

## CHAPTER 25

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# CHINA'S FINANCIAL OPENNESS AND ASSET RETURN LINKAGES IN EAST ASIA

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REUVEN GLICK AND MICHAEL HUTCHISON

### 25.1 INTRODUCTION

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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.<sup>1</sup> Though

Prasad and Ye (2012) 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 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 (2011) 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 (see Girardin, 2011; Glick and Hutchison, 2010; IMF, 2011; Ma et al., 2011; Lee et al., 2011; Ma et al., 2011; Ogawa and Simizu, 2011; Pongsaporn and Unterobderster, 2011). Less well-discussed is how the gradual process of financial liberalization and China's drive toward internationalization of the rmb 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 inevitably will have repercussions for the global economy, and of course even more so for its regional trade and financial partners in East Asia.

The objective of this chapter is to evaluate how changes in China's financial system, liberalization of capital controls, and the process of currency internationalization have affected financial markets in other East Asian economies. In particular, we examine the extent to which the financial market changes and openness in China

have affected the cross-country links of financial asset returns within the region. We examine whether linkages have grown stronger over time, either because (i) capital account liberalization in China has permitted more financial capital flows and arbitrage and hence greater cross-country financial integration, or (ii) stronger real sector linkages, trade flows, and business cycle synchronization within the region as a result of China's emergence as an engine of economic growth have indirectly linked financial asset returns in the region even in the absence of financial capital flows and asset market arbitrage. We measure financial market integration by several metrics and, to the extent that we find such linkages, we attempt to determine whether they are generated by direct financial market connections or by indirect real economic linkages.

The main theme and conclusion of this chapter is that domestic financial development in China has been modest and internationalization of the currency and liberalization of capital controls to date very limited. As a result, substantial differences in some financial asset returns remain between China and its neighbors. In particular, we find that short-term financial asset returns, as measured by interbank interest rates, are essentially unlinked within the region, while only weak linkages may be detected in longer-term interest rates, as measured by five-year government bond rates. Much stronger linkages, however, appear in equity markets. We argue that the dominant factor linking equity markets in China with other East Asian economies is not equity market arbitrage working through capital markets, but rather strengthening trade relationships and synchronization of economic activity associated with the emergence of China as an engine of growth within the region.

The chapter is organized as follows. Section 25.2 summarizes recent steps China has taken to open its capital account. Section 25.3 reviews the empirical literature on financial linkages between China and its East Asian neighbors. Section 25.4 presents new empirical evidence on linkages between China and East Asia that analyzes short-run linkages between exchange rates, interest rate, and equity markets using regression analysis, as well as long-run linkages using cointegration analysis. We conclude with some general observations about policy implications of the analysis for East Asia countries and how they are likely to be influenced increasingly by China's financial policies in the coming years.

## 25.2 CAPITAL CONTROL LIBERALIZATION IN CHINA

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China has pursued a cautious path toward 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.<sup>2</sup> 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.

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.<sup>3</sup> 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 a 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 measures.<sup>4</sup> 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.<sup>5</sup> 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

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" (QDIIs) for portfolio outflows.<sup>6</sup> 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.<sup>7</sup> 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.<sup>8</sup> The sheer magnitude of net and gross portfolio capital and “hot money” inflows clearly cast doubt on the effectiveness 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 yuan 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 (2011) 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). These parity deviations, shown in Figure 25.1, 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 indicate Chinese capital controls have been effective in partly “decoupling” Chinese financial markets from those in the United States, Hong Kong, and elsewhere (see Cheung et al., 2006; Ma and McCauley, 2007; and Liu and Otani, 2005; McCauley, 2011; Prasad and Ye, 2012b).

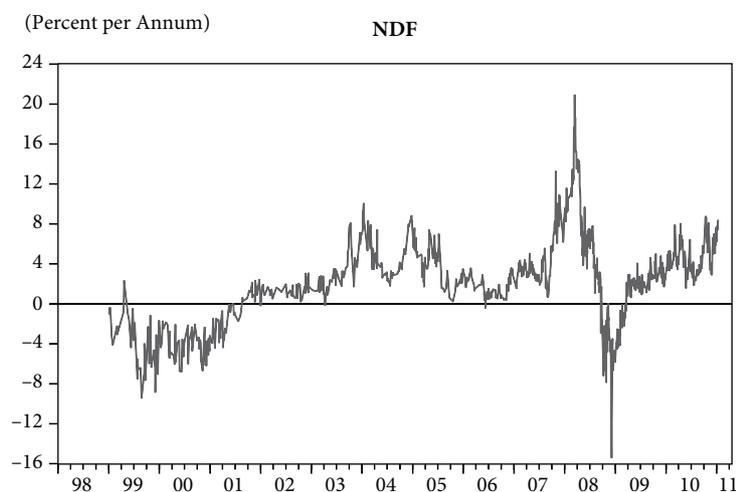


FIGURE 25.1 (Percent per Annum)

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### 25.3 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,<sup>9</sup> which was negative before the Asian financial crisis, is now positive, 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 China asset price changes in recent years are consistent with their differences in economic recoveries and inflation concerns.<sup>10</sup> Jang concludes that in the last decade Asian countries have achieved remarkable progress in economic integration. However, the degree of 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.<sup>11</sup>

A number of papers focus on co-movements of exchange rates in 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). (Somewhat ironically they find that the rmb mattered more outside of East Asia, including India and Pakistan as well as many countries in Africa.) 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 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 major currencies other than the dollar is greater at lower frequency, i.e., at weekly or monthly intervals rather than at a daily frequency. This suggests that the Chinese monetary authorities are trying to minimize currency fluctuations against the dollar on a daily basis, while managing the value of the rmb vis-à-vis a basket of currencies over the longer run, particularly during the period between mid-2006 and mid-2008.

## 25.4 CHINA AND EAST ASIAN ASSET RETURNS: NEW EVIDENCE

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Our review of the literature on China's capital controls and increasing international financial integration suggests that its domestic financial development is proceeding slowly in tandem with some modest steps toward liberalization of the capital account and very limited exchange rate flexibility. Some authors have found that China's financial markets are becoming more integrated with its East Asian neighbors despite pervasive capital controls. 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.

### 25.4.1 Exchange Rates

Despite the binding nature of capital controls, financial market developments in China may still have an impact on asset prices in other East Asian economies. One factor that influences this linkage is the extent that exchange rates move together. Movements in the value of the rmb have been affected by several distinct phases of Chinese exchange rate policy since the early 1980s, as shown in Figure 25.2 and summarized in Table 25.1. We identify nine phases since 1981 (denoted in the figure by vertical lines at the break dates). China realigned its exchange rate and effectively devalued the rmb by about 50 percent against the dollar in January 1994 (from 5.8 to 8.7 rmb per dollar). Since that time, the rmb has been either fixed against the dollar (1995–2005 and for a period during 2008–2010) or allowed to gradually appreciate. As of March 2012, the rmb/dollar

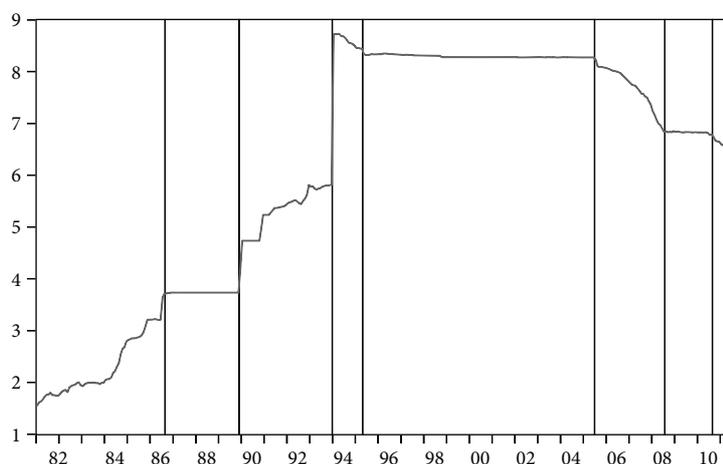


FIGURE 25.2 China RMB per US Dollar

Table 25.1 China's Exchange Rate Regimes, 1981–2011

#	Time Range	Rate	
1	January 1981–August 1986	1.6 to 3.7	substantial depreciation
2	August 1986–November 1989	3.7	fixed rate, 3 years
3	November 1989–December 1993	3.7 to 5.8	substantial depreciation
4	January 3, 1994	8.7	sharp devaluation
5	January 1994–May 1995	8.7 to 8.3	gradual appreciation
6	May 1995–June 2005	8.3 to 8.2	fixed rate (narrow range), 10 years
7	June 2005–July 2008	8.3 to 6.8	gradual appreciation
8	July 2008–June 2010	6.8	fixed rate (narrow range), 2 years
9	June 2010–July 2011	6.8 to 6.4	gradual appreciation

rate stood at 6.3, implying a cumulative appreciation of 28 percent over the past 18 years (about 1½ percent per year). This implies that the value of the rmb has been relatively stable against the dollar by comparison with the currencies of other large economies.

Financial linkages between countries depend on exchange rates through interest parity. That is, the closer the currencies of other Asian countries are linked to China's exchange rate policies, the closer one would expect financial linkages between the domestic interest rates in these economies and China. Exchange rate developments in China and selected Asia countries are shown in Figure 25.3. (Normalized exchange rate developments are shown in order to allow comparative analysis.) The most striking

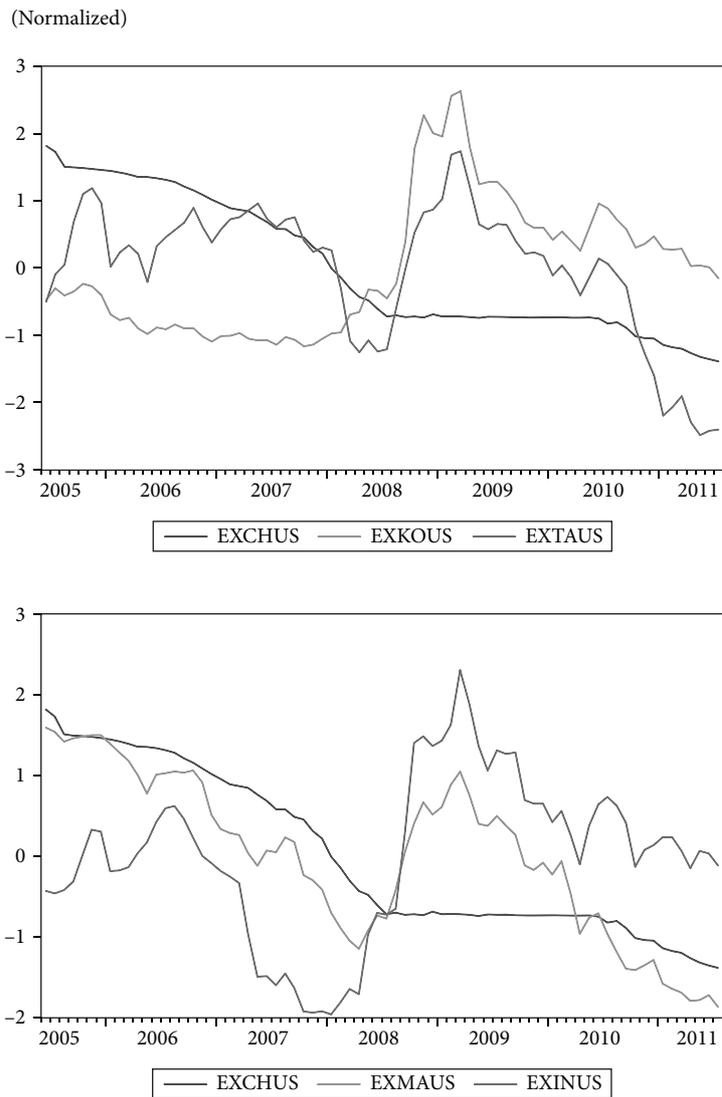


FIGURE 25.3 Exchange Rates (NORMALIZED)

observation is that substantially greater exchange rate flexibility is observed in these countries compared to China. Only a weak correspondence between China's modest exchange rate movements and those elsewhere in Asia are evident, suggesting that financial linkages may also be relatively weak.

### 25.4.2 Broad Trends in Interest Rate and Equity Market Linkages

This sub-section analyzes co-movements between China's and East Asian financial asset returns. We investigate linkages for three financial assets—interbank interest rates,

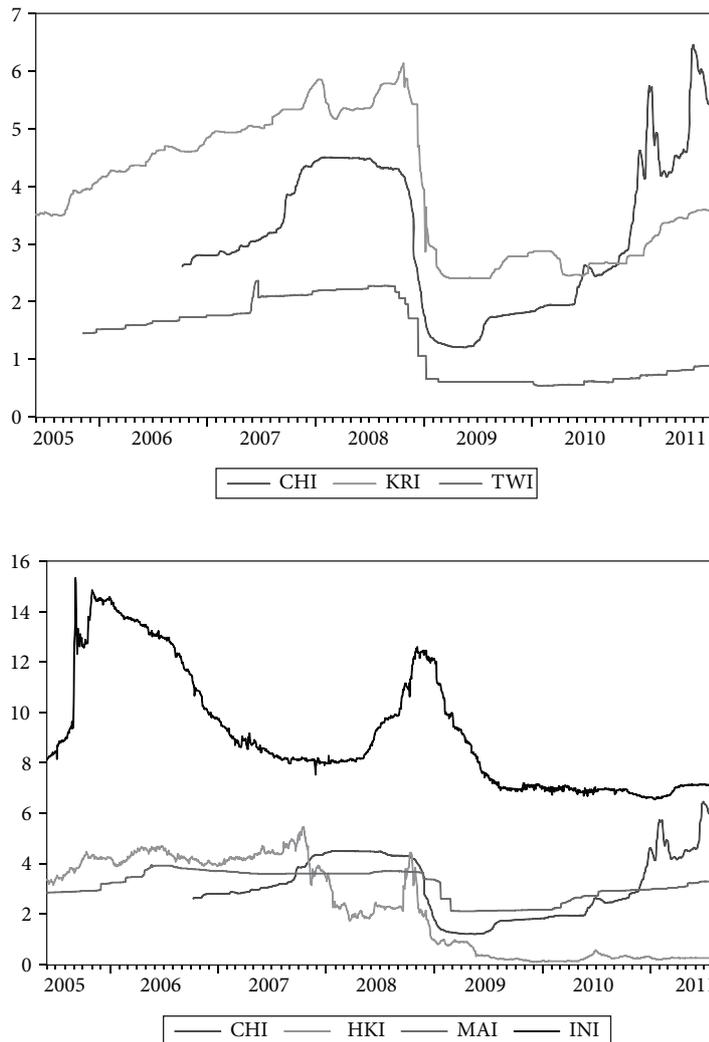


FIGURE 25.4 Interbank Interest Rates

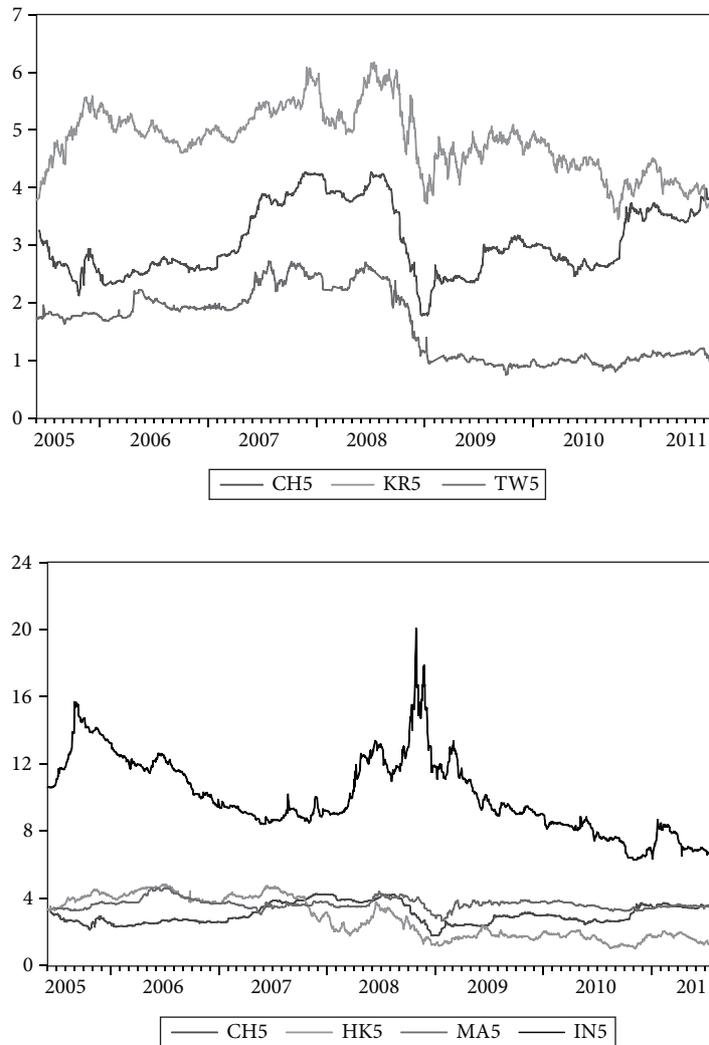
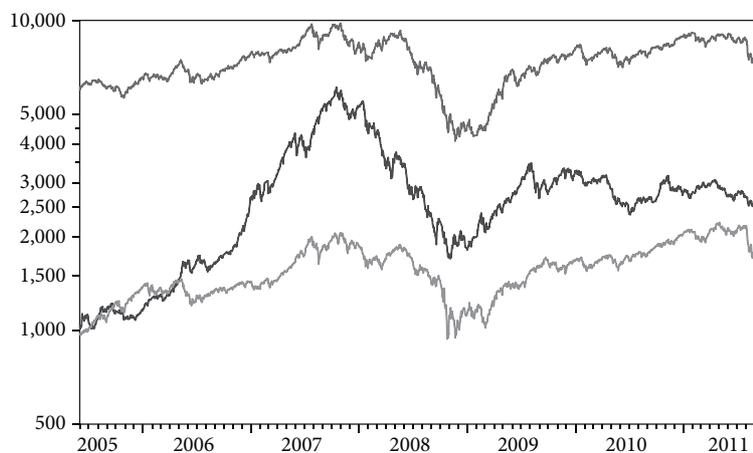


FIGURE 25.5 Five-year Government Bond Interest Rates

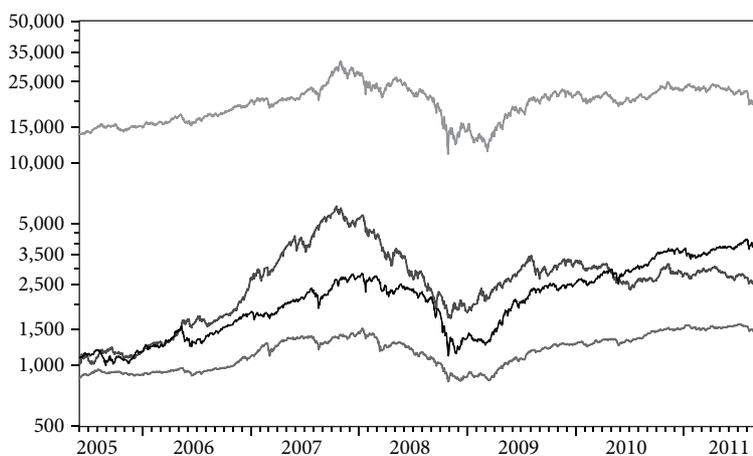
CH: China; KR: Korea; TW: Taiwan; HK: Hong Kong; MA: Malaysia; and IN: Indonesia.

five-year government bond interest rates, and equity prices—for Hong Kong, Korea, Taiwan, Malaysia, and Indonesia—using daily data. We consider the most financially open economy in the region, Hong Kong, as a “control” region since it is tightly linked to the U.S. dollar through its currency board arrangement, has no capital controls or other impediments to cross-border movement of capital, and is a world financial center. The other four countries are partially financially open and have developed financial sectors to various degrees, but it is not clear the extent to which China influences their domestic financial asset prices.

(Log Scale; Major National Indices)



— CHEQ — KREQ — TWEQ



— CHEQ — HKEQ — MAEQ — INEQ

FIGURE 25.6 Equity Prices

(Log Scale; Major National Indices)CH: China; KR: Korea; TW: Taiwan; HK: Hong Kong; MA: Malaysia; and IN: Indonesia.

Our choice of asset price variables allows us to examine whether the degree of financial linkage with China varies across asset maturities and type. Interbank interest rates are at the shortest end of the maturity spectrum and are most directly influenced by the central bank's policy target rate. Evidence of tight linkage of interbank rates would indicate that China has significant short-run influence over domestic monetary policy

in other countries. Five-year bond rates are “medium term” financial instruments, and evidence of linkage at this maturity 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 or trade linkages—financial linkage through capital flows and arbitrage, and trade linkage by competition and interdependence through exports and imports.

The results are shown in Figure 25.4 for interbank interest rates), Figure 25.5 for five-year bond rates) and Figure 25.6 for equity market price levels (using a logarithmic scale). Figure 25.4 indicates that China’s interbank interest rate developments display broadly similar movements with other East Asian economies over the long run, but also show substantial differences in the short run. Linkages among five-year bond rates, shown in Figure 25.5, indicate a similar pattern to that of interbank interest rates. The most dramatic linkages are shown in Figure 25.6 for equity prices (plotted using a log scale for comparison purposes). Equity prices for China and all the other East Asian countries are closely linked across time.

### 25.4.3 Daily Financial Market Linkages

To complement our graphical analysis, we analyze the daily linkages of financial asset prices of the same East Asian economies with China in a regression framework that controls for common shocks, represented by U.S. asset price fluctuations. Our object is to determine whether developments in China’s financial markets significantly influence financial asset prices in the East Asia region, and whether the form of the exchange rate regime or degree of exchange rate flexibility in China influences the strength of the transmission mechanism. The full sample period is June 2, 2005, through September 16, 2011, with subperiods corresponding to the exchange rate episodes identified in the previous section as (1) June 2005–June 2008 (gradual appreciation), (2) July 2008–May 2010 (tight peg, narrow range), and (3) June 2010–September 2011 (very gradual appreciation). Note that China’s desired degrees of exchange rate fixity is not independent of external conditions, as the second sub-sample corresponds with the global financial crisis.

The linkage regressions, reported in Table 25.2 for the interbank rates, Table 25.3 for the five-year bond rates, and Table 25.4 for the equity prices, regress each country’s financial asset rate against the corresponding China–U.S. rates (the U.S. rate is lagged one day due to the time zone differences). All interest rate variables are in first differences, and the equity price is in log first-differences. (All of the variables in levels were non-stationary.) Regressions with additional lags of the China and U.S. asset prices were estimated, and are available from the authors upon request; the results were almost identical to estimation results reported in the tables.

The results are quite striking. Interbank rates in the four East Asian countries are not influenced by interbank rate movements in China, regardless of the sample period (i.e., exchange rate regime), except very marginally in one instance (Taiwan over the

Table 25.2 Interbank Regressions

		Hong Kong Interbank Rate	Korea Interbank Rate	Taiwan Interbank Rate	Malaysia Interbank Rate	Indonesia Interbank Rate
6/2/05 – 9/16/11	U.S. Interbank Rate t-1	0.125*** (0.028)	0.012 (0.018)	0.016 (0.013)	–0.004 (0.013)	0.005 (0.034)
	China Interbank Rate t	–0.008 (0.057)	0.047 (0.041)	0.047* (0.028)	0.010 (0.029)	0.008 (0.073)
	Adj. R2	0.026	0.000	0.004	–0.003	–0.003
6/2/05 – 6/27/08	U.S. Interbank Rate t-1	0.048 (0.050)	0.010 (0.009)	0.014 (0.014)	0.000 (0.002)	–0.025 (0.047)
	China Interbank Rate t	–0.477 (0.404)	–0.015 (0.071)	0.017 (0.112)	–0.018 (0.016)	–0.443 (0.356)
	Adj. R2	0.002	–0.003	–0.005	–0.003	–0.001
7/3/08 – 5/28/10	U.S. Interbank Rate t-1	0.179*** (0.044)	0.011 (0.036)	0.018 (0.025)	–0.007 (0.024)	0.017 (0.056)
	China Interbank Rate t	–0.003 (0.115)	0.119 (0.108)	0.110 (0.069)	0.007 (0.072)	–0.002 (0.169)
	Adj. R2	0.056	–0.003	0.004	–0.007	–0.008
6/3/10 – 9/16/11	U.S. Interbank Rate t-1	0.011 (0.090)	–0.094 (0.097)	–0.079 (0.058)	–0.087 (0.114)	0.308 (0.324)
	China Interbank Rate t	–0.007 (0.010)	–0.008 (0.015)	–0.001 (0.009)	0.002 (0.019)	0.028 (0.051)
	Adj. R2	–0.009	–0.005	–0.001	–0.009	–0.005

Notes: First difference values for independent and dependent variables. Daily data. Standard errors in parentheses below. Significance levels: \*10%, \*\*5%, \*\*\*1%

**Table 25.3 5-yr Bond Regressions**

	Hong Kong 5 Yr Bond	Korea 5 Yr Bond	Taiwan 5 Yr Bond	Malaysia 5 Yr Bond	Indonesia 5 Yr Bond
U.S. 5 Yr Bond t-1	0.488*** (0.017)	0.147*** (0.027)	0.088*** (0.015)	0.082*** (0.017)	-0.196** (0.098)
6/2/05-9/ 16/11 China 5 Yr Bond t	0.030 (0.032)	0.201*** (0.051)	0.074*** (0.027)	0.029 (0.032)	0.526*** (0.186)
Adj. R2	0.481	0.049	0.052	0.029	0.012
U.S. 5 Yr Bond 1-1	0.549*** (0.028)	0.202*** (0.035)	0.119*** (0.022)	0.080*** (0.024)	-0.033 (0.072)
6/2/05 - 6/27/08 China 5 Yr Bond I	0.077 (0.060)	0.094 (0.075)	0.124*** (0.047)	0.007 (0.054)	0.084 (0.170)
Adj. R2	0.485	0.078	0.093	0.025	-0.004
U.S. 5 Yr Bond t-1	0.407*** (0.030)	0.089 (0.056)	0.032 (0.028)	0.091*** (0.033)	-0.522** (0.257)
7/3/08 - 5/28/10 China 5 Yr Bond	-0.010 (0.053)	0.300*** (0.098)	0.048 (0.049)	0.025 (0.056)	1.085** (0.450)
Adj. R2	0.409	0.035	0.001	0.022	0.030
U.S. 5 Yr Bond t-1	0.495*** (0.025)	0.120** (0.052)	0.104*** (0.021)	0.064*** (0.024)	0.133 (0.111)
6/3/10 - 9/16/11 China 5 Yr Bond t	0.015 (0.041)	0.121 (0.088)	0.015 (0.033)	0.082* (0.047)	-0.054 (0.176)
Adj. R2	0.676	0.027	0.115	0.050	-0.003

Notes: First difference values for independent and dependent variables. Daily data. Standard errors in parentheses below.

Significance levels: \*10%, \*\*5%, \*\*\*1%

**Table 25.4 Equity Regressions**

		Hong Kong Equity	Korea Equity	Taiwan Equity	Malaysia Equity	Indonesia Equity
6/2/05 -9/16/11	U.S. Equity t-1	0.429*** (0.032)	0.372*** (0.033)	0.361*** (0.028)	0.220*** (0.017)	0.368*** (0.034)
	China Equity t	0.326*** (0.026)	0.192*** (0.029)	0.163*** (0.024)	0.086*** (0.014)	0.143*** (0.029)
	Adj. R2	0.328	0.198	0.229	0.227	0.171
6/2/05 - 6/27/08	U.S. Equity t-1	0.695*** (0.055)	0.554*** (0.059)	0.562*** (0.054)	0.406*** (0.039)	0.529*** (0.070)
	China Equity t	0.213*** (0.028)	0.107*** (0.031)	0.129*** (0.027)	0.050** (0.019)	0.063* (0.036)
	Adj. R2	0.370	0.211	0.266	0.237	0.138
7/3/08 - 5/28/10	U.S. Equity t-1	0.332*** (0.055)	0.298*** (0.057)	0.290*** (0.046)	0.168*** (0.024)	0.294*** (0.054)
	China Equity t	0.494*** (0.060)	0.321*** (0.062)	0.213*** (0.050)	0.153*** (0.026)	0.257*** (0.059)
	Adj. R2	0.344	0.218	0.217	0.304	0.205
6/3/10 - 9/16/11	U.S. Equity t-1	0.354*** (0.048)	0.352*** (0.064)	0.378*** (0.054)	0.177*** (0.028)	0.367*** (0.059)
	China Equity t	0.341*** (0.057)	0.156** (0.075)	0.131** (0.064)	0.009 (0.035)	0.175** (0.073)
	Adj. R2	0.398	0.193	0.256	0.199	0.246

*Notes:* First difference of log values for independent and dependent variables. Daily data. Standard errors in parentheses below. Significance levels: \*10%, \*\*5%, \*\*\*1%

full period, though not in any sub-sample period). This indicates that short-term bank funding costs and monetary policies in the region moved independently of China's financial markets developments.

By contrast, there is more support, albeit modest, of linkages with China for five-year bond rates. In particular, there is no five-year bond linkage in any sample with Hong Kong, but linkages appear in at least one sub-sample (or the full sample) for the other four economies. Linkage with Korea and Indonesia appears during the global financial crisis period, when China maintained a narrow pegged exchange rate against the dollar, and Korea's and Indonesia's exchange rates depreciated sharply. (The linkage during this sub-sample explains the significant linkage over the full sample.) No linkage is seen during the first and third sub-samples. Linkages with Taiwan are seen in the first sample period (carrying over to the full sample period) but not in the other two sub-samples. Linkages with Malaysia are only found in the last sub-sample.

Finally, equity market linkages between China and other East Asian economies are strong and consistent throughout the sample, regardless of the exchange rate regime. In particular, equity price movements in China are strongly correlated with equity price changes in every country and every sub-sample period, with a single exception (Malaysia in the last sub-sample). Moreover, in a number of cases, the strength of the linkage with China is stronger than the linkage with U.S. equity prices. More specifically, the link appears to be somewhat stronger during China's fixed rate peg period which corresponds with the Asian financial crisis.

Overall, these results suggest that China's capital controls are quite effective in "decoupling" financial markets in the region, at least in the short-term. The only consistently strong and robust linkage exists with equity price movements, and these very likely are more influenced by direct and indirect trade linkages as opposed to financial market linkages.

#### 25.4.4 Long-Run Linkages

Despite our modest support for financial market asset price linkages between China and East Asian economies in the short run, it is possible that longer-run relationships may be identified. To this end, we consider the long-run linkage of five-year bond (shown in Figure 25.7) and equity prices between China and Korea, while controlling for fluctuations in U.S. asset prices. We chose Korea for this analysis since Korea is the largest economy in our group of East Asian economies investigated and, from the preceding section, probably has the strongest short-run linkage with China. We consider both nominal and real monthly bond interest rate and equity prices. The real bond interest rate is defined as the nominal rate less the 12-month inflation CPI inflation rate. The (log) real equity price is defined as the (log of the) nominal equity price divided by the CPI price index. Our sample period begins in June 2005, constrained by the availability of Chinese asset price data.

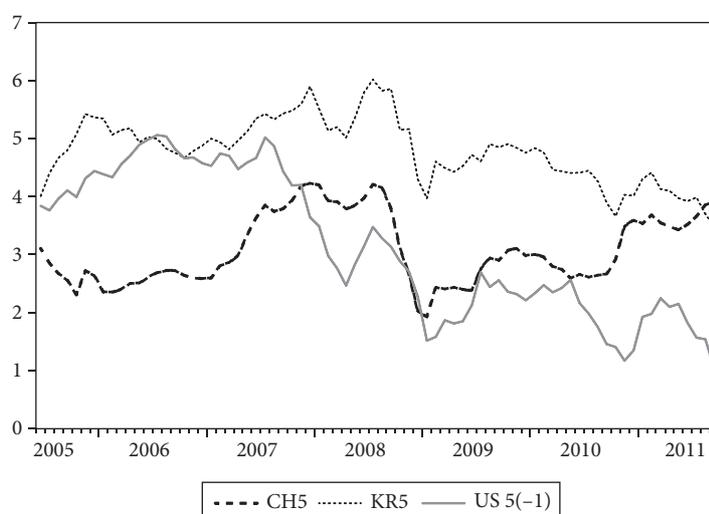


FIGURE 25.7 Five-year nominal bond interest rates in China, Korea and the United States

CH: China; KR: Korea; TW: Taiwan; HK: Hong Kong; MA: Malaysia; and IN: Indonesia.

We employ cointegration methodology to test whether asset prices demonstrate longer-run co-movement over time. Two variables are cointegrated if they move together over long periods, but perhaps deviate substantially over the short-term such as during business cycles. We employ two different cointegration tests—the Johansen (rank or trace test, and the eigenvalue test) system co-integration tests and the Engle-Granger single-equation cointegration test. These are standard tests of cointegration (Hamilton, 1994). We investigate the long-run linkage between China and Korea asset prices (as endogenous variables), while controlling for U.S. asset price fluctuations (treated as a deterministic common element).

The tests for nominal (real) five-year bond rate cointegration are reported in Table 25.5 (Table 25.6), and the tests for nominal (real) equity price cointegration are reported in Table 25.7 (Table 25.8). The left-hand-side of each table reports the Johansen tests, and the right-hand-side of each table reports the Engle-Granger cointegration tests.

We do not find cointegration between asset prices in China and Korea after controlling for U.S. asset prices movements. This is a robust result. The null hypothesis of “no cointegration” cannot be rejected in the system estimation (Johansen rank or eigenvalue test) or single-equation test (Engel-Granger test) at the 5 percent level or better for either nominal or real interest rates or equity prices. Moreover, further cointegration tests focusing on a system of three endogenous variables (Korea, China, and the United States) give similar results. China’s bond rates do not apparently have a systematic long-term linkage with financial market prices in Korea. This result should be interpreted cautiously, however, due to the limited sample period in which Chinese financial market data is available (since 2005). This is a very short period to unveil “long-term” relationships. Nonetheless, it is suggestive that the ultimate financial

**Table 25.5 Nominal Five-Year Bond Rate**

Johansen System Cointegration Tests					Engle-Granger Single Equation Cointegration Test				
Nominal Five-Year Bond Rate									
Sample (adjusted): 2005M09 2011M09					Series: CH5 KR5				
Included observations: 73 after adjustments					Sample: 2005M06 2011M09				
Trend assumption: Linear deterministic trend					Included observations: 76				
Series: KR5 CH5					Null hypothesis: Series are not cointegrated				
Exogenous series: US5(-1)					Cointegrating equation deterministic: C US5(-1)				
					Automatic lags specification based on Schwarz criterion (maxlag=11)				
Lags interval (in first differences): 1 to 2									
Unrestricted Cointegration Rank Test (Trace)					Dependent	Prob.*	z-statistic	Prob.*	
					tau-statistic				
					CH5	-1.454738	0.9064	-6.453215	0.8161
Hypothesized					KR5	-2.490964	0.4972	-11.06414	0.5103
Trace									
0.05									
No. of CE(s) Eigenvalue									
Statistic									
Critical Value									
Prob.**									
					*MacKinnon (1996) p-values.				
None	0.145861	11.98668	15.49471	0.1576					
At most 1	0.006518	0.477389	3.841466	0.4896					
Trace test indicates no cointegration at the 0.05 level					Intermediate Results:				
*denotes rejection of the hypothesis at the 0.05 level									
**MacKinnon-Haug-Michelis (1999) p-values					Rho - 1	-0.058746	-0.147522		
					Rho S. E.	0.040383	0.059223		
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					Residual variance	0.031805	0.039113		
					Long-run residual variance	0.039113			
Hypothesized					Number of lags	1	0		
Max-Eigen					Number of observations	74	75		
0.05					Number of stochastic trends	2	2		
No. of CE(s) Eigenvalue									
Statistic									
Critical Value									
Prob.**									
					**Number of stochastic trends in asymptotic distribution				
None	0.145861	11.50929	14.2646	0.1305					
At most 1	0.006518	0.477389	3.841466	0.4896					
Max-eigenvalue test indicates no cointegration at the 0.05 level									
*denotes rejection of the hypothesis at the 0.05 level									
**MacKinnon-Haug-Michelis (1999) p-values									
Notes: KR5, CH5 and US5 represent nominal five-year bond rates for Korea, China and the U.S., respectively.									
The US is treated as a deterministic variable so tests of cointegration are between Korea and China 5-year bond rates, controlling for a constant and US interest rates.									

Johansen System Cointegration Tests					Engle-Granger Single Equation Cointegration Test				
Sample (adjusted): 2005M09 2011M08					Series: KRR5 CHR5				
Included observations: 72 after adjustments					Sample (adjusted): 2005M062011M08				
Trend assumption: Linear deterministic trend					Included observations: 75 after adjustments				
Series:KRR5 CHR5					Null hypothesis: Series are not cointegrated				
Exogenous series: USR5					Cointegrating equation deterministic: C USR5				
Lags interval (in first differences): 1 to 2					Automatic lags specification based on Schwarz criterion maxlag=11)				
Unrestricted Cointegration Rank Test (Trace)					Dependent	Prob.*	z-statistic	Prob.*	
					tau-statistic				
					KRR5 -2.127437	0.6789	11.29321	0.4944	
					CHR5 -2.261953	0.6138	-9.607181	0.6079	
Hypothesized	Trace	0.05							
No. of CE(s) Eigenvalue Statistic Critical Value Prob.**					*MacKinnon (1996) p-values.				
None	0.104277	10.80151	15.49471	0.224					
At most 1	0.039112	2.872602	3.841466	0.0901					
Trace test indicates no cointegration at the 0.05 level					Intermediate Results:				
*denotes rejection of the hypothesis at the 0.05 level						KRR5	CHR5		
**MacKinnon-Haug-Michelis (1999) p-values					Rho - 1	-0.110313	-0.129827		
					Rho S.E.	0.051852	0.057396		
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					Residual variance	0.16379	0.624692		
					Long-run residual variance	0.322125	0.624692		
Hypothesized	Max-Eigen	0.05			Number of lags	1	0		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	Number of observations	73	74		
None	0.104277	7.928912	14.2646	0.386	Number of stochastic trends:	2	2		
At most 1	0.039112	2.872602	3.841466	0.0901	**Number of stochastic trends in asymptotic distribution				
Max-eigenvalue test indicates no cointegration at the 0.05 level									
*denotes rejection of the hypothesis at the 0.05 level									
**MacKinnon-Haug-Michelis (1999) p-values									
<i>Notes:</i> KRR5, CHR5 and USR5 represent real five-year bond rates for Korea, China and the U.S., respectively.									
The US is treated as a deterministic variable so tests of cointegration are between Korea and China 5-year bond rates, controlling for a constant and US interest rates. Real rates are the nominal rate less inflation over the previous 12 months.									

**Table 25.7 Nominal Equity Prices**

Johansen System Cointegration Tests					Engle-Granger Single Equation Cointegration Test				
Sample: 2005M06 2011M09					Series: LOG(KREQ) LOG(CHEQ)				
Included observations: 76					Sample: 2005M06 2011M09				
Trend assumption: Linear deterministic trend					Included observations: 76				
Series: LOG(KREQ) LOG(CHEQ)					Null hypothesis: Series are not cointegrated				
Exogenous series: LOG(USEQ)					Cointegrating equation deterministic: C LOG(USEQ)				
					Automatic lags specification based on Schwarz criterion (maxlag=11)				
Lags interval (in first differences): 1 to 2									
Unrestricted Cointegration Rank Test (Trace)					Dependent tau-statistic	Prob.*	z-statistic	Prob.*	
					LOG(KREQ)	-1.144247	0.9524	-3.498782	0.9499
					LOG(CHEQ)	-1.380522	0.9202	-4.105315	0.9301
Hypothesized	Trace	0.05							
No. of CE(s) Eigenvalue Statistic Critical Value Prob.**									
					*MacKinnon (1996) p-values.				
None	0.118215	11.27631	15.49471	0.1951					
At most 1	0.022313	1.715018	3.841466	0.1903					
Trace test indicates no cointegration at the 0.05 level					Intermediate Results:				
*denotes rejection of the hypothesis at the 0.05 level					LOG(KREQ)	LOG(CHEQ)			
**MacKinnon-Haug-Michelis (1999) p-values					Rho - 1	-0.050147	-0.054738		
					Rho.S.E.	0.043825	0.03965		
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					Residual variance	0.001851	0.009663		
					Long-run residual variance	0.001691	0.009663		
Hypothesized	Max-Eigen	0.05			Number of lags	2	0		
No. of CE(s) Eigenvalue Statistic Critical Value Prob.**					Number of observations	73	75		
					Number of stochastic trends:	2	2		
None	0.118215	9.561293	14.2646	0.2424					
At most 1	0.022313	1.715018	3.841466	0.1903	**Number of stochastic trends in asymptotic distribution				
Max-eigenvalue test indicates no cointegration at the 0.05 level									
*denotes rejection of the hypothesis at the 0.05 level									
**MacKinnon-Haug-Michelis (1999) p-values									
<i>Notes:</i> KREQ, CHEQ, USEQ represent nominal equity prices for Korea, China and the U. S., respectively.									
The US is treated as a deterministic variable so tests of cointegration are between Korea and China equity prices. All equity prices expressed in log values.									

Johansen System Cointegration Tests					Engle-Granger Single Equation Cointegration Test			
Sample (adjusted): 2005M06 2011M08					Series: LKRREQ LCHREQ			
Included observations: 75 after adjustments					Sample (adjusted): 2005M06 2011M08			
Trend assumption: Linear deterministic trend					Included observations: 75 after adjustments			
Series: LKRREQ LCHREQ					Null hypothesis: Series are not cointegrated			
Exogenous series: LUSREQ(-1)					Cointegrating equation deterministic: C LUSREQ			
Lags interval (in first differences): 1 to 2					Automatic lags specification based on Schwarz criterion (maxlag=11)			
Unrestricted Cointegration Rank Test (Trace)					Dependent tau-statistic	Prob.*	z-statistic	Prob.*
Hypothesized					LKRREQ	-1.673709	0.8533	-6.379997 0.8201
Trace					LCHREQ	-1.490728	0.899	-4.802817 0.9021
0.05								
No. of CE(s) Eigenvalue Statistic Critical Value Prob.**					*MacKinnon (1996) p-values.			
None	0.100364	9.486957	15.49471	0.3222				
At most 1	0.020515	1.554615	3.841466	0.2125				
Trace test indicates no cointegration at the 0.05 level					Intermediate Results:			
*denotes rejection of the hypothesis at the 0.05 level					LKRREQ	LCHREQ		
**MacKinnon-Haug-Michelis (1999) p-values					Rho -1	-0.088003	-0.064903	
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					Rho S.E.	0.05258	0.043538	
Hypothesized					Residual variance	0.001725	0.010586	
Max-Eigen					Long-run residual variance	0.001749	0.010586	
0.05					Number of lags	2	0	
No. of CE(s) Eigenvalue Statistic Critical Value prob.**					Number of observations	72	74	
None					Number of stochastic trends:	2	2	
At most 1								
0.020515 1.554615 3.841466 0.2125					**Number of stochastic trends in asymptotic distribution			
Max-eigenvalue test indicates no cointegration at the 0.05 level								
*denotes rejection of the hypothesis at the 0.05 level								
**MacKinnon-Haug-Michelis (1999) p-values								
Notes: LKRREQ, LCHREQ, LUSREQ represent (log) real equity prices for Korea, China and the United States, respectively								
The United States is treated as a deterministic variable so tests of cointegration are between Korea and China real equity prices.								

effects of the emergence of China as a global economic power have not fully been realized.

## 25.5 CONCLUSION

This chapter evaluates how gradual changes in China's financial system, liberalization of capital controls, and the process of financial "internationalization" have affected financial markets in other East 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 East Asian neighbors.

Our main conclusion is that domestic financial development in China as of early 2012 have been modest and internationalization of the currency and liberalization of capital controls has been very limited. Consequently, substantial divergences remain between the onshore and offshore prices of Chinese financial assets, as well as between the financial assets of China and its neighbors. Short-term financial asset prices, reflected in interbank interest rates, were essentially decoupled. Weak linkages were detected in longer-term interest rates (five-year bond rates). The strongest linkages, however, appeared in equity markets. We argue that equity market arbitrage working through capital markets was not the force driving these linkages between China and East 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.

## NOTES

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.
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.
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.
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 (2005a) provide an extensive chronology of capital controls over the period 1980–January 2005; Prasad and Ye (2012b) update the chronology into 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.
9. The three-month deposit rate was used for China because the lack of alternative data.
10. 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).
11. 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).

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