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中信银行 CHINA CITIC BANK

Real Estate Outlook

China

Hong Kong, 11 July 2011
Economic Analysis

- **This report, the third in our annual series, updates recent developments, policies, and prospects in the residential property sector.**
- **The property sector remains a focus of intense interest given its large contribution to China's economic growth** and financial risks posed by large price movements.
- **Property price increases have moderated over the past year** under the influence of government measures to cool the market, including restrictions on home purchases and tighter credit policies.
- **According to our estimates, the market is only slightly overvalued.** We expect price rises to remain subdued in the near term, and a modest downward correction, particularly in cities with large misalignments, cannot be ruled out.
- **The authorities have implemented ambitious plans for construction of affordable housing.** International experience may offer lessons for financing and land use policies.

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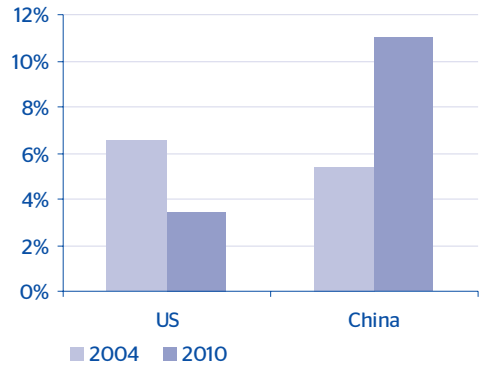
1. Introduction and Summary

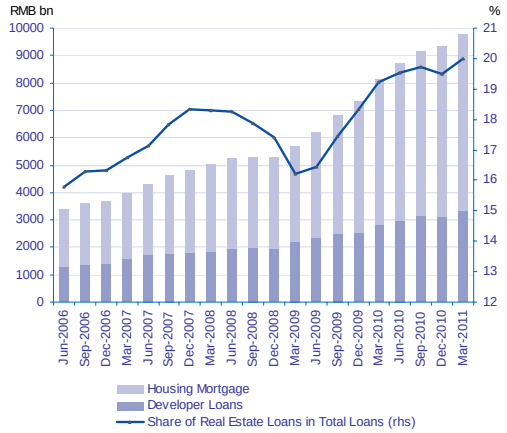
Since 1998, when market-oriented reforms were undertaken in China's real estate sector, the housing market has grown to become a major engine of growth for the broader economy. Rising demand for housing, fed by rapid income growth and urbanization, have led to a boom over the past decade, with investment in residential buildings in China now accounting for over 10% of GDP (Chart 1). The sector's contribution to growth has become even more important on the heels of a massive government-led investment program to expand the supply of affordable housing in the coming years.

Chart 1
Real estate investment-to-GDP



Source: NBS, CEIC and BBVA Research

Chart 2
Real estate loans and structure



Source: NBS, CEIC and BBVA Research

Given the importance of the housing market to the broader economy, and especially its roles in social policy (affordable housing) and as an investment class, the sector continues to attract enormous attention from investors and policy makers alike. Much of this attention has focussed on property price increases in the context of high market liquidity and rapid credit growth (Chart 2). In the view of many observers, these price increases have generated risks of asset price bubbles that, if left unchecked, could threaten economic and financial stability. Aware of such risks, including the need to maintain housing affordability for lower income segments of the population, the Chinese authorities have implemented a series of measures over the past 18 months to cool the market.

This is our third annual Real Estate Outlook on China. As in the previous year, we update recent developments in the property sector, including an evaluation of policies to cool the market and maintain housing affordability for lower income segments of the population. We also extend our analytical framework based on a model of supply and demand to asses how prices in the larger cities have evolved relative to underlying fundamentals.

Encouragingly, we find that price increases over the past year have moderated somewhat and that risks of a sharp downward correction, which we flagged in our two previous reports, have eased. In particular, our estimate of the degree of overvaluation of current prices relative to fundamentals has narrowed in comparison to last year's assessment, due both to improvements in our modelling and estimation techniques, as well as a moderation in actual price increases. The latter owes much to the authorities' efforts to reign in liquidity, tighten credit, and intensify macro-prudential measures.

That said, important challenges remain. In particular, measures of housing affordability have deteriorated further over the past year, placing a premium on the success of the authorities' ambitious efforts to encourage investment in affordable housing. In this regard, our report draws

on lessons from international experience with financing and land use policies for affordable housing. In addition, while the gap has narrowed, our estimates show that market prices still remain above those that would be justified by fundamentals, implying that a modest downward correction of prices may still occur and/or that the price increases going forward will be modest for some time.

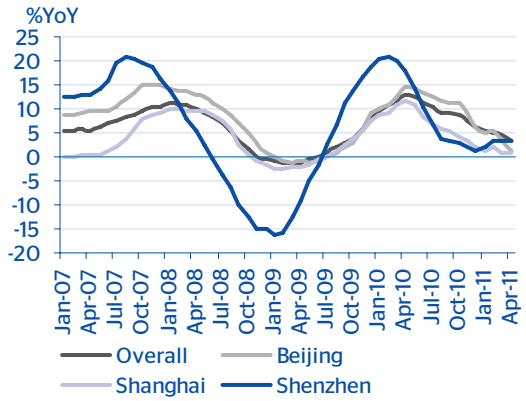
As in previous reports, we draw a distinction between short-term and long-term prospects. In the near term, although prospects for a hard-landing for the property market are remote due to strong income growth and demand, downside risks dominate the outlook. Over the longer term, however, we maintain our view that China's rapid projected income growth and urbanization favor an increase in prices.

The report is organized as follows. Section 2 reviews and updates recent policies to tame fluctuations in price movements. It assesses the impact of these policies and the implications for the near-term outlook for the property sector. Section 3 extends our econometric model of supply and demand by expanding our sample size to cover a much larger number of cities and municipalities (from 6 previously to 35 at present) and including a forward-looking variable (projected income growth) as a factor in determining equilibrium prices. The absence of such a variable in our previous work was a major shortcoming, which the present report now addresses. Section 4 presents our assessment of the medium-term outlook by projecting our supply and demand framework forward over the next decade. Finally, in section 5 we provide some case studies of international experience, which may be useful for drawing lessons for the authorities' social-housing program.

2. Recent Developments and Outlook for the Housing Market

China's housing market has cooled over the past year as the authorities continue to implement monetary tightening and macro-prudential measures. According to NBS data covering 70 major cities, price increases and sales transaction volumes have moderated.[1] In particular, the pace of housing price increases peaked in April 2010, at 13% nation-wide in year-on-year terms, before moderating steadily to just 4% as of May 2011 (Chart 3) (the trends are broadly similar in month-on-month terms). Meanwhile, transactions volumes have also declined (Chart 4).

Chart 3
The rise and fall of property prices



Source: NBS, CEIC and BBVA Research

Chart 4
Sales volume growth has fallen rapidly

Source: NBS, CEIC and BBVA Research

2.1 New measures to tame the housing market

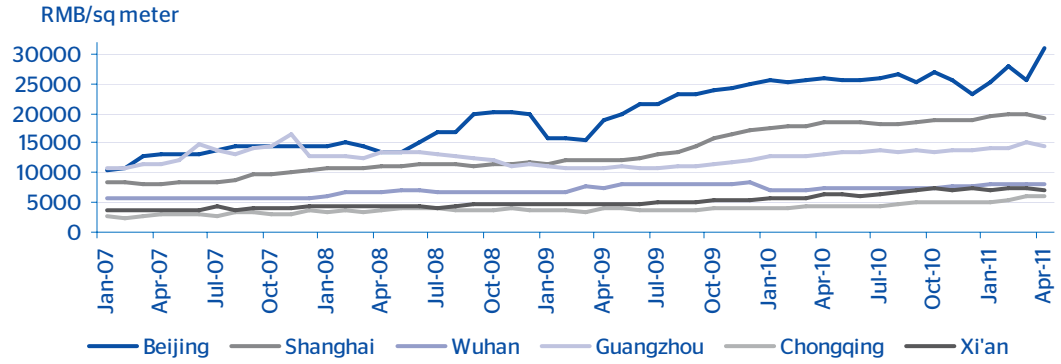
Over the past year the authorities have continued to implement tightening measures to cool the property market (see Box 1 for further details). The most significant of these were undertaken in two new rounds, in October 2010 and January 2011. Most notably, in October the enforcement of down payment requirements was stepped up, and a prohibition of mortgages for third home purchases was implemented. In addition, the discount from the benchmark lending rate that banks are allowed to apply on mortgages for first-home purchases was reduced. In January, purchase restrictions were imposed in large- and medium-sized cities, the central government began requiring municipal governments to set lower targets for property price increases, and a property tax was introduced on a trial basis in Shanghai and Chongqing on new home purchases.

2.2 Signs of moderation

The cumulative effect of the latest round of tightening measures appears to have succeeded in cooling the market. In particular, the pace of increases has moderated, and has even turned negative in some cities (Chart 5).[2] Nevertheless, price levels remain high by historical standards, and there has been a further erosion of housing affordability (Chart 6). In addition, while price increases have moderated, rents have been catching up with a lag (Chart 7), causing the price-to-rental ratio to level off (which, on the other side of the debate, is used as a measure by many observers to conclude that current price levels are not significantly misaligned). Taken together, therefore, we conclude that the government's measures have had their intended effect, but that further measures may be needed to limit the pace of further price increases and restore affordability.

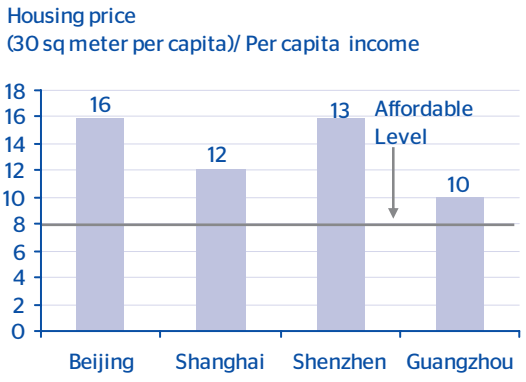
[1] In January 2011 the NBS discontinued publishing an aggregate housing price index, providing instead individual city-level data for new and existing home sales, respectively. To maintain continuity with the pre-2011 data series, we aggregated the individual city-level housing price index (see appendix for details).
[2] Chart 5 is based on NDRC data, which are concentrated in downtown locations, and may be a more precise gauge of housing trends in large cities, as NBS data tend to cover a broader regional area. For example, NBS data suggest that 2009 residential prices in Beijing averaged RMB 13,799 per square meter, while the NDRC survey suggests a much higher figure, of RMB 21,940 per square meter.

Chart 5
Downtown price trends in major cities



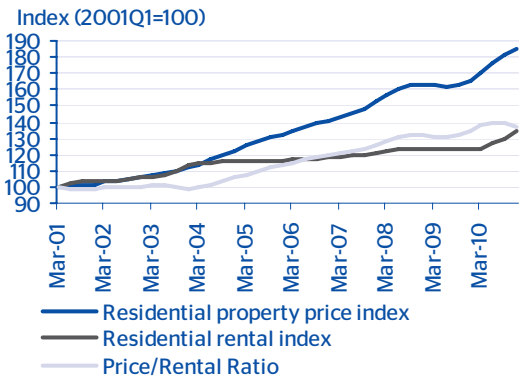
Source: NDRC, CEIC and BBVA Research

Chart 6
Prices are stretching affordability levels



Source: NBS, WIND, and BBVA Research

Chart 7
Price/rental ratios have leveled off, but mainly because of an increase in rents

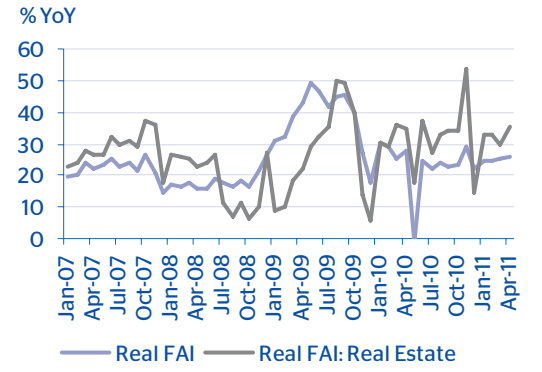


Source: NBS, CEIC and BBVA Research

Transactions volumes have moderated and inventories have risen...

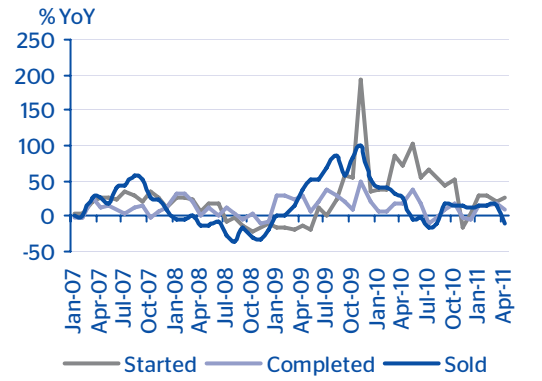
Beyond the impact on prices, the tightening measures appear to have had a significant cooling effect on the volume of transactions (Chart 4 above). At a nation-wide level, transaction volumes contracted in mid-2010 before recovering again toward the end of the year, but at a much lower level than in the preceding period. Some individual markets were affected especially hard by the tightening measures, with Beijing and Shanghai witnessing a continuous contraction in sales volumes since the second half of 2010. In addition to the stricter financing requirements and restrictions on purchases, the decline in sales volumes may well be due to purchasers postponing their decision to buy on expectations of further price declines in the period ahead. At the same time, downward prices adjustments may be sluggish due to the oligopolistic behavior of developers, who rightly expect prices to stay strong over the medium term given projections of strong demand and scarcity of supply, especially in the larger cities. An acceleration in construction of new homes during the second half of 2009 (Charts 8 and 9), and the decline in sales transactions has led to an increase in inventories of unsold housing.

Chart 8
Investment growth in real estate remains high



Source: CEIC and BBVA Research

Chart 9
Floor space dynamics

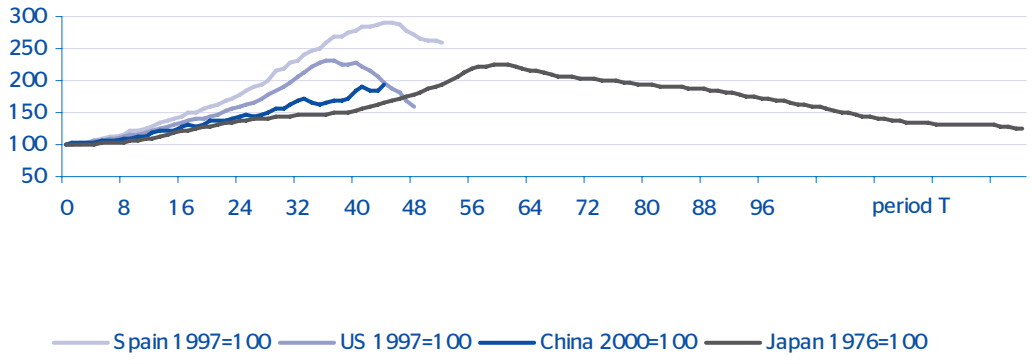


Source: CEIC and BBVA Research

... by international standards, China's housing price increases are not alarming

Following on our analysis of international experience with housing price bubbles in last year's report, Chart 10 below updates recent price developments in China. Set against the infamous bubbles of Spain, the US, and Japan, the rise in price levels in China are still below the respective peaks in those economies, and the pace of increase has been slower than was the case in Spain and the US. That said, the ongoing increase in prices does bear similarities to the run-up in Japan, justifying the authorities' interest in preventing further rapid increases.

Chart 10
International comparison of price bubbles



Source: CEIC and BBVA Research

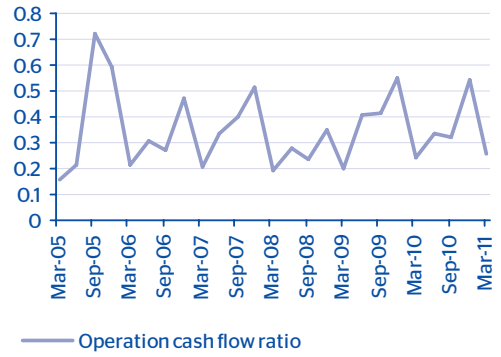
... financial risks still appear manageable

Despite concerns that real estate developers may be increasingly financially constrained (due to credit tightening) such that they might clean off inventory and ignite price wars that could lead to a market crash, we do not yet find this supported by data. It is true that loans to real estate developers have accelerated in the past few years. However, loans to real estate developers have actually declined relative to building sales (a proxy for operating cash flow) during the same period (Chart 11). In other words, the higher leverage in the real estate sector after the global financial crisis has been supported by even higher revenues from building sales. However, as transaction volumes contract, the debt-to-sales ratio may deteriorate. If the trend continues, liquidity risk could become an issue.

In the meantime, since the period of the global financial crisis, leverage risk in the real estate sector has declined, as the interest coverage ratio (proxied by sales net of investment, divided by interest expenses) has recovered to its previous level (Chart 12). Of course given that real estate loans and

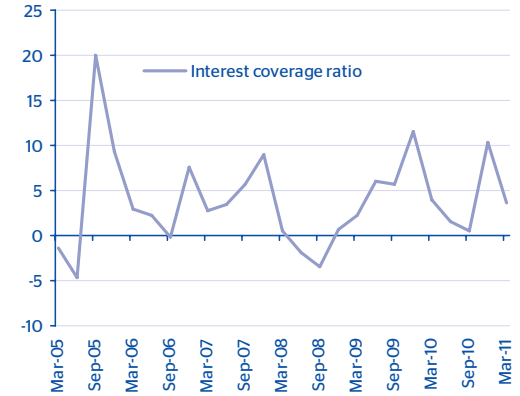
mortgages are now more restricted and have declined (Chart 13), liquidity in the sector will remain the most pressing issue.

Chart 11
Operating cash-flow ratio of real estate developers



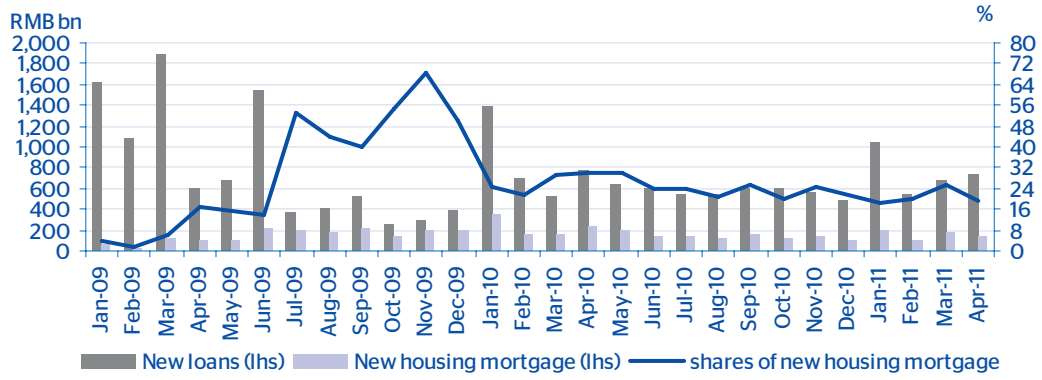
Source: CEIC and BBVA Research

Chart 12
Interest coverage ratio of real estate developers



Source: CEIC and BBVA Research

Chart 13
New mortgage loans



Source: CEIC and BBVA Research

... limited impact of social housing on market prices

Another potential concern in the market are the proposed plans for massive construction of social housing, which may significantly increase the supply of housing and reduce prices. Although it is unclear how much such low-cost housing may draw away potential demand from the commercial housing market, the impact in the short-term appears limited because the scale of new public housing supply in major cities is likely to be relatively small (see Section 5 below for further discussion and details of the social housing program).

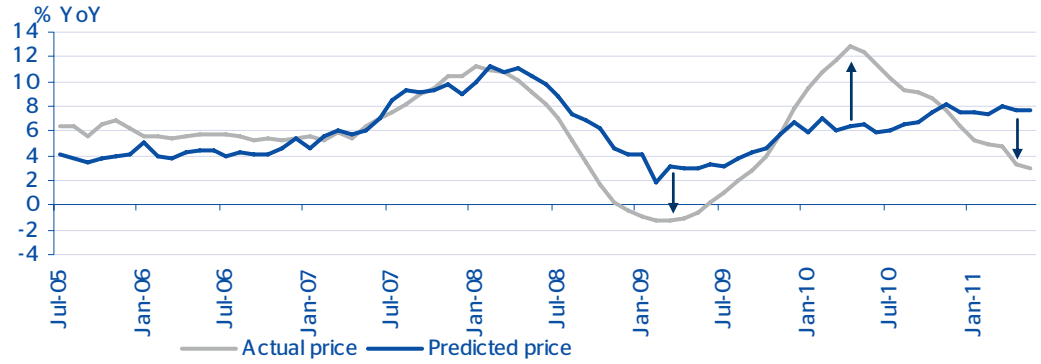
2.3 Macroeconomic drivers of recent price dynamics

In this section, we seek to determine the influence of monetary factors, in particular money supply growth and inflation, in explaining the recent evolution of housing prices in China. This follows from the international comparison in last year's report, in which we noted that a common characteristic among housing bubble case-studies is the presence of lax liquidity and rapid bank lending. Rapid money supply growth is associated with rapid credit growth, and demand for housing, and hence prices, tend to rise as a hedge against inflation.

To assess the influence of macro factors in China, we constructed a time series model to quantify the impact of money supply and inflation on China's housing price developments (see appendix

for details of the methodology). Our results confirm the role of these factors in determining recent housing price fluctuations, particularly from 2005-08 (Chart 14). Since the beginning of 2009, however, price fluctuations have been more volatile than that predicted by the model. In particular, the decline in price trends in 2009, the subsequent run-up in prices during 2010, and the more recent decline in 2011 have all exceeded the model's prediction. We attribute the 2009 decline to the spillover effects of the global financial crisis, the 2010 run-up to speculative behavior exacerbated by the government stimulus package, and the recent moderation to the cooling measures, none of which are captured directly by the macro variables in the model.

Chart 14
Actual and predicted housing price growth



Source: CEIC and BBVA Research

2.4 Perspectives from the ground

While monetary tightening and macro prudential measures to cool the property market have generated market concerns of a hard landing, our survey results show that participants on the ground generally do not share such concerns. To gauge such views, in preparation of this report a survey was distributed to property market agents in CITIC branches of 19 cities in China (see Box 2 for details). The responses and views from the ground are generally consistent with NBS data showing a gradual moderating trend in housing price increases. Most of the participants surveyed believe that price excesses are either small or non-existent. Only a handful of respondents report signs of price bubbles and expect a significant correction, a conclusion that applies in both large and small cities. Respondents' expectations of a continuation of upward price movements in the near term are based on their perception of solid demand stemming from robust economic growth and urbanization, as well as supply-side factors, especially limited land supply.

Box 1: Measures to cool the property market

Table 1
Chronology of Real Estate Policy Measures, 2009-11

Date	Policy Description
Dec 2009	Increasing the supply of social housing, controlling speculative demand, strengthening market regulations and promoting the construction for social security housing projects.
January 2010	The central bank begins raising yields on one-year bills.
January 2010	Increasing the effective supply of social housing, regulating housing demand, discouraging speculative demand. Down payment ratio of second mortgage must be no less than 40%
April 2010	Curbing unreasonable housing demand, more restrictive regulation of financing activities and land purchases by real estate developers
April 2010	Announcement of the possibility of introducing a property tax on a pilot basis in Shanghai, Beijing, Shenzhen and Chongqing. (The property tax is said to be 1.2 – 1.5% of 70% of the historical transaction value of each home.)
April 2010	The State Council decides to tighten mortgage rates and down payment requirements. Details include: 1) Second home buyers are required to pay 50% down payment instead of 40%. Mortgage rates are also raised to 1.1 times the benchmark mortgage rate of 5.94% vs previously 0.8-0.85 times the benchmark rate. 2) Banks are required to impose higher down payments for buyers of third or more homes, although it did not specific the percentage. 3) First-time home buyers of units larger than 90 sqm have to put down a 30% down payment, increased from 20%.
April 2010	Bank of China (BOC) becomes one of the first state banks to announce adjustments in existing customers' mortgage contract requirements upon expiry to current market standards. Existing mortgagees' will be required to follow terms of: 1) A minimum 30% down payment for first home buyers purchasing units less than 90 sqm, and 0.85 times the benchmark rate of 5.94%; 2) A minimum 50% down payment for second home buyers and 1.1 times the benchmark rate of 5.94%; 3) 1.2 times the benchmark rate (5.94%) for third or more homes. For third or above home buyers, BOC reserves the right to require a larger than 50% down payment or not approve the mortgage applications, if the applicants show a high-risk credit profile.
June 2010	MHURD, PBOC & BOC jointly issue a statement to enforce 2nd home buyer/mortgage definition. With immediate effect, the following will be counted as 2nd home purchases and extended with 2nd or above mortgage terms: 1) Buyers that own at least 1 property; 2) Ownership to be defined according to family as a unit, instead of number of persons; 3) Buyers even with paid-off mortgage liabilities will still be counted as second home purchasers; 4) Non- local buyers without at least one year of local tax records or social securities records will be considered as a second home buyer according to different banks.
October 2010	Mortgage loans for 3rd or more homes are banned nationwide; the minimum down payment ratio is raised to 50% and mortgage rates are set at 1.1 times the PBOC's benchmark lending rate; the minimum down payment ratio for first home purchase is set at 30%; loans to developers with a record of regulation violations are suspended.
October 2010	Adjustment of the deed tax rates and preferential personal income tax rates: 1) For purchases of single and ordinary homes, the deed tax rate is halved, and for the purchases of such homes smaller than 90 sq.m., the rate is reduced to 1.0%. 2) For those who sell their self-use homes and then purchase a new home within one year, the personal income tax is no longer exempted.
October 2010	The CBRC reduces the discount that banks are allowed to apply on mortgages for first-home purchases. The new discount is set at 15%, from 30% previously. (The 30% mortgage rate discount for first home purchases was launched in 2008 as part of China's stimulus package.)
Nov 2010	Restrictions announced on provident fund loans, with the interest rate for second houses raised by 10%. Second home purchases by provident fund loans apply only to ordinary housing to improve living conditions; first instalment shall be no less than 50%, and interest rates cannot be lower than 1.1 times of the rate set for the first housing provident fund loan.
Nov 2010	Ministry of Housing and Urban Rural Development and SAFE jointly announce restrictions on home purchases by non-residents. According to the measure, a foreigner can at most buy one house for personal residence under the condition that he or she can provide the proof of working in China for more than a year. For residents of Hong Kong, Macao and overseas Chinese, the measure still applies with minor relaxations.
Jan 2011	The State Council unveils 8 new measures to toughen curbs on the property market: 1) Require local governments to set housing price targets in line with local income levels for 2011; 2) Accelerate the construction of social security residential properties; 3) Business tax for housing sales within 5 years of purchase must be levied on total sales value; 4) The down payment ratio for second-home purchases must not be less than 60%, up from 50%, with interest rate at least 1.1 times of the benchmark rate; 5) Strengthen the management of land supply for housing; 6) Purchase restrictions imposed in all large- & medium-sized cities. Families already owning a property are restricted to buy only one more, while those already owning 2 or more properties are prohibited to purchase additional properties; 7) Strict implementation & accountability for local governments over the housing price control targets; 8) Improvements in guidance for media's housing market coverage.
Jan 2011	Shanghai and Chongqing announce the long-expected property tax on trial basis, to be imposed on new purchases.
Jan 2011	The State Council requires local governments to publish and meet their annual housing price targets (set in line with the income growth of their regions).
March 2011	The National People's Congress (NPC) passed the 12th five-year plan of 2011-2015, in which the central government targets to build up 36 million units of public housing in next five years (10 million units in 2011).
May 2011	NDRC begins to impose a "one house one price" policy, under which developers are required to enhance public information disclosure about the offering price and available supply volume when selling residential properties.
June 2011	NDRC permits the local government financing vehicles (LGFVs) to issue bonds to finance the public housing program.

Source: Media reports, press releases, and Government websites

Box 2: Views from the ground based on questionnaires

To collect local market views, CITIC Bank made use of its nationwide network to distribute questionnaires to its main branches in 19 first and second tier cities. The questionnaires were distributed to managers of local branches in May and June of 2011. They sought to garner views and perceptions on recent price developments in local real estate and land markets, the existence and size of any housing price bubbles, the outlook for price trends in the coming years, the effects of housing market developments on economic growth, and the effectiveness of government measures. The key findings are summarized as follows:

1. In the past five months, perceptions are that housing prices in most cities have continued to rise, albeit at a moderating pace: out of 19 cities, only in Nanjing and Dalian do participants perceive there to have been a slight decline in prices. Participants in most cities (12 of the 19) thought there has been a decline in transaction volumes. Two respondents thought transaction volumes have been stable, with another two seeing an increase. These perceptions are broadly consistent with information from other data sources, which suggest a moderating trend in price increases, and a decline in transactions volumes.
2. Perceptions are that the land market has followed a similar pattern to the broader real estate market: moderating price increases and declines in transaction volumes. Participants in only four cities thought there has been a decline in land prices, while participants in two cities saw an increase in land prices, with only one respondent reporting stable land prices. Meanwhile, participants in 11 cities have seen no change in land prices.
3. Regarding the existence of housing price bubbles, participants in most cities believe there to be either small or no bubbles in local real estate markets. Participants in only five cities (Shenzhen, Nanning, Nanchang, Suzhou, and Hefei) believe that significant bubbles exist (defined as at least a 10% over valuation). Participants in five cities (Nanjing, Nanning, Beijing, Chengdu and Tangshan) expect a downward correction of prices in the coming year. For the medium term, participants in all cities expect housing prices to continue to rise.
4. Respondents believe that housing prices will be supported by both demand and supply factors. On the demand side, respondents expect support from continuing urbanization, income growth, and investor demand as a hedge against inflation; on the supply side, limited availability of urban land, high land cost, improvements to complementary infrastructure, and strategic location are the main support factors that were cited.
5. Participants in most cities perceive that local governments have implemented their intended real estate policies effectively. They also view local housing price targets of local governments as reasonable. Regarding the effectiveness of real estate policies of the central government, most report that restrictions on home purchases and mortgage policies have been most effective in controlling housing prices, while there is no consensus on the effectiveness of policies for real estate loans and affordable housing.

Questionnaire

1. How have transaction prices and volumes evolved during the first five months of 2011 for both newly built and existing homes in the region of your branch?
2. How have transaction prices and volumes evolved in the land market (including both residential and commercial) during the same period?
3. Are local housing prices under or over-valued in your view? If so, by how much? What are the reasons?
4. What is your view on the outlook of local housing prices in the coming year? If prices are expected to rise or fall, by how much?
5. What do you think of the effectiveness of recent real estate policies of the central government: policies for real estate loans; mortgage policies; restrictions on for home purchase; affordable housing policies?
6. What do you think will be the impact of these policies on local economic growth?
7. How effectively do you think the local government has enacted its intended real estate policies? Are price targets set by the local government reasonable and feasible?

Table 2
Summary of Local Real Estate Market Questionnaires

Cities	*Housing prices*	*Transaction volume*	*Land prices*	*Land transaction volume*	*Size of bubbles*	*Housing price (in 1 yr)*	*Housing price (over 1 yr)*	*Effectiveness of real estate policies*
Beijing	rose slightly	declined slightly	rose	declined	no bubbles	decline 10%	rise	effective
Shanghai	declined slightly	declined	-	-	some bubbles	rise <= 5%	-	-
Shenzhen	rose	declined slightly	-	declined	significant bubbles	rise<=10%	rise	less effective
Hangzhou	rose	rose	stable	declined	no bubbles	rise 10%	-	effective
Changchun	stable	declined slightly	-	-	no bubbles	rise <= 10%		-
Changsha	stable	declined	-	-	some bubbles	rise	-	-
Chengdu	-	-	declined	declined	no bubbles	decline <=10-15%	rise	less effective
Dalian	declined slightly	declined slightly	declined slightly	declined	no bubbles	stable	rise	effective
Fuzhou	rose	declined slightly	-	stable	unclear	rise 5%	-	effective
Guiyang	stable	declined slightly		-	no bubbles	rise <= 10%	-	-
Haerbin	rose	declined	-	-	no bubbles	rise steadily	-	-
Hefei	-	-	declined	rose	10-30% of bubbles	rise 5-10%	rise	less effective
Jinan	stable	declined	stable	-	no bubbles	rise 5-10%	rise	effective
Kunming	stable	declined slightly	-	declined	no bubbles	rise steadily	-	-
Lanzhou	declined	declined	-	-	no bubbles	rise <= 10%	-	-
Nanchang	rose	rose	-	stable	10-15% of bubbles	rise 8-10%	-	less effective
Nanjing	rose slightly	declined slightly	rose	declined	no bubbles	decline 10-15%	rise	effective
Nanning	declined slightly	declined slightly	-	declined	significant bubbles	decline 10-15%	rise	less effective
Shijiazhuang	rose	rose	-	-	some bubbles	rise <= 10%	-	-
Suzhou	rose	stable	-	-	10% of bubbles	-	-	effective
Taiyuan	rose slightly	declined slightly	-	-	small bubbles	rise slightly	rise	effective
Tangshan	-	-	-	-	no bubbles	decline 5%	-	less effective
Tianjin	rose	stable	declined	declined	-	rise 10%	-	effective
Xiamen	rose slightly	declined slightly	-	-	no bubbles	rise 10%	rise	effective
Xi'an	-	declined slightly	-	declined	small bubbles	rise 5%	rise	effective
Zhengzhou	-	declined slightly	-	-	-	rise <= 10%	-	effective

Source: Citics and BBVA Research

3. Re-assessing the Misalignment of China's Housing Prices

An improved model of supply and demand...

Following on last year's report, we update our empirical model of supply and demand to estimate the degree of misalignment between actual and equilibrium housing price values in China's largest cities. Beyond updating the model with new data through mid-2011, we address various shortcomings in the framework by strengthening the estimation technique and improving the model's structure to incorporate forward-looking variables.

In particular, we expand the sample coverage from China's largest six metropolitan areas (Beijing, Shanghai, Shenzhen, Guangzhou, Chongqing and Tianjin) to 35 major cities and municipalities for which data are available (in so doing, we augment our model to take advantage of a panel-data structure). To incorporate forward-looking variables—a major shortcoming of our previous framework—we include future expected income into our model. Nevertheless, given remaining limitations of the model, uncertain data quality, and the complexities of an analysis such as this, the results are intended as suggestive only, rather than as a prediction of near-term price levels.

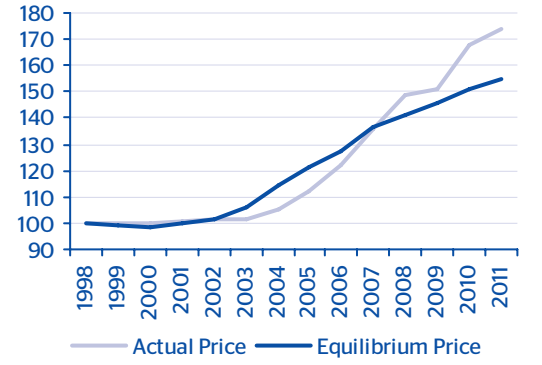
With these refinements, the general modelling framework follows our previous report. Equilibrium prices are estimated with an econometric model based on a demand and supply framework (see the Appendix for details). The underlying factors in the model include real income growth, population density, and construction costs. These factors determine the equilibrium prices by affecting housing demand and supply. In general, higher real income growth and higher population density will increase housing demand and result in higher equilibrium prices, all else equal. On the other hand, higher construction costs and higher interest rates on real estate loans will reduce housing supply, also driving up equilibrium prices.

Current price levels modestly exceed equilibrium...

As was the case with our estimates last year, we continue to find that current housing prices are generally higher than those predicted by the model based on fundamentals. Importantly, however, we find that the degree of misalignment (7%) is smaller than we estimated previously (22%), due to a combination of the larger sample size (narrowing the misalignment by 5 percentage points) and improvements in our estimation and modelling techniques discussed above (narrowing the misalignment by 10 percentage points). The recent moderation in price increases has prevented the misalignment from getting larger, as price increases (4% year-on-year) have been in line with the increase in estimated equilibrium prices.

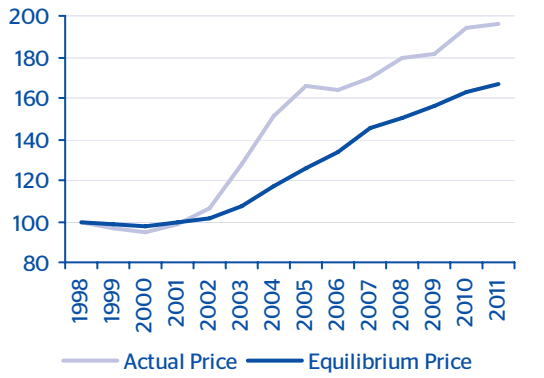
According to our model results, in the first quarter of 2011, housing prices in all of the six large metropolitan areas with the exception of Guangzhou were higher than the estimated equilibrium levels, by some 10-20 percent (compared to our estimates last year of 20-30 percent). The results point to excessive valuation going back to 2003 (for Shanghai) and 2007 for the other cities.

Chart 15
Beijing



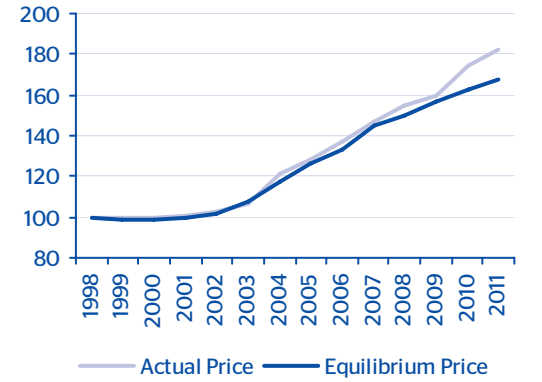
Source: CEIC and BBVA Research

Chart 16
Shanghai



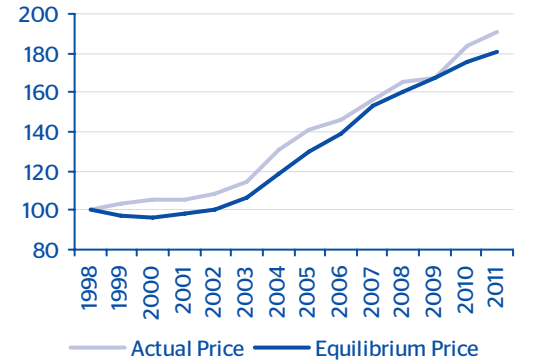
Source: CEIC and BBVA Research

Chart 17
Tianjin



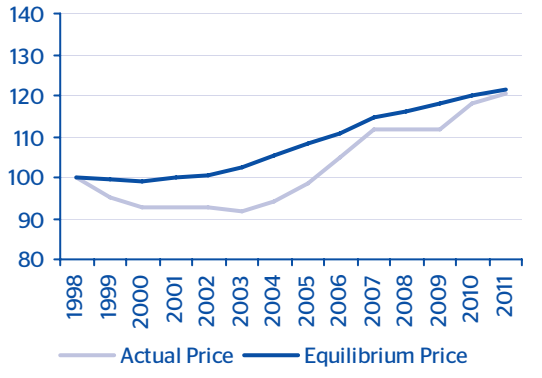
Source: CEIC and BBVA Research

Chart 18
Chongqing



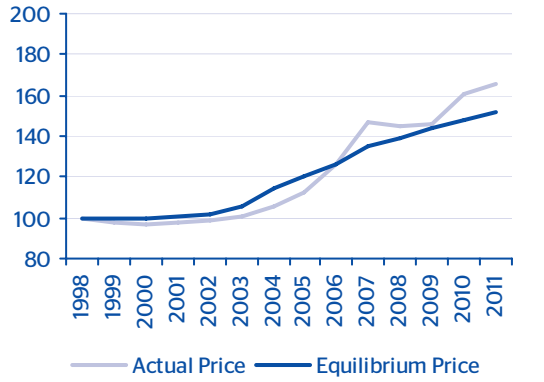
Source: CEIC and BBVA Research

Chart 19
Guangzhou



Source: CEIC and BBVA Research

Chart 20
Shenzhen



Source: CEIC and BBVA Research

For **Beijing**, actual prices are estimated to have crossed above equilibrium prices in 2007 (Chart 16). Since 2004, actual prices have risen rapidly, by 75% over the last 7 years, outstripping fundamental factors determining demand, of around 60%, largely driven by population growth and rapid income growth. Our model estimates suggest a 13% of overvaluation on average in Beijing's housing prices in the first quarter of 2011.

In **Shanghai**, our estimates show that actual property prices were mostly aligned with equilibrium prices before 2003 (Chart 17). After 2004, actual prices rose rapidly and the deviation from equilibrium prices has been expanding. Actual residential property prices have risen by over 80% since 2003. However, propelled by high income growth and limited supply of housing stocks, our model estimates suggest that equilibrium prices have also been rising quickly. Over the same period, they have increased by around 60%. Our estimates suggest a 12% overvaluation relative to equilibrium in Shanghai's housing prices in early 2011.

In **Shenzhen**, our estimates show that, until 2006 actual residential property prices were below estimated equilibrium prices (Chart 21). However, since 2007 actual prices have risen above the estimated equilibrium. During the global financial crisis, actual prices fell, while equilibrium prices grew slightly. Actual prices bounced back quickly in 2009. The deviation between actual and equilibrium prices is estimated to be around 9% in 2011.

Guangzhou's property price developments are the outlier in our sample (Chart 20). According to our estimates, actual prices have remained below equilibrium property prices throughout the sample period. The undervaluation was as much as 10 percent in 2003, but actual prices rebounded back and converged towards the equilibrium prices after 2004. We estimate that the deviation turned negative, to -3%, in 2011.

In **Chongqing**, to the contrary, although equilibrium prices rose faster than other metropolitan areas, by around 80 percent, actual property prices rose even faster, by around 100 percent. Hence, actual property prices have been consistently higher than the equilibrium prices around 12% in 2011 (Chart 19).

Tianjin's actual property prices have been well aligned with the equilibrium prices throughout our sample period, but show some recent sign of increasing misalignment (Chart 18). Our model estimates suggest that equilibrium prices have increased by over 60% over the same period, led by higher construction costs, steady growth in per capita real income and limited growth in urban population. Actual prices increase by around 80 percent. As a result, Tianjin's overvaluation is estimated at 10% in 2011.

To facilitate comparison, we summarize information for six metropolitan areas (Table 3). From 1999 to 2010, actual prices increased by about 6.2% on average per year in these six areas; on the other hand, equilibrium prices increased by 5.0% on average. The rise in equilibrium prices have been supported by rapid increases in real income (9.6% per year on average), population growth (3.3% per year on average), and rising construction costs (1% per year on average).

Table 3

Housing Fundamentals and Price Levels by City

	Average growth, 1999-2010					*Estimated Over-valuation (2011Q1)*
%	*Real income*	*Construction costs*	*Population density*	*Actual prices*	*Equil. prices*	
Beijing	11.0	0.4	3.0	6.2	4.8	+13.6
Shanghai	10.1	0.3	2.6	9.3	5.9	+12.4
Shenzhen	3.8	0.6	9.8	5.8	4.4	+8.7
Guangzhou	9.3	1.2	2.8	2.2	1.9	-3.3
Chongqing	11.4	1.4	-0.5	7.1	7.3	+11.5
Tianjin	11.7	2.1	1.7	6.8	5.8	+10.0
Average	9.6	1.0	3.3	6.2	5.0	+8.8

Source: BBVA Research

In conclusion, it appears that most regional markets, with the exception of Guangzhou, are experiencing a degree of overvaluation, and that some near-term correction is likely. We emphasize that these estimates are suggestive only, given limitations to the model. Overvaluation of property prices in these cities can be eliminated gradually as housing prices moderate, making a hard landing scenario unlikely.

We can also apply our results to the remaining 29 cities in our sample. These cities show a mixed pattern of price misalignments. In particular, cities in the Yangtze River Delta region show significant signs of overvaluation, including Nanjing, Hangzhou, and Ningbo. The Northwestern regions, including Urumqi, Lanzhou, and Yinchuan have seen prices increasing faster than

equilibrium since the "Go-West" policy. Most of the remaining second-tier cities show either aligned or under-valued housing prices. Notably, a number of cities with strong growth potential have seen housing prices lagging behind estimated equilibrium values, including in the Northeast (Changchun and Harbin in particular) and Southwest regions (including Kunming and Nanning). Our model suggests that these latter markets may present the most promising investment opportunities.

Box 3: A survey of price misalignments from the literature

This box surveys recent findings on housing prices in China from a spectrum of research (see reference). In general, our conclusions are consistent with the more optimistic end of the literature arguing that there is little evidence of a severe misalignment (or bubble). Table 4 summarizes the key results of the studies surveyed.

The key question in the studies surveyed is whether there are price bubbles in the real estate market? At one end, researchers from the HKMA and BIS (Ahuja, Cheung et al, 2010, Peng and Tam, 2008, Glindro et al., 2010) conclude that housing prices in China are generally not overvalued, but that the mass-market segment in certain pockets, such as in Shanghai and Shenzhen as well as the luxury segments in Beijing and Nanjing, do show signs of price misalignment. The first two studies (by HKMA) consider only regions in China, while the third study compares cities across Asia.

At the other end, studies by the NBER (Wu, Gyourko and Deng, 2010) and the University of Nottingham (Yao, Luo and Loh, 2011) find evidence of property price bubbles, and suggest that a housing market crash in the future is highly likely. Wu, Gyourko and Deng (2010) compare housing prices and rental rates for major cities of China, while Yao, Luo and Loh (2011) apply time-series econometrics to aggregate data of China.

There is no consensus in the literature on the major factors driving property prices in China, probably because of the different sample periods considered and the different methodologies applied. Some studies support the effects of fundamentals in driving price movements, including economic growth and urbanization. Other studies find evidence for the relevance of bank lending and monetary conditions.

There is some evidence showing that government measures matter. In an IMF-HKMA study, Ahuja, Cheung et al (2010), find that government policy implemented in April 2010 has generally narrowed the gap between market prices and their fundamentals, but mass-market prices continue to remain misaligned in some cities. However, current government regulatory measures may be sufficient, as credit controls do not directly affect benchmark prices.

Our study builds on the existing literature and extends the results in several ways. In particular, as discussed in the main text, we estimate two models, one based on a time-series approach and the other using panel data. The time series model and data are similar to those used in Yao, Luo, and Loh (2011) but instead of running bivariate Granger causality models, we consider a single-equation model of housing price increases. Similar to that study, we also find that money supply growth is important for the housing price movement in China, and we seek to use this information to provide a forecast of the housing price growth in the short term. Our panel data model also has a relatively broad coverage (35 cities), and includes an income expectations variable, which has a significant effect.

Table 4
Summary of Findings of Studies on China's Housing Market

Studies	***Bubble***	***Factors driving property price***	***Type of study***
HKMA, Peng and Tam (2008)	Likely in coastal regions	• Income growth • Urbanization • Mortgage credits • Local governments	Dynamic panel-data model of real property price growth applied to 31 provinces and major cities, 1998-2004. Price rent relationship.
IMF, HKMA Ahuja, Cheung et al (2010)	Likely in coastal regions	• Bank lending • Fundamentals • Government measures	Dynamic OLS model of property prices (with correction towards fundamentals), applied to 35 cities, 2000-2009. Price-rent (asset pricing) approach.
NBER,Tsinghua, NUS, UPenn, Wu, Gyourko and Deng (2010)	Strong support	• State-owned enterprises • The 2008 stimulus Package • Speculation	Price-to-rent ratio, appled to 8 major cities, 2007-2010.
University of Nottingham, Yao, Luo and Loh (2011)	Strong support	• Speculation	Johanson's cointegration test and Granger Casality on asset prices and monetary policy, applied to monthly aggregate data, 2005-2010.
BIS, BSP,Bank of Thailand, HKMA, Glindro, Subhanij, Szeto and Zhu (2010)	Slight hubble in some markets	• Economic growth • Bank lending • Exchange rate • Land suplly • Institutions	Panel data model of housing price growth (with correction towards Fundamentals), applied to 32 cities in nine Asian economies, 1993-2006.

Source: See references in Section 6.

4. Medium-term Outlook

The outlook for China's real estate sector over the medium term is for continued strong growth. This is based on our expectation of continued strong trends in real income growth, urbanization, and construction spending. As such, equilibrium prices should continue to rise steadily with strong demand side support.

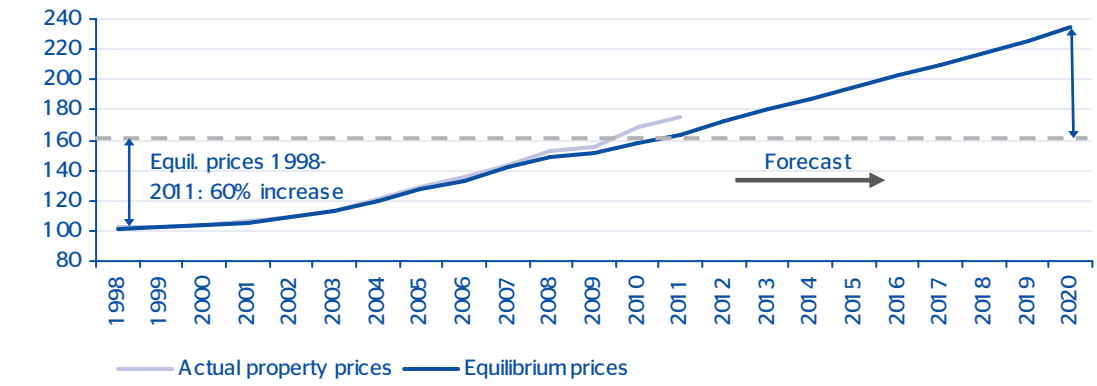
Using our updated model to project medium-term equilibrium housing values…

We can use our supply and demand framework to forecast the evolution of equilibrium housing values over the medium term (Chart 20). As noted previously, we have improved our estimates, in that we now include a forward-looking variable to capture the impact of expected income growth on current prices. Nevertheless, the resulting projections should be taken as suggestive given the model's remaining limitations and the usual uncertainties surrounding projections of this nature.

Our baseline projection through 2020 assumes real income growth of 10% per year, urbanization (measured as the growth in urban population) of 2% per year, and increase in housing supply of 7% per year. These assumptions are in line with recent trends and credible estimates of China's medium-term growth prospects, investment rates, and demographics.

We estimate that current housing prices are about 7% higher than equilibrium—as noted above, this is considerably lower than our previous estimates due to the moderation of price increases that has occurred over the past year, as well as improvements in our model structure that incorporate forward-looking income expectations, and the larger sample size. The relatively small degree of overvaluation at present suggests that, at an aggregate level, housing price bubbles are not a serious problem (although they may be in certain segments of the market or in certain cities). If price increases are contained in the next couple of years, it is possible that actual and equilibrium prices could converge in the not-too-distant figure, although in the meantime some modest downward pressure in nominal prices is still possible, especially in cities with the largest degree of overvaluation.

Chart 21
Actual and equilibrium housing prices



Note: Average residential housing prices in China's 35 big and middle-size cities.
Source: CEIC and BBVA Research

Medium-term policy challenges

Over the medium term the government will continue to face challenges in fostering a healthy real estate market. Although we estimate price misalignments to be quite modest at present, going forward affordability will remain a pressing social issue. To prevent distortions and speculation in the real estate market, sound financial incentives and tax policies, including the broader introduction of property tax, would be helpful. Meanwhile, local government fiscal reforms would help to remove incentives of local officials to use land sales as a main source of revenue, which would inevitably push up land prices and housing prices. One factor not adequately accounted for in our medium-term outlook is the potential market impact of the authorities' investment program in social housing. The 12th 5-year plan incorporates an ambitious target for the construction of 36 million units, and such a large increase in supply of such housing could affect the real estate market and housing prices. We address this issue in the next Section.

5. Provision of social housing

5.1 The government's plans

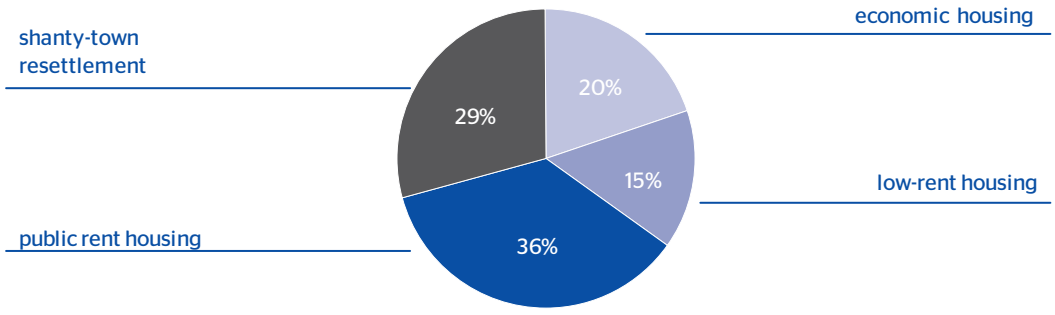
The concept of social housing as it is used today in China first appeared in 1998 when the authorities ended their practice of direct housing distribution and implemented market-based reforms. Taking into account affordability concerns for low income families, the authorities sought to develop social housing programs, as an integral part of a broader social safety net system. At the outset, the concept mainly consisted of "economic" and "low rent" housing (see below). But as housing affordability problems intensified, social housing initiatives have been amplified.

Responsibility for the construction and provision of social housing has been delegated to local governments, but with the central government assigning targets. As the local governments have little financial incentive on their own to provide social housing, the central government audits their progress in meeting targets. The central government also provides funds to local governments to cover part of the cost of social housing provision and encourages them to provide land. Due to the large funding requirements (described in detail below), the central government also engages commercial real estate developers, banks, and other social organizations in the provision of social housing.

The financing and land-use needs of such an ambitious plan are enormous. We estimate the funding needs at RMB 5.1 trillion over the next five years, of which about half is to be spent in 2011 and 2012, amounting to 3.1% and 2.5% of GDP, respectively. The central government has pledged to provide 7%-8% of total funding needs in 2011, with the local governments and private sectors to provide the remainder.

The challenges of land provision vary depending on the different categories of social housing (Chart 22). For example, land provision for shanty-town resettlement programs is automatic, since most of the original residents move back to the renovated region after short-term accommodation. As described in Box 4, the government is to sell land to developers for construction of economic housing (which includes price-cap housing), meaning that local governments can earn revenue from land sales. Meanwhile, land provision for low- and public-rent housing appears to be more problematic given the lack of incentives of local governments. To ease such constraints, the authorities have adopted various administrative measures to ensure the land provision for social housing.

Chart 22
Estimate of Affordable Housing Plans by Category (2011-15)



Source: BBVA Research and press reports

Box 4: China's approach to social housing

China's new 12th five-year development plan lays out a number of objectives and targets for social and economic development for 2011-15, with an emphasis on economic rebalancing toward private consumption, promotion of social wellbeing, and the development of new strategic industries. One of the plan's focus is to address the intensifying housing affordability problem, including the following key points, to:

- establish a housing system in which the government takes responsibility for providing social housing for low income households, while the market provides commercial property for relatively high income households;
- significantly increase the provision of social housing, especially for public-rent housing, which is envisaged to become the main body of the broader social housing program;
- encourage local governments to take responsibility for monitoring the property market, setting relevant targets, and eliminating speculation.

Although not contained in the Plan itself, the authorities have set a target to construct 36 million units during the period 2011-2015, among which 10 million units are to be completed in 2011. Social housing can be classified into the following:

Economic housing: the size of such housing is subject to strict limits and qualified purchasers' income must be below certain thresholds. In general, land for economic housing construction is provided by the government, enabling such units to be sold at a discount relative to the market price. After a fixed period, habitants of economic housing units are allowed to resell them on the condition of paying compensation to the government. Price-cap housing falls within this category: it is a new form of social housing in which the government sells land to developers at below-market price and then caps the housing selling price.

Low-rent housing: such housing is owned by the government and leased to qualified low income households at below-market rates. Land for construction and funding are mainly provided by the government. Low-rent housing units are not for sale.

Public-rent housing: a new form of social housing aimed to cater to the demand of households whose income levels fall between the thresholds required for economic housing and low rent housing. Unlike low-rent housing, public-rent housing can be sold to the tenants after satisfying certain requirements (including a residency period, income cap, and compensation to the government).

Shanty-town resettlement: this form of social housing is aimed at improving the well-being of low income households living in areas considered to be shanty towns (or "slums"). The government takes responsibility for renovating the shanty town and building social housing.

Table 5
Affordable Housing

Type	*Qualified household Income Level*	*Rent or Sale*	*Land provision, development mode and funding*
Price-Cap Housing	Midium low	sale; resale is allowed with certain restriction	Government sells the land to developers for construction, funding through developers
Economic Housing	low	sale; resale is allowed with certain restriction	Government provides the land and hires developers for construction; government owned the completed units, funding by government
Public-rent Housing	lower	Rent; sale is allowed with certain restriction	Government provides land and hires developer for construction; the government may invite social funds to participate
Low-rent Housing	Lowest	Rent; sale is not allowed	Government provides land and hires developer; funding from government budget

Source: BBVA Research and CEIC

5.2 Implications for the broader housing market

Given the ambitious size of government plans for construction of social housing in 2011-12, such investment is expected to be one of the key contributors to China's economic growth in the near term. Provision of public housing on the scale envisaged could also have important spillovers for the broader housing market, both positive and negative. While efforts to cool the commercial real estate market will generate headwinds to economic growth in the near term, the program of social housing provision will be an important offset.

At the same time, however, the provision of social housing might have crowding-out effects on the commercial market, on both the supply and demand sides. From the supply side, social housing will require large amounts of land which, all else equal, will restrict the availability of land for commercial real estate market. This may push up land and housing prices. Meanwhile, on the demand side, it may have a depressing effect on prices in the commercial market by acting as competition. Indeed, by 2015, social housing is expected to account for about 30% of total housing stocks, up from the current level of 10%. On balance, we believe that over the longer term, upward price pressures from the impact on the supply of land could outweigh the depressing effect from greater competition on the demand side. This is because of the limited availability of land designated for development which, given the authorities' efforts to protect land for agricultural use, is unlikely to be expanded significantly in the foreseeable future.

5.3 Lessons from international experience

Social housing, sometimes also referred to internationally as public, affordable, or low income housing, can be provided by governments, social organizations, cooperatives, or the private sector. The practice of government-provided social housing has become widespread internationally in recent decades, and accounts for around 20 percent of global housing.

In contrast to advanced economies, low-income economies have lagged behind given financial and other implementation constraints. On average, social housing is estimated to account for about 10% of total housing in low-income economies. Some Latin American governments are relatively more advanced, having constructed public housing equivalent to 15% of the housing stock in the majorl cities, for example, in Bogota, Caracas, Mexico City, and Santiago, and Brasilia. Among the most important determinants of the success or failure of affordable housing programs are land use and financing policies.

Box 5: International experience with social housing: finance and land use policies

In the box, we survey Latin American case studies with social housing, consisting of Mexico and Peru, to derive relevant lessons for China. Within Asia, Singapore and Hong Kong are useful references and, although their experiences are not surveyed here, some key features are provided below in Table 6.

1. Latin America's experience in the provision of affordable housing: Mexico and Peru

Mexico's Experience with Affordable Housing

Affordable housing finance

The federal government currently has four housing subsidy programs that operate through the Department of Social Development (Sedesol for Secretaría de Desarrollo Social) and the National Housing Commission (Conavi for Comisión Nacional de VIvienda). Sedesol is responsible for three of these: the Program for the Development of Priority Zones (PDZP for Programa para el Desarrollo de Zonas Prioritarias), the Your Home Program (Programa Tu Casa) and the Rural Housing Program (Programa Vivienda Rural). In turn, Conavi manages the program "Esta es tu casa" (This is your Home).

Sedesol's programs take the form of direct subsidies, targeting low income groups with no access to mortgage loans from a financial institution. The subsidies are lump sum and represent a fraction (ranging between 5% and 14%) of the total value for a new home for low income population. In terms of coverage, these programs reach nearly 800,000 families annually, accounting for around 2.5% of total homes (29 million). The total budget for these three programs, of around US$ 1 billion, is relatively small compared to total mortgage finance provided by commercial banks and government institutions (of nearly US$ 18billion in 2010). Conavi's programs also take the form of a lump sum subsidy, but require beneficiaries to have obtained a mortgage loan from either a private financial institution or a mortgage sponsor from the public sector (Infonavit or Fovissste). In 2010, a total of nearly 150,000 subsidies were granted through this program, accounting for one out of every four of the 610,000 mortgages granted nationally.

Land use policy

Legislation in Mexico allows municipalities to determine their land policies independently. Thus, until now, aside from some isolated experiences at the State level, there has been little progress in achieving a unified and fully coordinated land policy for the country. However, in recent years, the federal government has come up with a new model, called Sustainable and Integrated Urban Developments (DUIS for the Spanish acronym), under which land developers and homebuilder team up with the government (at the federal, state and municipal level), to guarantee not only affordable housing, but also adequate (and sustainable) urban infrastructure and services for the residents. So far, four DUIS have already been approved and are in the building process. Together, they will gather around 230,000 housing units, for nearly 900,000 people, mainly low income families. Although each DUIS varies in size, since all the development consists of newly built homes, this model will actually imply building full mid sized cities (of between 200,000-250,000 population) from scratch. The government is enthusiastic about this model, and plans to develop several more DUIS in the coming years.

Peru's Experience in Affordable Housing

Affordable housing finance

In Peru, government land auctions have been important to develop large affordable housing projects.

Under a supply-driven approach, the construction firm that offers to build and sell these houses at the lowest price (after meeting certain requirements) is allotted the project. The government, in turn, provides basic utilities, namely electricity, water, and sewage. On the demand side, the government channels public resources through the private financial system, granting financial facilities (eg. interest rates) and direct subsidies (when installments are paid on schedule). The most important programmes are "Mivivienda" (for houses with prices between US$ 18,000-60,000) and "Techo Propio" (for houses with prices between US$ 7,000 -18,000), the former directed to middle/low income households and the latter directed to low income households. Eligibility requirements include (i) not yet owning a house or land, and (ii) not having received government assistance previously to purchase or build a house.

Land use policy

The main problem relates to the supply of land for such projects, which is increasingly scarce in developed areas (central areas or districts). Therefore, the State is bidding some of this land, the largest, to be allocated to the development of social housing projects. However, the set of lands is limited, and efforts to bid can be cumbersome and time consuming. Meanwhile, the Government through the Ministry of Housing, Construction and Sanitation provides the necessary infrastructure. However, it should be noted that in some cases, given the lack of speed by the Government, the same promoter would be in charge of enabling the infrastructure to start the project earlier.

Table 6
Social housing in Hong Kong and Singapore

Social housing	*Hong Kong*	*Singapore*
Market share	30% of population reside in public rental houses; another 18% purchase public houses	85% of the population resides in publicly provided housing units
Fund sources	From the government, budget, facilitated through commercial auxiliary facilities like commercial building and parking lots to generate revenues	Compulsory 40-50% of personal income levies to form a public fund
Land policy	The government provides free land to construct affordable housing	The Housing & Development Board bids land for affordable housing from the government, at a well below market price.

Source: UNCHS, 1996: 200

2. Lessons for China's social housing initiatives

While some international experiences are considered more successful than others, there is generally no universally accepted "optimal" method. In addition, of course, countries will have to explore policies appropriate for their individual economic and social conditions.

Our review of international affordable housing finance and land uses policies can be summarized as follows:

First, few governments can afford on their own the costs associated with social housing. In addition, excessive government intervention can cause problems of inefficiency and corruption. The private sector is often better placed to expand housing operations to include much wider sections of the population including many of the lower income households (World Bank, 1993). Based on this experience, China may wish to seek public-private partnerships Furthermore, instead of focusing on the supply of affordable housing, the government can also use demand side methods to enhance affordability of low income households.

Second, affordable housing in most countries tends to be of low quality and located in remote areas, which makes voluntary participation in such programs less attractive. To avoid these problems, many countries use planning mechanisms like inclusionary zoning, and ask private developers to allocate a portion of units with low prices for low income families. China may benefit from planning mechanism, if local governments have enough determination and efforts to provide affordable housing.

Finally, international experience suggests that there is a shared but clear responsibility of providing affordable housing between the central and local governments. Local governments are typically responsible for providing land and portions of funds; and in most of cases, responsibility for management of affordable housing rests with local governments Therefore, the degree of fiscal decentralization, efficiency, and willingness of local governments are crucial for the success of affordable housing programs. However, in these aspects local governments in China are relatively weak. This will likely require the central government to continue to assume a high degree of involvement.

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7. Appendix

Data

Below we summarize data used in this report. All data are expressed as year-on-year changes, and were retrieved from the CEIC database and compiled by BBVA research.

Table 7
Summary of Data

Variables	*Sample and frequency*	*Notes*	*Sources*
Aggregate housing price index	Monthly, 2005.7-2011.5	2011 data compiled from disaggregate price index	NBS, CEIC, and BBVA calculation
City housing price index	Quarterly, 1998.1-2011.5, 70 cities.	2011 data compiled from disaggregate price index	NBS, CEIC, and BBVA calculation
M2	Quarterly, 1998.1-2011.5		CEIC
Inflation	Quarterly, 1998.1-2011.5		CEIC
Income per capita	Yearly, 1998-2010		CEIC
Lending rate	Quarterly, 1998.1-2011.5	Five-year lending rate	CEIC
Urbanization	Yearly, 1998-2009	Population/area	CEIC

In January 2011 the NBS discontinued the publication of an aggregate housing price index at the national and city level. To make the data consistent with historical series, we have reconstructed an aggregate price index for 2011 from city-level new-construction and second-hand price indices (which are still published by NBS). The weights used to construct the aggregate price index are estimated using price data prior to 2010 by regressing aggregate price index on their components.

Description of empirical model for estimating equilibrium prices

To estimate the equilibrium property prices, we use a demand-supply framework of fundamental property prices.[3] Under this framework, if the housing market adjusted to shocks instantaneously, then the model could be closed at the equilibrium:

$$p_{it}^{d*} = p_{it}^{s*} = p_{it}^{*} \qquad \text{(A2.1)}$$

Note that our prices and determinants are at the city-level, with index *i* indicating cities. In the long-run demand equation, the determinants include housing stocks (s), current and expected per capita household income (y), real user cost of residential capital (measured in real interest rate; rr) and population density (dens). To obtain the long-run demand price pd*, we use an inverted housing demand function as follows:

$$p_{it}^{d*} = \alpha_1 s_{it} + \alpha_2 y_{it} + \alpha_3 y_{i,t+1} + \alpha_4 y_{i,t+2} + + \alpha_5 rr_t + \alpha_6 dens_{it} + \alpha_t \qquad \text{(A2.2)}$$

The coefficients of income and population density should be positive (α_2, α_3, α_4, α_6>0), while housing stock and user cost are expected to be negative (α_1, α_5<0). Here the time-specific fixed-effect α_t controls for the common impact of macroeconomic fluctuations, such as changing money supply, on the housing prices in different cities.

[3] See McCarthy and Peach (2004), "Are home prices the next 'bubble'?" *Economic Policy Review*, Federal Reserve Bank of New York. In addition see Leung, Chow, and Han (2008), "Long-term and short-term determinants of property prices in Hong Kong, " Hong Kong Monetary Authority, for an application of the similar approach that applies to the Hong Kong property market.

On the supply side, it is assumed that market entry and exit ensure that property developers make zero profits in the long run. Therefore, given the construction cost (c), the long-run supply price, ps*, induces a sufficiently high investment rate to cover depreciation and expected housing stock growth. This relationship can be expressed as follows.

$$p_{it}^{s*} = \alpha_5 \left(i/s\right)_t + \alpha_6 c_t \qquad \text{(A2.3)}$$

where i/s is the investment rate; i, the real residential investment, is proxied by fixed asset investment (FAI) for real estate adjusting by FAI deflator and c is the real construction cost. Since higher prices encourage investment, the coefficient of the investment rate is expected to be positive (α_5>0). Property prices are expected to respond to construction cost positively (α_6>0).

In practice, we combine equations (A2.2) an (A2.3) to estimate its reduced-form version using panel-data estimator in Eviews. The deviation between the actual prices and the prices predicted by the model will give us an indication of housing price mis-alignment.

In addition to the fundamental-based model above, we also estimate a time-series model on the growth rates of national aggregate price index:

$$\Delta p_t = \beta_1 \Delta M_t + \beta_2 \Delta Inf_t + \beta_3 \Delta i_t + \beta_4 \Delta Y_t + \varepsilon_t \qquad \text{(A2.4)}$$

In this model the year-on-year change of monthly national price index (*p*) is influenced by the changes of monetary supply (M), inflation (Inf), interest rates (*i*), and economic output (*Y*). Incorporating the monetary and macroeconomic conditions explicitly allows us to investigate the underlying forces of housing price fluctuations and mis-alignment. Use standard package in Eviews, we confirm that the year-on-year price growth is an I(1) process and estimate the model within a standard cointegration framework. After the model is estimated, we use the predicted price growth to compare with the actual price growth. We also project the price growth up to 2005.

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