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## Housing Price Volatility and the Capital Account in China

Yuan Tian and Kevin P. Gallagher

### Abstract

China experienced significant volatility in its housing market from 2005-2013. Economists analyzing the determinants of volatility in these markets find that the bubble was largely been driven by factors specific to the Chinese economy and Chinese economic policy. In this paper, we examine the extent to which a) short-term capital flows may have further impacted the prices and volatility in the Chinese housing market and b) whether China's 2006 Capital Account Regulations (CARs) on foreign purchases of Chinese real estate were effective in reducing the level and volatility of prices in China's housing markets. According to our OLS baseline model, we find that short-term capital flows from abroad had a modest impact on price increases in the Chinese housing market, but a more significant impact on increasing market volatility. In terms of Chinese 2006 CAR, the measures did not appear to have impact on reducing housing prices, but had a strong impact on reducing volatility in Chinese housing market. The results from a supplementary quantile regression analysis show that hot money magnified the impacts of capital flows on housing prices during upward surges in the housing price. In terms of market volatility, our quantile regressions suggest that the more volatile the housing market became, the larger the impact short-term capital flows had on accentuating such volatility. Furthermore, we find that the 2006 CARs continued to have a strong impact on reducing volatility in the Chinese housing market during the period under study.

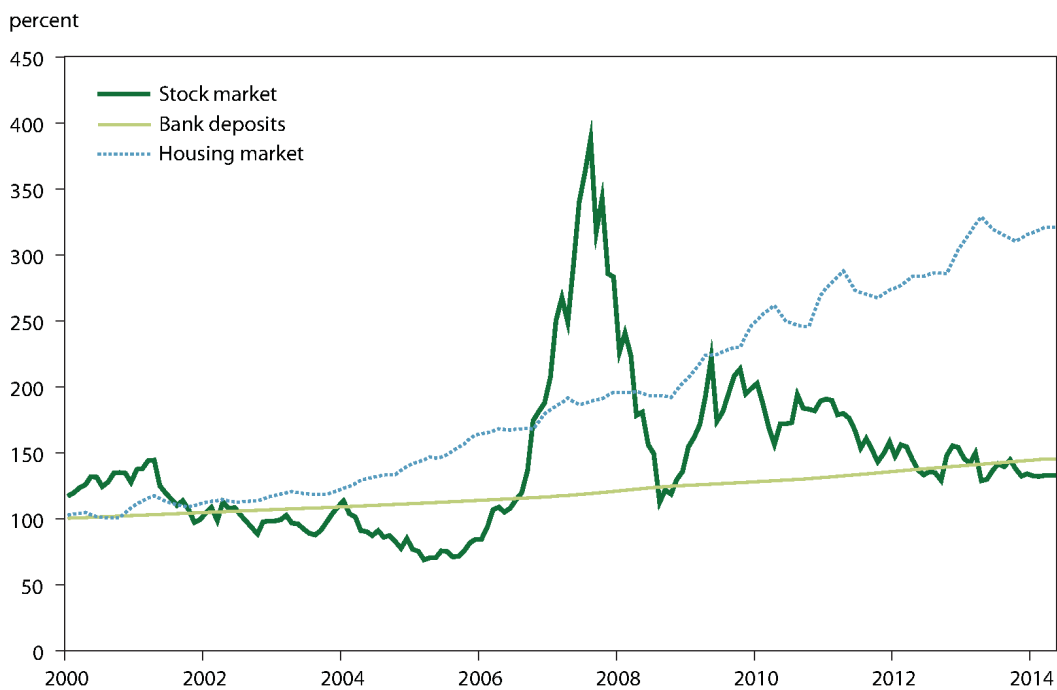
Key Words: China housing price volatility, Capital Account Liberalization, 2006 regulation policy (CAR), quantile regression.

JEL Classification: E52, F42, G12

## 1. Introduction

China did not establish a market-determined real estate market until 1998 when it abolished the state-planned housing distribution system. Since that time, the Chinese housing market has experienced increases in prices and volatility at alarming proportions.

By 2015, housing in China accounted for roughly 15 percent of gross domestic product—not counting the significant indirect effect on GDP through other sectors such as banking and construction. This is reflected in the fact that real estate investment has provided a compounded rate of return of 10.1 percent a year over the past decade<sup>1</sup>. From 2000 to 2014, returns on property investments have been attractive for Chinese residents because of the limited investment options available in the less-developed Chinese financial Markets.



Source: CEIC Data.

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<sup>1</sup> According to Peterson Institute for International Economics, China's average urban property price was estimated at RMB 5,850 per square meter by the National Bureau of Statistics in 2013, yielding a national price-to-income ratio of 6.1. On the other hand, property prices in China's first-tier cities have been rapidly approaching the average prices of other major Asian cities such as Mumbai and Tokyo.

To attempt to contain the housing boom in China's keep prices affordable, Beijing imposed a variety of restrictions between 2005 and 2014. Those measures together with a slowing economy appeared to be having an impact on the housing price after 2014. Property market investment slowed to a five-year low of 10.5% in 2014 from a year earlier - the slowest pace since the first half of 2009. Estimates from HSBC say that more easing by the central bank will likely be needed, in the form of rate cuts and injection of liquidity, to guard against the downside risks stemming from a "wobbly real estate market" in 2015<sup>2</sup>. Indeed in November 2014, the country's central bank did unexpectedly cut interest rates to 2.75% for first time since 2012 in an attempt to revive the economy.

Alongside reforms in the housing market, China has also embarked upon opening its capital account and loosening its exchange rate policies with hopes to rapidly internationalize the country's currency, the Yuan (or RMB). It is the aim of this paper to examine the extent to which measures pertaining to the capital account are at all associated with changes in China's housing market.

The 2005–2013 Chinese property bubble has been attributed to many factors. Chief among those factors has been the low interest rates and increased bank lending that have been prevalent since 2003, when Secretary Wen forged a cheap credit policy to trigger the construction and purchase of property while making competing debt investments less appealing.

During the bubble, local government relied on land sales for income (accounting for up to 50% of revenue), incentivizing the continued sale and development of land. Limited access to foreign investments for Chinese citizens increased the appeal of domestic investments such as property. Chinese citizens also faced cultural pressures encouraging home ownership, particularly for men seeking a wife. Responding to the 2008 global financial crisis, the spending from the China economic stimulus program also found its way into real estate, contributing to the bubble.

China's unreported "gray income" are very large, around one-tenth of GDP<sup>3</sup>. Most of grey incomes are invested in the real estate market of China's largest cities, which contributes to the fact that the leverage rate of Chinese properties appear to be

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<sup>2</sup> Based on the most recent reports from BBC "China's growth slows to weakest in 24 years", <http://www.bbc.com/news/business-30876464> and "Will China's property market unravel in 2015?", <http://www.cnbc.com/id/102218625#>.

<sup>3</sup> For more details on Chinese grey income, refer to <http://blogs.wsj.com/chinarealtime/2010/08/27/shining-light-on-chinas-gray-income/>.

small compared to the property bubbles in other countries. The normalization of gray incomes in China feeds the property bubble in the long run.

Historical patterns show that the first rate cuts in a cycle – September 2008 and June 2012 –helped drive a pickup in housing sales that lasted 1-1.5 years, according to CIMB. Home prices also started to rebound in 1-2 quarters after the first interest rate reduction<sup>4</sup>.

## 2. Determinants of housing prices in China: A literature review

Over the past few years, a number of economists both inside and out of China have examined the determinants of China’s housing prices. By and large, the empirical linear modeling results indicate that the changes of monetary policy and mortgage rates have had the largest and negative effect on changes in house prices, while changes in all the other factors such as broader macroeconomic impacts have positive but less significant effects.

Empirical nonlinear modeling reveal that the product of mortgage rates and value-added industrial outputs, the product of real effective exchange rates and stock index, the product of export growth and short-term capital flows, and product of the house price index and producer price index, are dominating in the determination of house prices.

Table 1 discusses the key variables, data sources, and economic rationales for the main drivers of China’s housing prices that have been found in the literature to date.

<b>Table 1 Summary of Determinants of housing prices in China</b>			
Key Variables	Data	Economic rationales	Citation
Monetary policy	M2, M2 growth rate	The sharp increase in property prices in 2009 as a consequence of the extremely loose monetary policy adopted by the Chinese government to counter the global financial crisis, such as easily-attainable bank loans and discounts in interest rates.(Positive impact on the housing price index)	Vrontis and Thrassou, 2013; Rigobon and Sack, 2004; Zhang et al 2011; Verry 2007
Inflation	CPI	The current growing demand in the housing market is due to certain companies and investors’ fear of inflation. (Inflation push in Chinese housing market)	Li, 2013; Cochrane 2011; IMF 2010

<sup>4</sup> From CIMB Asia Pacific Research Reports: [Asia Pacific Daily | 24 November 2014 - CIMB Group](#)

International trade	Net export growth rate	Fast increment of international trade volume contributed much to the booming of Chinese economy and hence may provide a momentum for house price changes. (Positive)	IMF, 2013; Zhang et al, 2011; Wolf Jr. 2011; Bergsten et al 2008
Exchange rate fluctuation	Real exchange rate of Yuan to US Dollar	China's exchange rate policy played a critical role in its international trade and FDI booms and improved China's competitiveness in attracting FDI flows to China as well as creating favorable conditions for maximizing exports. (Fluctuations in housing market) The 12 Month RMB/dollar Non-deliverable Forward contracts (NDF) is also collected for measuring the effects of RMB appreciation expectations.	IMF 2013; Li, 2014; Devlin et al, 2006; Xing, 2006; Korenberg et al. 1988; Billings and Zhu, 1994
Land price	Real estate investment growth rate	Local governments, depending on land financing, have strong incentives and abilities to generate significant revenue from the real estate investment. The soaring land price pushes up the house price.	Chen et al, 2011; Zhang et al, 2011
Capital flows	Hot money / short-term capital flows	The speculative capital flow or 'hot money' due to RMB appreciation expectations is one of main factors helped accelerate the bubble. Based on Guo and Huang (2010), the hot money is calculated by (change in foreign exchange reserves) minus (trade and service balance) minus (foreign direct investment).  The 12 Month RMB/dollar Non-deliverable Forward contracts (NDF) is also collected for measuring the effects of RMB appreciation expectations.	Liang, 2014; Guo and Huang, 2010; Martin, 2008; Li, 2007
Price volatility	Volatility of housing index	Granger causality test indicated that the price fluctuations are the Granger reason for changes monetary policy, economic growth and price level. Housing volatility represents the fluctuation of the housing market.	Chen et al, 2014; Meidani, 2011; McCarthy and Steindel, 2009; Goodhart and Hofmann, 2008
Economic growth	GDP growth rate	Variance decomposition analysis showed that the house price fluctuations on the impact of monetary policy, the lagged effects of the existence of about three months. Research shows that China's	IMF, 2013; Kaiwa and Lamberte, 2010; Wang, 2009

		economy can develop smoothly and orderly through the automatic adjustment of the market and the macroeconomic control of the government.	
Unemployment rate	Unemployed population	The dynamic VAR model indicates that House price increase is highly related to China's economy: money supply increase, higher price level, slower economic growth, and higher unemployment rate in the long run.	WESP, 2013; IMF, 2013

## 2.1 Theoretical literature on China's regime for capital flows and asset bubbles

China used to maintain tight restrictions on their capital account, but has been gradually opening the capital account in a sequenced manner for a decade. There has been a shift in official views which have become more sympathetic to capital controls (Ostry et al. 2011; IMF 2011). However, there are no international rules to constrain, discipline, or indeed legitimize restrictions that countries put on their capital account.

There has long been a debate on capital account liberalization and volatility controls (Subramanian, Jeanne, and Williamson, 2012). The pros and cons of prudential capital controls to curb the boom-bust cycle in capital flows have been discussed before (Williamson 2005), but economists now understand better the theoretical case for such policies with a new literature on the welfare economics of prudential capital controls (Korinek 2011). This literature essentially transposes to international capital flows the closed-economy analysis of the macro prudential policies that aim to curb the boom-bust cycle in credit and asset prices.

In calibrated dynamic welfare optimizing models, capital account controls can be represented by imposing tax with endogenous binding constraints (Bianchi 2011). Free capital mobility has been found little impact on economic development<sup>5</sup>. However, China, because of its importance in the global economy, sets the most complicated example of research interests. Capital flow regime in China has its

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<sup>5</sup> Although there is some evidence that foreign direct investment and stock market liberalization may raise growth temporally, those capital restrictions can be used to distort real exchange rates to the advantage of the countries that impose them.

special characters in its developing progress of financial asset markets and growing housing markets.

Chinese capital account is hardly proper to be described as completely closed with such large amounts of foreign direct investment and tax incentives, while China did severely restrict other forms of capital inflows, and controls its outflows, as well. Most of the Chinese foreign assets are accumulated as international reserves.

However, full control over capital flows implies full control over its macroeconomic doppelganger, the trade balance, and hence the real exchange rate (Jeanne 2011). IMF (2012) came up with an up-to-date and operational framework for policy advice on liberalizing capital flows and on the management of capital outflows. It proposed an “integrated approach”<sup>6</sup> and made systemically important implications on emerging market economies (EMEs) that extensively control capital flows (China and India).

The appropriate degree of liberalization for a country would depend on its specific circumstances, notably on whether it has reached certain thresholds with respect to financial development. In China, further liberalization would be beneficial based on implementation of the authorities’ liberalization plans and more rapid progress on supporting reforms, particularly in the financial sector. However, it’s also essential to control the market volatility during reform changes to avoid unstable situations.

New evidence (Mody and Murshid 2013) has been shown consistent with standard economic theory under volatility regimes of cross-border private capital flows. With volatility below a certain threshold, the inflow of foreign capitals has promoted growth. However, during periods of volatile growth, more flows have been associated with slower growth. Volatility levels and changes reflect an interaction: domestic production and institutional structures with global factors.

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<sup>6</sup> The use of capital flow management measures (CFMs) on outflows in preventing and managing crises set forth the frameworks as to inform policy discussions with and advice to Fund members, but not intended to provide guidance on members’ obligations under the Articles of Agreement.

## **2.2 Empirical evidence of the links between capital account opening, short-term capital flows and the housing market**

The empirical literature on capital flows is not unified under one single theoretical framework in macroeconomic analysis of controls. Heterogeneity across countries and time in the capital account opening policy measures implemented vary significantly. In most of the empirical literature, there are no distinctions between capital controls on outflows and controls on inflows—these exercises suffer from the same problems as the de jure IMF classification of exchange rate arrangements. There is also temporary versus permanent issue in the application (Reinhart and Smith 2002).

Furthermore, China, as a special case, has not substantially liberalized like other countries that actually went down the path of financial and capital account liberalization and has decided at some point to reintroduce controls, as the latter have developed institutions and practices that are integrated in varying degrees to international capital markets. What's more, China has substantial capital and exchange controls; therefore, isolating the effects of capital controls to make them comparable is a more difficult task (Reinhart and Reinhart 1999). Additionally, there are reserve requirements and policies applied in China as an alternative to capital controls.

For the links between capital account opening and capital flows, Magud, Reinhart, and Rogoff (2011) first explicitly define the measures constructed as capital controls and standardize the results of over 30 empirical studies by introducing two indices of capital controls: Capital Controls Effectiveness Index (CCE Index), and Weighted Capital Control Effectiveness Index (WCCE Index). They point out that current empirical studies lack a common methodology, such as “overweighed” country cases (Chile and Malaysia). Instead, they model the effects of imposing capital controls on short-term flows using a portfolio balance approach. There also exist country-specific characteristics for capital controls to be effective. The equivalence in effects of price- vs. quantity-capital controls is conditional on the level of short-term capital flows.

**Table 2.1: China Capital Account Liberalization in China Research: Methodology and Major Results**

<u>Authors &amp; Institutions</u>	<u>Research Questions</u>	<u>Data and Methodology</u>	<u>Major Results</u>
Bayoumi, Ohnsorge (2013)	Do Inflows or Outflows Dominate? Global Implications of Capital Account Liberalization in China	Historical macroeconomic data	China needs to be more cautious on the capital account liberalization.
Gallagher, Ocampo, Zhang, Yu (2014)	How Long will China Capital Account Take to Get Fully Liberalized?	Historical data	Reform and regulate first. Open capital accounts leave emerging markets susceptible to the pro-cyclical nature of global finance.
Gruben, McLeod (2002)	Capital Account Liberalization and Inflation	Romer (1993), Quinn-Toyoda (1996) models with cross-country data	Widespread capital account liberalization (early 1990s) appears to contribute to the worldwide deflation.
Huang, Wang, Guo and Wang (2011)	The Order of Liberalization of China Capital Account $RGDP_{it} = \beta_0 + \beta_1 CACI_{it} + \beta_2 X_{it} + \epsilon_{it}$	Capital Account Control Index of China (CACI) (monthly and annual database)	The authorities could probably abandon restrictions on debt financing and ODI quickly.
Jeanne (2012), He, Cheung, Zhang, Wu (2012)	Capital Account Policies and the Real Exchange Rate: How would Capital Account Liberalization Affect China's Capital Flows and the Renminbi Real Exchange Rates?	A simple small open economy model with capital controls, focusing on real exchange intervention	Public accumulation of foreign assets might affect the real exchange rate even in countries with fairly open capital account.

Luo, Jiang (2005)	What are the Links btw Liberalization, Diminishing Capital Controls and Chinese Stock Market Returns?	International Asset Pricing Models; Property Rights Regime with Price Distortion, Moral Hazard and Monetary Overhang	Property rights reform should be given the first priority and the main impediments toward CAL are monetary overhang and moral hazard in the stock market.
Wei, Zhang (2012)	Impact of Related Factors on the Capital Account Liberalization Strategies, Perspective of Financial Stability	Chinese financial institution spreadsheets	The relative low saving rate and deterioration of external debt will exacerbate financial risks.
Yang, Leatham (2011)	The Impact of Currency Convertibility on the Informational Linkage btw Official and Swap Market Exchange Rates	ADF Unit Root Test and Error Correction Model	More complete currency convertibility is needed for more informed RMA exchange rate.

There are also comparative quantitative studies on Chinese capital markets with developed economies. Financial capital and fixed capital tend to flow in opposite directions between poor and rich countries. Wang et al (2012) introduced frictions into a standard two-country neoclassical growth model to explain the pattern of two-way capital flows between emerging economies (such as China) and the developed world (such as the United States). They showed how underdeveloped credit markets in China can lead to abnormally high rate of returns to fixed capital but excessively low rate of returns to financial capital relative to the U.S., hence driving out household savings (financial capital) on the one hand while simultaneously attracting foreign direct investment (FDI) on the other.

**Table 2.2: Chinese Housing Market Studies**

Sample	Study	Goal	Methodology
1999-2010	Zhang, Hua and Zhao	Exam monetary policies impacts in China housing prices	Non-linear Auto-Regressive Moving Average Model with Exogenous inputs
2003	Hui and Yue	Investigate whether there is a housing price bubble in Beijing, Shanghai and Hong Kong	Granger causality tests, generalized impulse response analysis, and the reduced form of housing price determinants
1995-2005	Lu and Miao	Analyze the dynamics of housing prices in 35 urban cities	Time series serial correlation and mean reversion
1999-2010	Yu	Measure size and characteristic of housing bubbles in China major cities	Decompose bubble characters, panel unit root test, VAR model
2000-2010	Wu, Jing, Gyourko and Deng (2012)	measures of Chinese land and housing prices; evaluate conditions in major Chinese housing markets	Comparative analysis and time series

### 2.3 History of China Capital Account Liberalization and Policy Debates

China has been gradually and sequentially opening its capital account for some time. In the late 1970s, gradual liberalization in the foreign trade regime began with direct investment inflows and some opening up of credit markets. In 1994, to restructure China's foreign exchange control system, substantial reforms resulted in the establishment of a nationwide foreign exchange interbank market. In December 1996, China made the Renminbi (RMB) convertible for current account transactions, removing both quantitative and regulatory restrictions on the use of foreign exchange.

Since December 11, 2001, China has become a member of World Trade Organization (WTO), which has also been seen as a catalyst for capital account liberalization and currency convertibility. In 2006, China's current account and capital account surpluses were US\$170 billion and US\$ 60 billion, respectively. The growth rate of net exports was more than 70 per cent, after having registered a growth rate of 220 per cent in 2005. Although the RMB exchange rate has appreciated by about 6 per

cent against the US dollar since July 2005, the appreciation pressure on the RMB is unabated.

In 2006, there are a few policies introduced in Chinese financial and housing markets including implementing QDII schemes, phasing out compulsory requirement on surrendering of foreign exchange by domestic entities, and imposing restrictions on property purchase by foreign entities.

The major recent changes in China's capital account measures can be summarized as follows:

- Originally Chinese enterprises and commercial banks were allowed to keep a certain proportion of foreign exchange earnings from current account transactions in foreign exchange bank accounts. Currently there are no such limits.
- Residents are allowed to convert RMB to foreign currency up to \$50,000 per annum. They are now free to open foreign exchange accounts.
- Chinese enterprises' overseas investment is now much less restricted than in the past.
- Residents are allowed to buy foreign equities via qualified domestic institutional investors (QDII). The QDII scheme was introduced in June 2006, which allowed qualified domestic banks to conduct overseas wealth management for their clients and qualified securities brokers (such as fund management companies and securities companies) to make overseas portfolio investment. By the end of October 2007, a total of some \$27 billion of funds had been invested outside the mainland under the QDII scheme.
- Non-residents are allowed to open RMB accounts in China.
- Non-residents are allowed to buy A shares via the qualified foreign institutional investors (QFII) scheme. The QFII scheme is a transitional institutional arrangement opening China's capital markets to foreign capital. By the end of October 2007, a total of 52 foreign institutions had obtained QFII status from the China Securities Regulatory Commission (CSRC), of which 49 had been granted an aggregate investment quota of some \$10 billion by the SAFE. At this moment, the total quota of QFIIs is \$30 billion.
- Restrictions on domestic institutions' issuance of bonds abroad have been loosened. By the end of 2006, a total of 27 domestic institutions (including the Ministry of Finance) had been allowed to issue 141 international bonds in major capital markets such as Japan, the United States, Europe, Singapore and Hong Kong SAR of China, raising \$30.8 billion.

- International development institutions have been allowed to issue RMB bonds domestically. In October 2005, the International Finance Corporation (IFC) was permitted to issue RMB1.13 billion and the Asian Development Bank (ADB) RMB1 billion bonds domestically.
- By the end of October 2007, the China Development Bank, the Export-Import Bank of China and Bank of China had issued RMB5 billion, RMB2 billion and RMB3 billion yuan bonds in Hong Kong SAR, respectively.
- Non-residents are allowed to buy houses in China as long as they have been in China for work or study for more than one year.
- The “extra-national treatment” previously granted to foreign banks which had allowed them to borrow abroad with fewer restrictions than domestic banks has been abolished.
- A new foreign exchange settlement system has been established. Under this system, capital inflows are under stricter scrutiny. It is assumed that all inflows should be based on real transactions. Inflows of foreign exchange originating from “foreign investment” must be paid to designated recipients and are not allowed to enter into and stay in RMB accounts of enterprises in order to benefit from an appreciation of the RMB.<sup>7</sup>

The main features of China’s current capital account regime are summarized in Table 2.3. According to the SAFE, among 43 items of transactions under the capital account, 8 items are completely liberalized; 11 items are under loose restriction; 18 items are under moderate restriction; and convertibility is strictly prohibited only for 6 items. Calculations based on the International Monetary Fund (IMF) formula show that so far 80% of China’s capital account has been liberalized.

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<sup>7</sup> From World Investment Report 2014: Investing in the SDGs: An Action Plan.  
[http://unctad.org/en/PublicationsLibrary/wir2014\\_en.pdf](http://unctad.org/en/PublicationsLibrary/wir2014_en.pdf)

**Table 2.3: Restrictions on Capital Market and Monetary Market in China (2013)**

		<b>Inflow</b>	<b>Outflow</b>
<b>Monetary Market</b>	A		
	B	PBOC and SAFE permission	Through authorized institutes
<b>Stock Market</b>	A	B shares and QFII	Sell B shares under QFII
	B	Sell H shares abroad under QDII	QDII
<b>Bonds and other Debt Market</b>	A	QFII	International financial entities under QFII
	B	PBOC and SAFE, state external debt plan	Authorized financial institutions
<b>Collective Investment in Securities</b>	A		
	B		
<b>Derivatives and other Instruments</b>	A		
	B	Operations in such instruments by financial institutions are subject to prior review of qualifications and to limit on open foreign exchange position	Operations in such instruments by financial institutions are subject to prior review of qualifications and to limit on open foreign exchange position

Sources: PBOC policy report; IMF, "Exchange Arrangements and Exchange Restrictions," Annual Report, 2013. <https://www.imf.org/external/pubs/nft/2013/areaers/ar2013.pdf>

Notes: Inflow A: nonresidents buy in domestic market; Inflow B: sold and issued by residents abroad; Outflow A: sold and issued by nonresidents in domestic market; Outflow B: residents buy abroad.

The Ministry of Housing and Urban-Rural Development (MOHURD) and the State Administration of Foreign Exchange (SAFE) jointly issued the Circular on Further Standardizing the Administration of Property Purchases by Overseas Institutions and Foreigners (restrictions on the purchase of properties by foreign entities with a presence in China and foreign individuals). Circular 186 was issued to implement the wider macro-economic policies set out in the Circular on Firmly Restraining Rapid Growth of Real Property Prices in Certain Cities (Guo Fa No. 10 of 2010) issued by the State Council on 17 April 2010 and to strengthen the implementation of Opinions on Regulating Foreign Investment in Real Estate Market Access and Administration of Foreign Investment in Real Estate (Jian Zhu Fang No. 171 of 2006) jointly issued by six ministries on 11 July 2006 ("Circular 171").

Circular 171 states that foreign individuals and branches and representative offices established by foreign entities are only permitted to purchase properties in China for self-use. It requires that a foreign entity that purchases property for self-use purposes must, in addition to other documents required by laws and regulations, present the business license or registration certificate of its branch or representative office and a letter of undertaking certifying that the purchase of commercial property is genuinely for self-use purposes. These purchases of properties in China for purposes other than for self-occupation must strictly follow the principal of "commercial presence" set out in the Article 1(1) of Circular 171 i.e. the foreign investor would first have to establish a wholly foreign owned enterprise (read taxable presence) in China in order to do so.

Beijing Municipal Government issued a circular entitled Circular on Regulating the Purchase of Commodity Housing by Foreign Entities and Foreign Individuals on 29 January 2007 (the "Beijing Circular") which provides that such properties bought by foreign entities and foreign individuals must not be leased or sold after purchase without permission. Although the Beijing Circular should not apply to places outside Beijing, it does seem designed to put foreigners off purchasing property in Beijing. Having been the first municipality to have expressly relaxed the "one property rule" applicable to foreigners subsequent to the issuance of the Circular 171 and then reintroducing the rule later, it appears that Beijing seems to have executed more policy flip-flops than most, perhaps due to the higher reported percentage of foreign buyers.

Although we note that the Chinese government has also issued certain restrictive policies applicable to domestic investors (for example, the loan-to-value percentage for such investors has been reduced if the investors have bought more than one property in China) and the percentage down payment increased, these restrictions do not restrict purchases in absolute terms, only the number of qualified buyers. A

wealthy cash buyer in China can simply carry on buying in the market despite the new restrictions; when one compares him or her with his foreign counterpart, the double standard is obvious. Hence the motivation behind applying these restrictive policies to foreign investors is somewhat questionable, given the relatively modest share of foreign investors in the market taken as a whole. Despite these policies, prices in many major cities in China such as Guangzhou and to a lesser extent Shanghai have continued to rise in recent months, suggesting the policy of reining in real estate prices is not able to fully achieve its aims.

Whilst there is a genuine and understandable concern about foreign investment being a front for speculation on the RMB, the difficulty in extracting money from the real estate market for foreigners due to foreign exchange controls makes it difficult to imagine that this is an easy target for "hot money", which tends to move rapidly and freely from place to place. Therefore one view about the real motivation is that the Chinese authorities are, by implicitly suggesting that foreign speculators and "hot money" are somehow to blame for high prices, once again trying to distract attention away from the more fundamental issues which are causing price surges in the market, and putting the dream of owning a property even further out of reach of most ordinary people in China.

Despite the new policy of "Difficult in, Easy out", capital inflows have continued to flow in rapidly through the current account as well as the capital account. The destinations of these capital inflows are China's money markets and capital markets, especially China's real estate markets and stock markets. So far there is not hard data on how much speculative capital has flown into what markets. Some argued that at least a third of China's current account surplus in 2006 is disguised capital inflows through over-invoicing exports and under-invoicing imports.<sup>8</sup>

To channel large scale of speculative capital across borders into China is not that difficult. For example, there are numerous Taiwanese companies with certain amount of registered capital. However, capital is allowed to be injected gradually over the years. To utilize these loopholes, hedge funds can put money into those enterprises' accounts as injected capital legally with a price. Then this money will leave the account of these corporations and enter into their subsidiaries' accounts.

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<sup>8</sup> INTERNATIONAL MONETARY FUND: Liberalizing Capital Flows and Managing Outflows Approved by Jan Brockmeijer, David Marston, and Jonathan D. Ostry March 13, 2012  
<http://www.imf.org/external/np/pp/eng/2012/031312.pdf>

Now it is entirely legal for these subsidiaries to put the money into their accounts held by securities companies on behalf of them to buy shares.<sup>9</sup>

Under these circumstances, probably only two kinds of capital will be eager to utilize opportunities provided by the “loosening control over capital outflows” to flow out of China: the unwinding speculative capital and money that needs to be bleached. Legitimate outbound investment and remittance of investment incomes have already channels in place to move out of the borders without undue difficulties. However, even this legitimate outbound investment should be carefully monitored and supervised. Without careful monitoring and supervising, the results of the disorderly outflows of Chinese capital will fare much worse than Japan two decades ago.<sup>10</sup>

Many of the emerging markets with closed capital accounts have underlying fragilities like a large fiscal deficit, flexible exchange rates, a large amount of corporate and government debt denominated in dollars, a banking sector with significant nonperforming loans, or an opaque corporate non-financial sector, which make full capital account convertibility risky.

### **3. Baseline Model**

Based on the related literature mentioned in the previous sections, we build our baseline model as a reduced form of housing price equation. We include these price determinants and create the measure of hot money. We add the 2006 event dummy and hot money into the model to examine the extent to which a) short-term capital flows may further impact the price/volatility swing in Chinese housing market and b) whether China’s 2006 Capital Account Regulation (CAR) were effective in stemming the bubble in terms of price/volatility.

#### **3.1 Data and model**

We collect a monthly data set of Chinese housing markets and macro fundamentals (Dec 1998 - Oct 2013) in the last 15 years, starting right after the 1997 Asian crises and covering the 2007 global financial crises. The variables and resources are summarized in table 1. These variables are chosen based on the previous literature and research in China housing market. Different from previous research on annual

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<sup>9</sup> From Capital Market Liberalization and Development Edited by José Antonio Ocampo and Joseph E. Stiglitz [http://inctpped.ie.ufrj.br/spiderweb/pdf\\_2/3\\_frenkel\\_capital\\_market.pdf](http://inctpped.ie.ufrj.br/spiderweb/pdf_2/3_frenkel_capital_market.pdf)

<sup>10</sup> From ADB Institute Discussion Paper No. 96: Managing Capital Flows : the Case of China, Yongding Yu March 2008 <http://doc.mbalib.com/view/f608a62f5bc310d70a23c4d408243356.html>

data, we choose monthly frequency and calculate the volatility of housing price index based on the previous 12 months.

We are interested in how the housing price is affected by capital flows and policies. To learn China housing market price, we also need to take the macro fundamentals into account. Therefore the baseline model is as follows:

$$Y_t = \alpha + \beta X_t + \gamma F_t + \delta D_i + \epsilon_t, \text{ where}$$

$Y_t$ : China housing market index HI, China Housing volatility HV

$X_t$ : Macro fundamentals of Chinese economy, including CPI (inflation), M2GR (monetary policy), CNY (foreign currency exchange market), NEXGR (net exports), REIGR (real estate investment growth rate).  $X_t = (X_{1t}, X_{2t}, X_{3t})'$  are vectors, representing a list of economic variables.  $\beta = (\beta_1, \beta_2, \beta_3)$  are the corresponding coefficients of  $X_{1t}, X_{2t}, X_{3t}$ .

$F_t$ : Capital flows represented by hot money. The derivation of hot money follows the formula:

$$\text{Hot Money} = (\text{FX reserves change}) - (\text{trade/service balance}) - \text{FDI}$$

$D_i$ : Dummies representing the capital market liberalization, where  $i$  represents the events/policies taken place at year  $i$ . Here I pick one representative year between 1998 and 2013: 2006. In 2002, QFII schemes were introduced to attract more foreign investors which opened the capital account in China to a certain level. 2006 was a year adding more flexibility to the foreign exchange market as well as broaden domestic investors' investment choices.

We first test the consistency of our results compared with previous literature. Since we arrived at the same the results, we add two additional important measurements of the Chinese housing market. One is hot money in the capital and financial market. The other is the 2006 policy dummy on the housing regulations in China.

**Table 1: List of variables and sources**

Variable	Name	Explanation	Source
HI	Housing Index	National monthly index of China housing market 199801-201310	National Bureau of Statistics
HV	Housing Volatility	Calculated based in the variance of past 12-month housing index	
NDF12M	Non-Deliverable Forward 12-month		Bloomberg
NDF1M	Non-Deliverable Forward 1-month		Bloomberg
MSCI	MSCI China Indexes	Chinese investment market including Qualified Domestic Institutional Investors (QDII) and Qualified Foreign Institutional Investors (QFII) licensees, based on the MSCI Global Investable Market Indexes (GIMI) Methodology.	Bloomberg
CNY	Yuan/Dollar exchange rate	Monthly foreign currency market for price	Bloomberg
USH	US Housing	Housing market mortgage rate in the US, an average of 30-year housing loan in US from the Primary Mortgage Market Survey (PMMS)	Bloomberg
USHMF	US Housing Mortgage Rate	Bankrate.com US Home Mortgage 30 Year Fixed National Avg	Bloomberg
NEXGR	China Net Export Growth Rate	Total exports- imports	National Bureau of Statistics
REIGR	China Real Estate Investment Growth rate		National Bureau of Statistics
M2	Monetary policy: M2	M2 includes savings deposits, money market mutual funds and other time deposits, which are less liquid and not as suitable as exchange mediums but can be quickly converted into cash or checking deposits.	National Bureau of Statistics
M2GR	M2 growth rate		National Bureau of Statistics
CPI	National Consumption Price Index		National Bureau of Statistics

### **3.2 Measure of hot money and 2006 policy**

Capital flows are difficult to measure, especially for developing countries like China. Based on macroeconomic literature, we calculate the hot money by the difference between foreign exchange reserves change and trade-service balance together with FDI. This is a general formula widely applied in the capital market literature. As discussed in the previous section, 2006 regulation policy on the housing market is of research interest for the housing volatility. Therefore we generate a dummy variable representing this policy with 1 after the policy is issued and zero before 2006.

### **3.3 Summary statistics**

Table 2 summarizes the variables of interest from 1998 to 2013. Housing Index (HI) takes the value range from 50 to 170. It has a value interval of 100 with median larger than mean. Housing Volatility (HV) is calculated based on HI and ranges from 0 to 50. The MSCI Emerging Markets Index for China is a free float-adjusted market capitalization index that is designed to measure equity market performance in the global emerging markets. Numerous ETFs based on the MSCI Emerging Markets Index have been launched and are listed in on the major stock exchanges. CNY is the currency exchange rate of US dollars in terms of Yuan. USH is the mortgage rate in the US housing market and USHMF is the 30-year loan interest rate in the US housing market.

Net Export (NEX) measures the international trade market in China and NEXGR is the growth rate based on NEX. M2 measures the monetary policy in China and M2GR is the growth rate. Real Estate Investment (REI) measures the land market in China and REIGR is the growth rate based on REI.

**Table 2: Summary Statistics**

	max	median	min	mean	standard error
HI	161.27	106.694	53.624	101.6949	35.51059484
HV	43.55311	4.29563	0.009146	7.774139	9.249913989
MSCI	102.98	40.56	13.73	42.87242	19.90287227
CNY	8.28	7.85625	6.0543	7.460043	0.849791097
USH	8.62	5.91	3.32	5.742368	1.258729172
USHMF	8.27	5.53	3.4	5.544158	1.132588129
NEX	4.16E+09	6.34E+08	21295934	1.01E+09	941689161.5
NEXGR	50.8	23.4	-29	19.43175	16.84022796
M2	1209587	367326.5	117638.1	479188.3	322597.4545
M2GR	29.7	16	12	16.7435	3.81325004
REI	86013.38	7736.42	184.4	15529.3	17925.0195
REIGR	50.2	24.6	1	25.3711	7.848992237
CPI	108.7	101.9	97.8	102.0741	2.38696079
FXR	4.87E+11	2.08E+11	8.57E+09	2.27E+11	1.71926E+11
f	3.56E+11	6.83E+10	-1.8E+11	9.04E+10	1.36051E+11
FDI	2.8E+11	1.04E+11	3.84E+10	1.24E+11	82413621105
D2006sep	1	1	0	0.507937	0.499937008

Note: The unit is in RMB/Yuan.

### 3.4 Regression results

We find the consistent results in monetary policy (significant +), inflation (significant +) and net exports (insignificant +), compared with the previous literature on the determinants of Chinese housing markets. However, the land price push is not well represented by the real estate investment growth rate. Real estate investment growth rate has a significant negative impact on the housing price index, making the housing market more competitive.

Since we arrive at similar results to the previous literature estimates, we rerun the model but add F and 2006 reform dummy. It turns out that these two variables add to the explanation. There is a positive and statistically significant relationship between F and the HI, as well as the HV. In addition, we also find a negative relationship between the 2006 and the HV. In general, our analysis adds to the existing explanations to the housing bubble and adds to the discussions about the efficacy of capital account regulation.

To be consistent with the previous determinants of housing price, deleting the variable REIGR improves the goodness to fit of the model.

- i) Add hot money F only into the baseline model of HI (housing index): + impact, significant at 5% confidence interval;
- ii) Add both hot money F and 2006 reform dummy into the baseline model of HI (housing index): + impact, significant at 10% confidence interval, insignificant negative impact of the 2006 reform dummy;
- iii) Add both hot money F and 2006 reform dummy into the baseline model of HV (housing volatility): + impact, significant at 5% confidence interval, R<sup>2</sup> improved from 0.2005 to 0.2882

Consistent with previous literature of Chinese housing index, we find significantly positive impacts of monetary policy (M2 growth rate), inflation and international trade (net export growth rate) on the housing price. There is also a negative effect of the exchange rate on the housing index as expected.

Adding hot money improves the goodness of fit of the baseline model. Hot money represents the short term capital flows. It has a significant positive impact on the housing price. As there exist more and more hot money in the economy, they might flow into the housing market causing housing bubbles. Therefore we find quantitative evidence of short-term capital flows that increases the housing prices in China.

On the other hand, the policy change in Sep 2006 influences the housing market in a different way. Though there is an insignificant negative impact on the level of the housing prices, the major effect of such kind of policy lie on the volatility control of the housing market. We find significant negative impact of the 2006 event dummy on the housing volatility. The policy stabilizes Chinese housing index by lowering the volatility of the housing index.

In sum, capital flows have significant impact on Chinese housing market. Capital flow liberalization in China might cause the burst of housing bubble while regulations and policies would work to stabilize the housing market.

**Table 3: OLS regression results**

<b>Panel A: China Housing Price Index (Levels)</b>						
HI	[1]Baseline model		[2]Adding hot money only		[3]Adding hot money and 2006 event dummy	
f			2.1e-11**	[1.01e-11]	2.25e-11*	[1.2e-11]
d2006					-1.13	[5.13]
M2GR	1.28***	[0.23]	0.71*	[0.36]	0.69*	[0.36]
CPI	3.04***	[0.41]	2.29***	[0.56]	2.3***	[0.57]
NEXGR	0.16***	[.083]	0.058	[.065]	0.058	[.065]
CNY	-34.8***	[1.16]	-36.4***	[1.48]	-36.9***	[3.16]
constant	32.5	[47.1]	127.6*	[67.6]	132*	[70.8]
N	167		167		167	
R-squared	0.899		0.9035		0.9035	
<b>Panel B: China Housing Volatility (Variance)</b>						
HV	[1]Baseline model		[2]Adding hot money only		[3]Adding hot money and 2006 event dummy	
f			-1.34E-12	[7.82e-12]	1.77e-11**	[8.9e-12]
d2006					-15.1***	[3.81]
M2GR	0.64***	[0.18]	0.71**	[0.28]	0.50*	[0.27]
CPI	1.92***	[0.31]	1.69***	[0.43]	1.8***	[0.42]
NEXGR	0.11	[.068]	0.071	[.065]	0.069	[0.04]
CNY	3.22***	[0.89]	2.49***	[1.15]	-5.7**	[2.35]
constant	-223***	[36.4]	(-)197.2***	[52.6]	-137.6***	[52.56]
N	167		167		167	
R-squared	0.208		0.2183		0.2882	

Note: Standard errors are listed in the brackets.

It's worth noting that the improvements in R square indicate the importance of capital flows and regulation in explaining housing market in China. As we can see from table 3, the significance of hot money remains positive and explains the bubble in the housing market. In addition, though the government proposed cooling policy for the housing prices in 2006, the effect of such policy doesn't significantly influence the overall housing price level. We do find significant impacts in the second regression of housing volatility.

To further explore the effects of capital flows, we introduce quantile regression to tell the different impacts according to the distribution of the housing price and

volatility. Since OLS coefficients give the median impact of hot money, it's not adequate to learn about the change patterns of hot money for the housing market. As the housing markets are fluctuating all the time, the effects are not constant and vary across time. Therefore in the next section, we apply quantile regression to learn about the changing pattern of the effects of hot money on the housing market.

#### **4. Quantile Regression**

Quantile regression offers a natural and flexible framework to the statistical analysis of nonlinear response models for conditional quantile functions gradually. By minimizing asymmetrically weighted absolute residuals, quantile regressions estimate full range of conditional mean functions and provide a complete statistical analysis of the stochastic relationships among random variables.

Quantile regression has been widely used in many different areas such as economics (Koenker and Hallock, 2001) and survival analysis (Koenker and Geling, 2001) among others. The essential aim of this paper is to explore the potential of quantile regression models as a tool for analyzing capital flows and regulation policies for China housing market.

##### **4.1 Measures in quantiles**

There is a significant difference between housing price regression and housing volatility regression. The exchange fluctuation push has different signs. It affects the housing volatility positively while has a significant negative impact on the housing prices.

###### **4.1.1 For the housing price index at the market price level**

The positive effect of hot money on the housing price index is only happening at the upper quantiles of the distribution of the housing prices. This indicates the OLS average results could not represent the general case. In fact, only when the overall housing price index is high, hot money flows may cause positive impact on the price index.

The effect of 2006 event dummy is not constant across the distribution of the housing price. We found significant negative impact at the tails of the distribution; however, the results for the median are positive based on the quantile regression results.

Monetary policy and inflation shows strong positive impact at the lower quantiles but lose significance at the higher quantiles.

In general, quantile regression tells the effect of interest regarding the distribution of the price index. It tells the performance of capital flows and economic policies at specific level of the housing market. The lower quantile represents the housing market in the recession while the higher quantile tells there might be a housing bubble in the market.

#### 4.1.2 For the housing volatility at the frequency level

We see sharp changes at the higher quantiles in all dependent variables coefficients. This means higher housing volatilities make the market unstable, therefore, much easier to be affected by the capital flows and related policies as well as macro fundamentals.

The effect of hot money is significantly positive at the upper quantiles of housing volatility. It stays the same for under 0.6 quantiles. The 2006 Sep event has a significant negative impact on the housing volatility, especially for the upper quantile.

**Table 4: Quantile Results Summary**

Determinants of housing price index (including controls for fundamentals)											
Quantiles coefficients and standard errors											
HI	bootstrap		bootstrap		bootstrap		bootstrap		bootstrap		
	0.1	s.e.	0.25	s.e.	0.5	s.e.	0.75	s.e.	0.9	s.e.	
F	-1.37E-12	1.53E-11	-3.35E-12	1.29E-11	2.54E-12	1.22E-11	1.82E-11	1.52E-11	1.77E-11	1.30E-11	
d2006sep	-4.37	20.075	-0.32	18.53	16.78	13.535	5.08	7.74	-1.55	2.9615	
M2G											
R	1.06	0.1927	1.19	0.22	0.79	0.4215	-0.34	1.126	-0.22	0.3958	
CPI	1.74	0.0304	2.03	0.5688	2.26	0.7433	0.43	0.7973	-0.16	0.3114	
NEX											
GR	0.035	10.234	0.068	0.046	0.092	0.078	0.08	0.138	0.027	0.0783	
CNY	-45.23	68.49	-42.05	9.956	30.22	6.283	-30.17	4.312	-28.51	2.5903	
Constant	237.96	87.496	181.9	94.448	73.48	59.4948	294.64	88.421	352.23	46.5613	
Pseudo R2	0.7701		0.7816		0.7466		0.663		0.659		
N	167										

Note: the bootstrapping is conducting in 20 times.

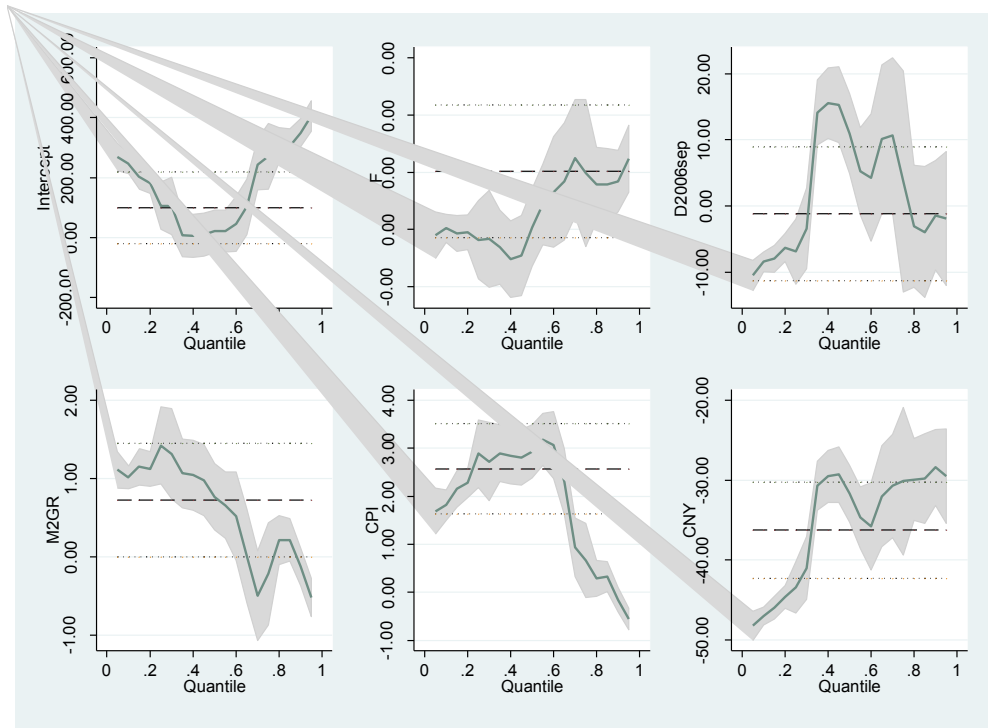
We see the effects of hot money are mostly significant positive on the higher quantiles, reaching the maximum around the 80 percentiles. For the dummy 2006, we do find negative impact at the tails, meaning that the policy has influence of dragging the price away from the extreme cases.

The factor driving housing prices surge includes hot money, which is significant for the upper distribution of the housing index. This result comes from the quantile regression. The policy is not significantly well represented by the dummy variable. We see quantile regression also improves the goodness of fit of the model regardless of the sample size. To be more precise, the results turn out indifferent on the number of bootstrapping.

Base on our unique dataset of China housing market at national level, we can also conclude that herding formation is stronger in increasing markets than that in decreasing markets. When the markets are turning turbulent, in the high quantile regression, there is significant influence of short term capital flows. The results support the asymmetry of herding behavior in increasing and decreasing markets.

Investors in China residential housing markets tend to herd by quantile regression when housing market is increasing. Our quantile regression provides empirical evidence on investigating abnormal increasing price of China housing market. Due to China housing market unique characteristics, the policy measure is not captured well in the quantile regression. However, the methodology is extendable in China real estate market to practitioners, academia and policymakers.

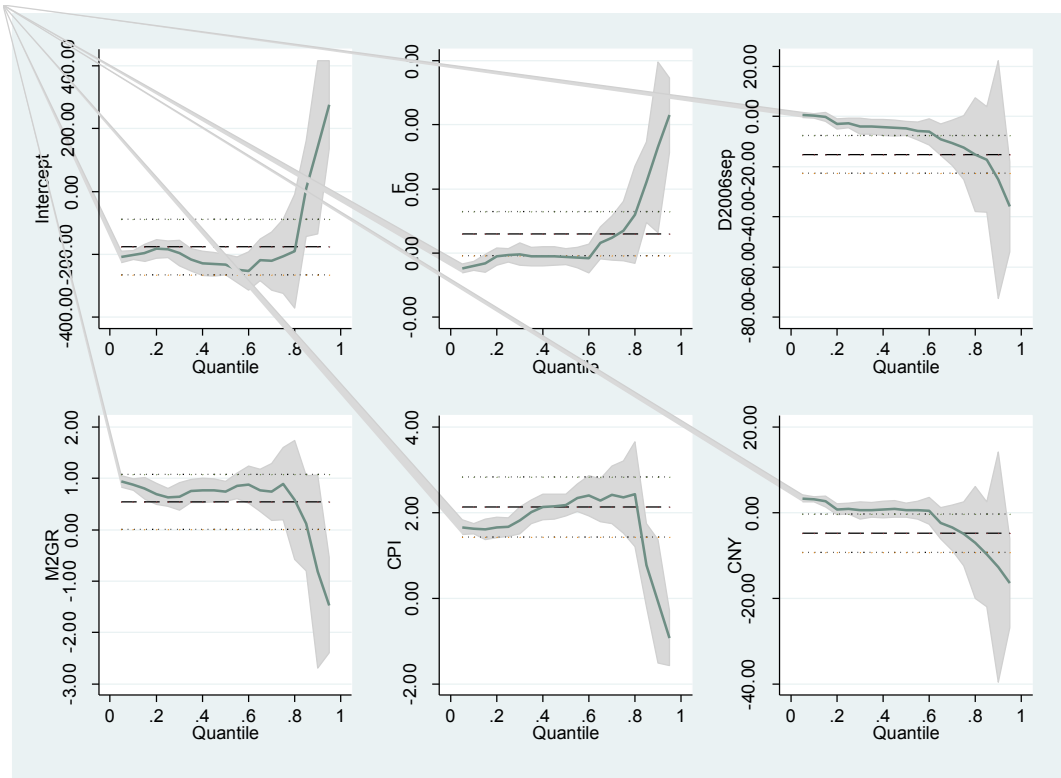
## 4.2 Graphs of effects



**Figure 1: Quantile Regression of housing price index at the market level**

Figure 1 and 2 draw the coefficients across different quantiles of the housing price index and volatility. We can see the differences of coefficients clearly from the graph, especially for hot money  $F$  and regulation policy  $D2006sep$ . In Figure 1, the regulation policy is more effective for the median price level at its peak around the 40 percentile of the distribution of housing prices.

Figure 2 tells that the effects at the right tail, which means at a higher volatility level of housing prices, are much larger. For example, hot money creates more volatility when the housing market is volatile. On the other hand, the policy becomes more effective on stabilizing the housing market at the 0.8 quantile.



**Figure 2: Quantile regression of housing price volatility**

The advantage of quantile regression for policy maker is that it helps understand the effectiveness of regulation policy and indicate when it's the optimal time to issue a policy. For the housing market, policies like 2006 would stabilize the housing market more efficient during the volatile period. The effect of cooling down the hot housing market is bigger during the extreme housing price periods.

In sum, short term capital flows affect the housing market creating housing bubbles. Hot money not only increases the housing price but also makes the market more unstable, especially when the fundamental economy is volatile. Regulation policies on the housing market are effective in stabilizing the market but have no significant impact on reducing the prices.

## 5. Conclusions

This paper sought to examine the extent to which external financial flows also have an impact on China's housing prices and their volatility. We find that short-term capital flows from abroad had a modest impact as price increases in the Chinese housing market, and a significant impact on increasing housing market volatility. Our quantile regression analysis shows that short term capital flows magnified the impacts of capital flows on prices during upward surges in the housing price.

We also examine the extent to which China's capital account regulations on foreign real estate purchases in 2006 had an impact on stemming housing price increases and volatility. We find that these policies did not appear to have impact on reducing overall housing price, but we do find that there is a strong impact on reducing volatility in Chinese housing market. The effects on different quantiles of house price index are mixed.

One issue the paper doesn't cover is the time effect of a policy. It's difficult to measure when the policy works and this paper assumes the effect as a consistent constant across time. However, one policy might be effective at a certain period of time or change afterwards. Therefore, the regression results are in need of careful interpretations.

Although China's housing bubble has appeared to ebb to some degree, this paper has lessons for China's ongoing discussions regarding capital account liberalization. As China liberalizes its capital account, it will have to devise mechanisms to evaluate the impact of capital flows on asset prices, and may need to resort to temporary regulations on capital inflows. This paper shows that such policies can be modestly effective.

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