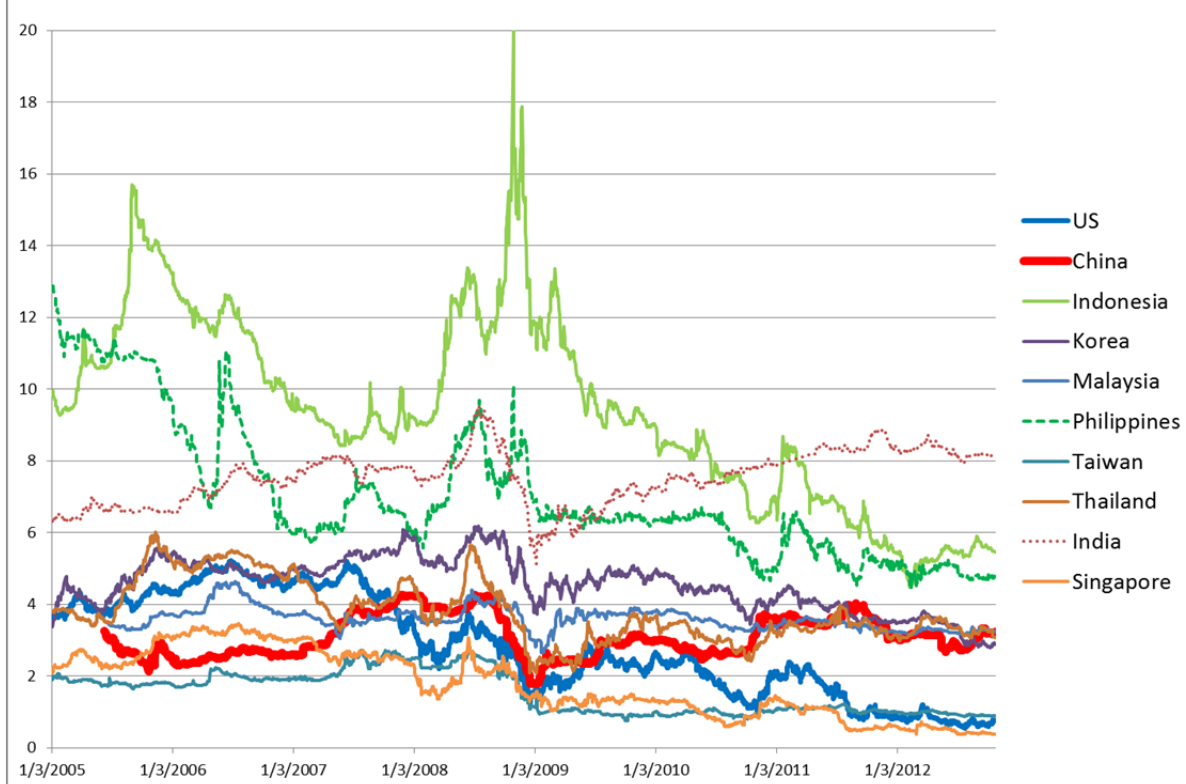


Figure 2a. Equity prices, U.S. and China
(1/4/2005=100)



Figure 2b. Equity prices, Asia
(1/4/2005=100)

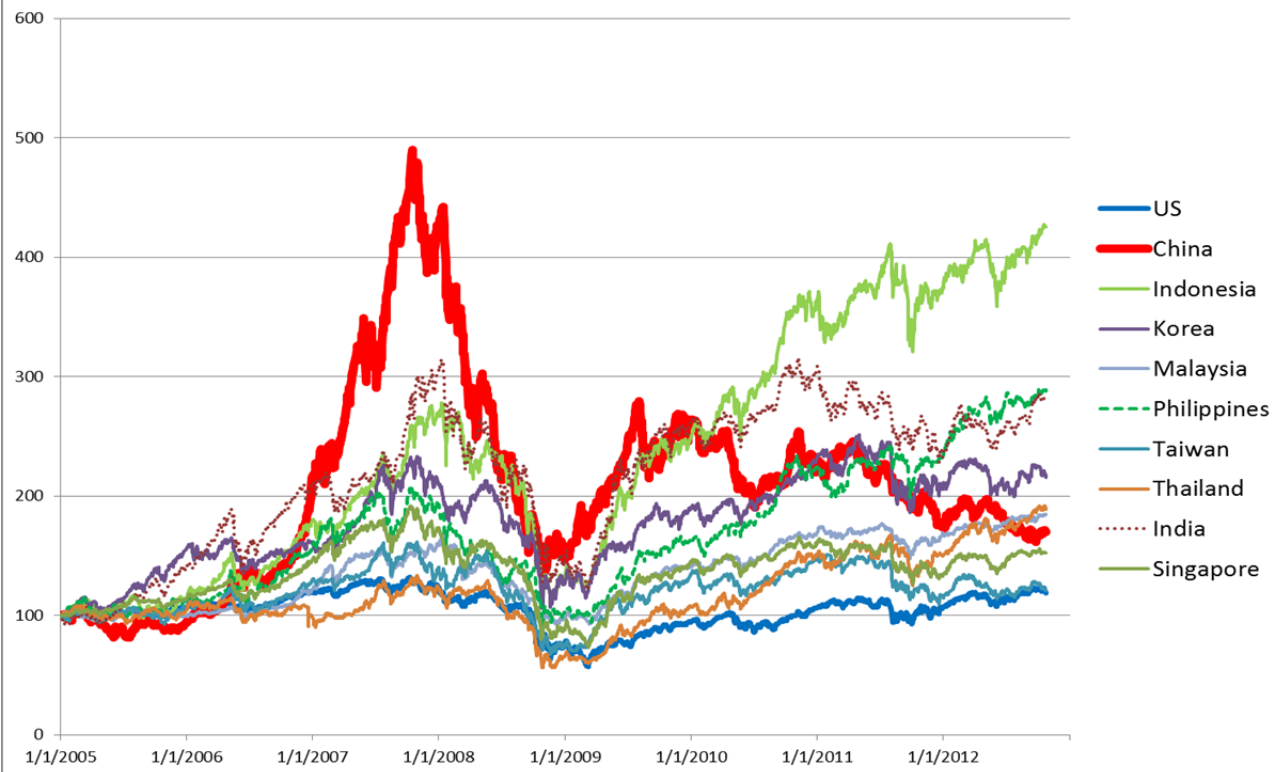


Figure 3a. Correlation of Equity Returns
with China (percentage)

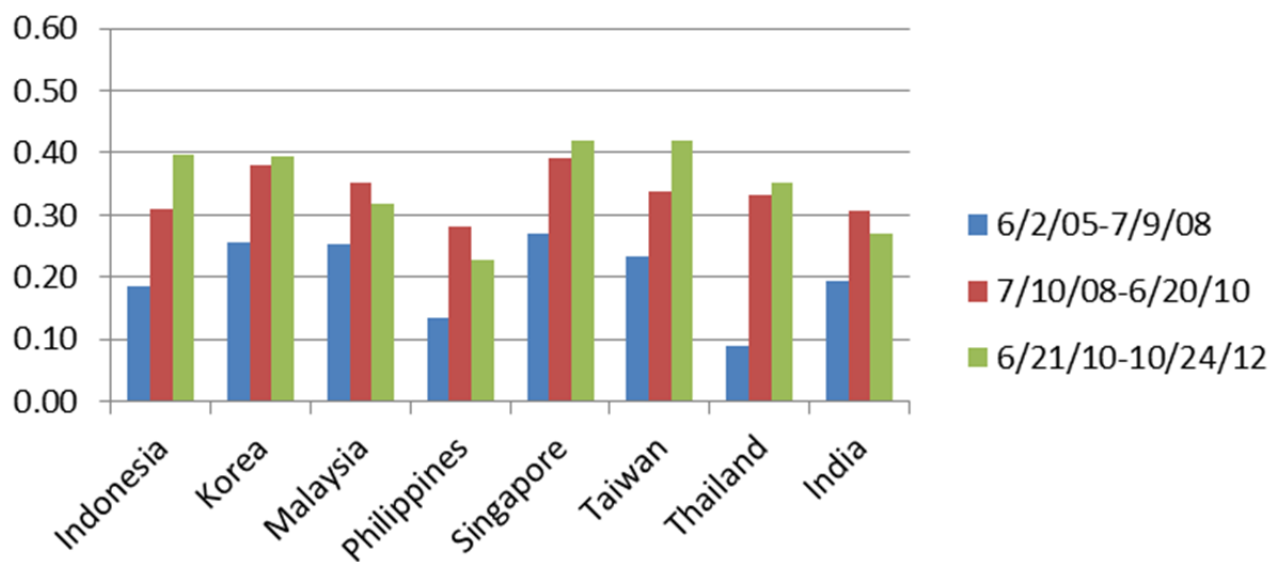
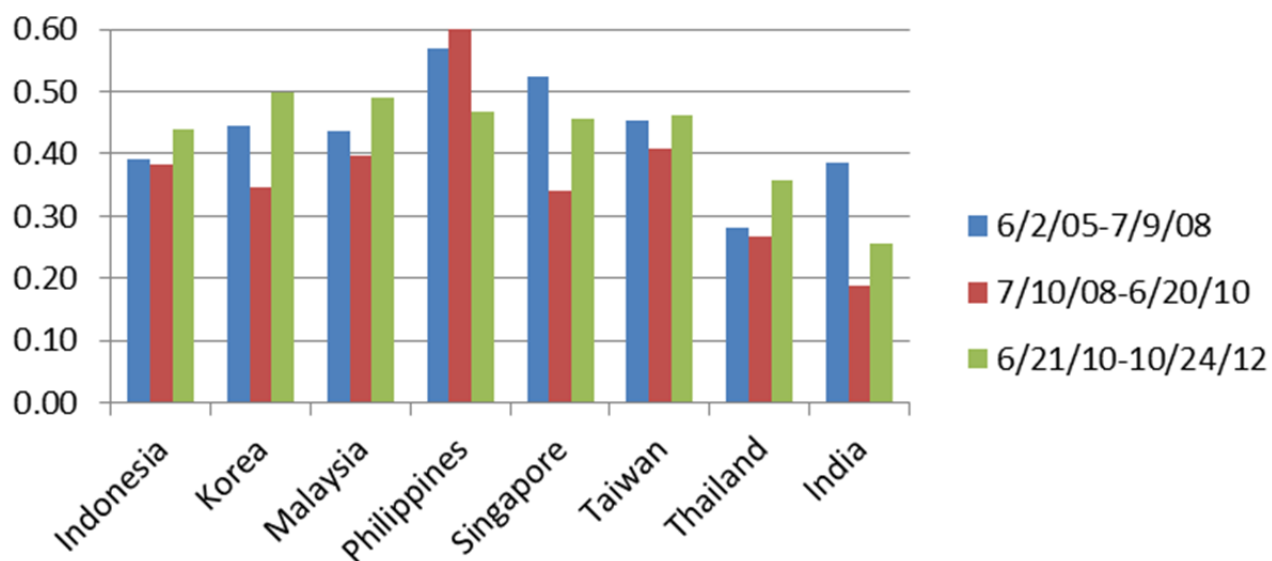


Figure 3b. Correlation of Equity Returns
with U.S. (percentage)



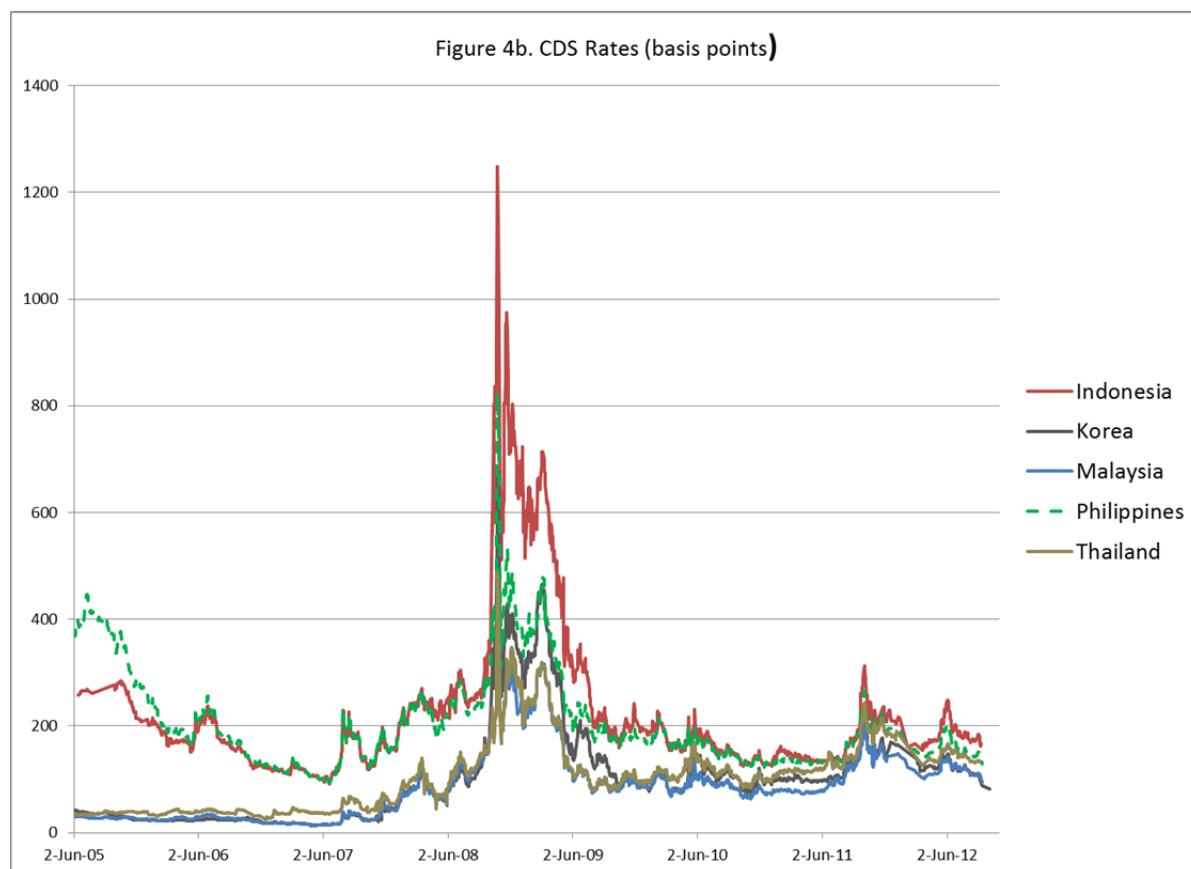
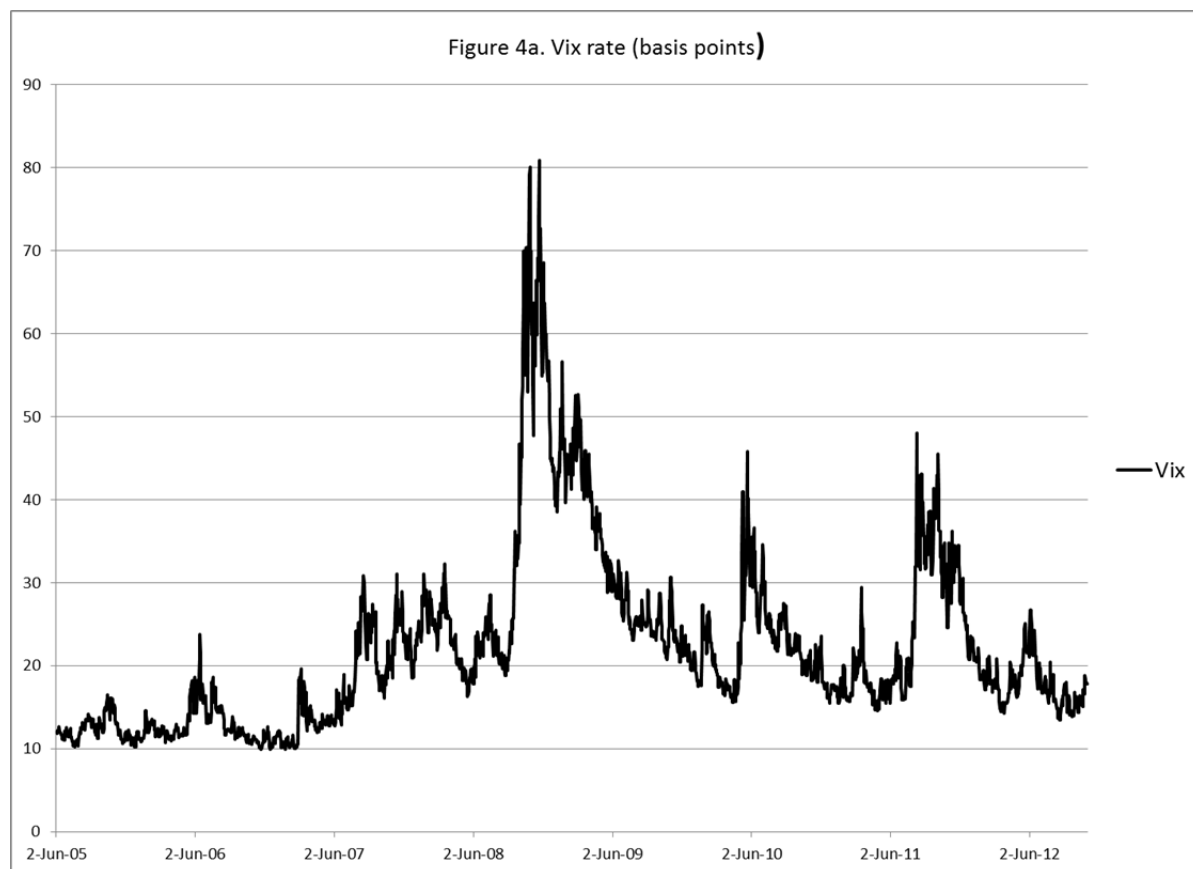
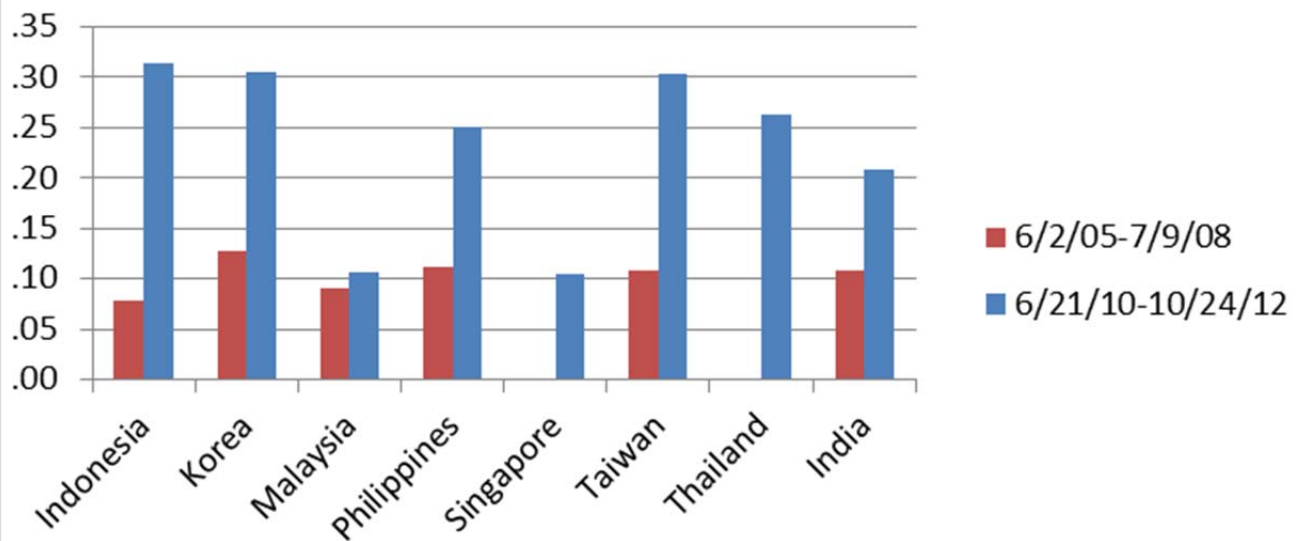


Figure 5. Coefficients on China equity return
in Table 3b



Note: Coefficients for Singapore and Thailand in the pre-GFC period are near zero.