Investor Confidence as a Determinant of China's Urban Housing Market Dynamics

Siqi Zheng
Tsinghua University
zhengsiqi@tsinghua.edu.cn

Weizeng Sun
Tsinghua University
sunweizeng@gmail.com

Matthew E. Kahn
UCLA and NBER
mkahn@ioes.ucla.edu

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Abstract

Macro economists have documented the association between consumer confidence dynamics and durables purchases. A similar dynamic exists in China's urban housing market. At any point in time Chinese consumer confidence hinges on beliefs about the state of the macro economy and the resolution of policy uncertainty related to the national and local housing policies. We build a 35 Chinese city real estate confidence index. All else equal, this index predicts subsequent house price appreciation and new housing construction. Given that housing plays a key role in China's marriage market, we document that in cities with more skewed sex ratios that this index has a stronger association with market price dynamics. In cities featuring a more inelastic housing supply, we document a stronger association between price dynamics and the confidence index. We supplement this city panel research with results from our household level expectations survey.

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Introduction

Urban housing in China is a multi-trillion dollar industry. In recent years, the rate of return on Chinese housing assets has been phenomenal. Figure 1 displays quality-adjusted hedonic housing price indices for 35 major Chinese cities from 2006 to 2013.[1] The 35 major cities account for one quarter of the total urban population in more than 600 Chinese cities and are also the home to roughly one quarter of total newly-built housing unit sales. Beijing has an annual average appreciation rate of 27.4%, and the average return for the 35 cities is 14.3% between 2006 and 2013. This extremely high price appreciation has led some real estate scholars to conclude that the very high price-to-income and price-to-rent ratios in Chinese urban housing markets is a sign of a housing market bubble (Wu, Gyourko and Deng, 2010).

*** Insert Figure 1 here ***

Potential domestic investors seeking opportunities in China's urban housing market are well aware that there are deep policy uncertainties. China's central government and the local governments heavily intervene in housing markets. They sometimes seek to stimulate the housing sector to achieve economic growth and maximize land sale revenue, while at other times they seek to regulate the market to slow price appreciation in order to appease the poor and middle class who are angry about soaring housing costs. During the last ten years, more than thirty national regulations were implemented. Such high-frequency interventions cause considerable uncertainty about the government's

[1] These 35 major cities represent all municipalities directly under the federal government, provincial capital cities, and quasi provincial capital cities in China. For this subset of big cities, we have access to a high quality transaction based hedonic home price index by city and quarter. The construction of this city housing price index is based on the real transaction prices of all newly-constructed housing units in a city. The municipal housing authority keeps all the transaction contracts of these units in a database. The contract contains the information on the transaction price (Yuan/square meter), the dwelling's physical attributes (unit size, floor number, building structure type, decoration status, etc.) and its detailed address, from which locational attributes (distance to the city center, distance to the closest subway stop, etc.) can be derived. A standard hedonic model is used to compute the quarterly price index, using all the transaction observations. Every municipal housing authority then reports the index to the State's Ministry of Housing and Urban-Rural Development. This set of hedonic housing price indices is proprietary data and has not been publicly published. Two co-authors of this paper are on this housing price index team.

future policies.[2] Individual investors have strong incentives to seek out information concerning what other potential buyers are thinking about the effects of policies and other macroeconomic shocks on the future trend in the local real estate market.

Real estate trend information in China is especially demanded because market instruments such as an ability to buy and sell future Case-Shiller style price indices do not exist. If such futures markets existed then a standard Grossman and Stiglitz (1980) argument would argue that such futures prices would be a sufficient statistic in providing information to potential real estate investors concerning the beliefs of other investors.

The rise of access to the Internet in China provides a cheap source for social learning as potential Chinese buyers tap into the "collective wisdom".[3] We use Google to construct our confidence index to measure how aggregate confidence varies across cities at a point in time and how it evolves within a given city over time. This confidence index measures the optimistic view (versus pessimistic view) about future housing market trend by city/quarter using Internet search data. Our approach builds on U.S work by Soo (2013) and Chauvet et. al. (2014). Our approach also builds on the approach of Baker, Bloom and Davis (2012) who use newspaper coverage of policy-related economic uncertainty as a component in their policy uncertainty index.

We examine how our new confidence index performs in explaining a variety of housing market outcomes in China's emerging housing market. Using a 35 city panel covering six years of data, we study how prices and sales of newly-built housing units are associated with our confidence index. We document the predictive power of this variable even controlling for a set of "fundamental factors". The evidence suggests that

[2] Some recent policy uncertainties come from whether the central or local governments will stick to the current heavy market interventions such as purchase restriction; the possible introduction of property tax legislation in more cities to cool down the speculative demand; the possible launch of a national system for tracking real estate ownership to precede the roll out of the property tax, as well as to help CCP rooting out corruption; the vast but uncertain amount of the supply of subsidized cheaper apartments by local governments. For more information, see http://blogs.wsj.com/five-things/2014/02/06/5-things-to-watch-in-chinas-housing-market-in-the-year-of-the-horse/

[3] Such Internet searches yield valuable data for researchers searching to learn about household's interests and priorities (Kahn and Kotchen 2011).

this confidence index does contain additional information about the future path of housing market price growth and the growth of apartment sales.

We document that this confidence index has a heterogeneous impact on local real estate outcomes depending on both city level demand side and supply side factors. This index's correlation with next quarter's price growth is greater in cities featuring a larger share of young men who are eager to buy homes to raise their marriage prospects. We find that in cities featuring an inelastic housing supply that there is a larger positive correlation between our confidence index and local price increases. We also report results from our household level expectations survey covering seven cities to further explore the underpinnings of the empirical relationships we document. The household survey reveals that the respondent's expectation about future housing price appreciation is significantly positively correlated with the market confidence index in his or her city. Those respondents with higher expectations of future price appreciation state that they plan to purchase an apartment sooner.

Our study of China's real estate price dynamics builds on a recent US literature. Soo (2013) constructs a U.S housing sentiment index and shows that her index forecasts the boom and bust pattern of housing prices at a two year lead, and can predict over 70% of the variation in aggregate house price growth. Chauvet et. al. (2014) develop a housing distress index and find that this index predicts subprime mortgage credit-default swaps and foreclosures. A number of papers use the University of Michigan's Consumer Sentiment Index and the Conference Board's Consumer Confidence Index – to evaluate the relationships between consumer confidence and the real economy, such as consumer spending and asset prices (Ludvigson, 2004; Lemmon and Portniaguina, 2006). They show that those popular confidence measures do contain information about the future path of aggregate consumer expenditure growth and the returns of small stocks.

Housing Market Expectations and Social Learning

Within a given Chinese city in a given quarter, there are a large number of people considering purchasing an apartment. These individuals differ with respect to their income, demographics and their expectations of future real estate price dynamics. Each of these factors affects housing demand. All else equal, richer people are more likely to own housing. Second, there is a group of young men who seek an apartment to raise their marriage prospects (Wei and Zhang 2009, 2011). Such individuals are competing in a relative status market such that by purchasing an apartment they are able to jump over their competitors (Becker, Murphy and Werning 2005). A third factor determining ownership demand is the expectation of future price appreciation. To simplify this discussion, define D as a vector of household demographics including income and define θ to be an individual's expected return to owning an apartment. People differ with respect to their θ such that there exists both optimists and pessimists at a point in time. Researchers such as Manski (2004) have analyzed how such subjective expectations influence investment choices.

To simplify this discussion, we assume that all housing in a city/year is of identical quality. In this case, each possible demander can be expressed by his maximum willingness to pay for an apartment in city j at time t. For person l, this can be expressed as:

$$WTP_{ljt} = f(D_{ljt}, \theta_{ljt})$$

This can be sorted from highest to lowest and the market clearing price will be the willingness to pay of the marginal buyer such that aggregate demand equals aggregate supply in that city.[4]

Self-interested individuals seek out more information about likely rates of return to housing in city j at time t. Such Bayesian households use the Internet to update

[4] To simplify this discussion, we are treating each city as a closed economy such that migrants are not moving in from other cities to arbitrage cross-city price differentials. The lingering domestic passport *hukou* system raises the migration costs of moving across cities as new migrants without the local *hukou* do not enjoy access to local schools or hospitals.

their prior assessments of rate of return to housing. This Internet search provides a common signal to all those searching for information about city j at time t. This allows individuals with heterogeneous priors to update their beliefs.

Most optimists are likely to shade down their willingness to pay. Social learning takes place here. Access to the Internet allows those who recognize their ignorance about the true model of price discovery for these assets to learn from other people. As individuals update their priors about the expected returns to housing, this will affect their willingness to pay for housing as shown by equation (1), the resulting equilibrium price in the market will be affected. The empirical work we present below will explore this hypothesis.

Our simple framework for incorporating social learning into explaining house price dynamics has been systematically explored in recent research. Rebelo et al (2012) model how social interactions impact the housing market booms and busts based on the epidemic spreading of optimistic or pessimistic beliefs among home buyers. Given how easy it is to access the Internet, our approach can be thought of as a special case of Rebelo et. al.'s model in which everyone is "infected" and updates their beliefs.

In the empirical work we present below, we study how local real estate markets in China are affected by investor confidence dynamics. Unlike earlier research, we are especially interested in the interaction of demographic factors and market confidence indicators. We posit that these factors are complementary such that in cities with many young men seeking apartments to raise their status that when confidence about market conditions is high that there are especially large price and quantity dynamics consistent with increased demand.

On the supply side of the market, in the standard U.S setting the two sources of housing supply are incumbent owners choosing to sell their homes and real estate developers choosing to build new housing. In such a setting, the confidence index could affect the supply of housing on the market by reducing the likelihood that

incumbents sell. Optimists who own a home may delay selling in order to gain the higher returns in the future. In the case of China, the re-sale market remains a small fraction of total sales. The sales of newly-constructed housing units account for the majority of total housing sales in Chinese cities annually during the past ten years (about 70% in the 35 major cities, Liu and Jiang (2014)).[5] This discussion highlights the pivotal role that developers play in China in determining apartment supply. China's developers can only supply new apartments if they are able to acquire a land parcel from the government and if they choose to develop an apartment complex. Developers have a profit incentive to form expectations of future price growth. In a standard inventory model, the most optimistic developers should be the least likely to sell now because they would seek to build and sell apartments in the future when prices are expected to be higher. However, housing supply responds much slower than demand to market confidence due to several reasons in Chinese cities. First, the urban land supply is controlled by city governments and is sluggish in responding to market signals. Second, it takes developers about two to three years to build after they buy land parcels from city governments. Third, most real estate developers in Chinese cities face a very tight financing constraint (with the average debt ratio over 60%), so in most situations they choose to sell their apartments very quickly to receive cash back. Therefore we view our confidence index to mainly be a demand shifter rather than a supply shifter.

[5] We are unable to test the associations between market confidence and housing price/quantity in the resale market due to the lack of resale data. Nevertheless, the resale market is closely related to the new housing market through the filtering process. In a hot market with high confidence index, rich households who own relatively higher quality and newer units in the existing stock (at the top of the filtering ladder) will sell their existing homes to the second-tier buyers at higher prices in order to finance their new purchases. Those second-tier buyers (renters or owners of relatively lower quality houses) are willing to move up along the ladder by paying higher prices if they also believe that housing prices will continue to rise. Therefore we believe that the positive associations between our confidence index and housing price/quantity will also exist in the resale market.

In the results we report below, we will test whether the effects of the confidence index differ depending on a city's housing supply elasticity.[6] These results build on the mushrooming U.S housing literature documenting the key role that the housing supply elasticity plays in determining market outcomes (Saiz 2009, Glaeser, Gyourko and Saks 2005). Wang et. al. (2012) show that topographic patterns (shares of water area and hilly area, etc.) are the key determinants of Chinese cities' housing supply elasticity. In our 35 cities, the highest supply elasticity is about twice of the lowest one (see Table 1).

The strongest tests for establishing the role of investor confidence as a driving force in China's real estate market would be to elicit estimates of how θ_{ljt} (the annual expected rate of return on housing) evolves across people across cities and time. In a later section, we introduce a small sample survey explicitly intended to measure this parameter. Given that such data do not exist for a large population, we instead develop an alternative measure of θ_{jt} which represents an aggregate measure of a city's overall confidence in the local housing market at a point in time.

Measuring Housing Market Confidence Within and Across Cities

Real estate is a hot topic among Chinese urbanites. To attract readers, Internet media companies and newspapers allocate considerable space for real estate news and commentary. Journalists, correspondents and specialists write about this topic intensively. Internet searches by households point them to these articles. The original articles are copied by other news and forum websites and blogs, and can be further

[6] Scokin and Xiong (2014) discuss how the elasticity of housing supply interacts with investor social learning in determining housing price. They argue that a higher supply elasticity will reduce the importance of consumers' social learning as in this case the housing price is highly driven by the supply-side shock. In our empirical work below, we test this claim.

copied and commented upon. Each individual who engages in this behavior is providing some public goods both for researchers such as ourselves but also for other interested parties eager to learn more about the Chinese real estate market. Such individuals are unlikely to have a strategic intent but instead devote their time to linking to such stories because they enjoy being engaged about this issue. This behavior creates a signal that we researchers can use to detect salient information.

We construct our confidence index by city/quarter by counting the total entries of the key words describing housing price trend in Google search.[7] For each of the 35 major cities, we type in its name, plus "housing price" and the mostly popular positive key words ("rising" or "increasing", in Chinese), and restrict the time of the search to a specific quarter of a given year. Google Search reports back the total number of entries by quarter ($Positive_{it}$). These entries include the original articles with the optimistic views, and also the cross-pastes of those articles, and the comments about those articles in all kinds of websites. Therefore this count measures the Internet chatter that has an optimistic view about price trends. We repeat this process but replace the positive key words with negative ones ("falling" or "decreasing") and obtain the total count by city/quarter ($Negative_{it}$). Our confidence index is then calculated as the ratio of the count of positive entries to the total count of both positive and negative entries (Equation (2)).

$$Confidence\ Index_{i,t} = \frac{Positive_{i,t}}{Positive_{i,t} + Negative_{i,t}} \qquad (2)$$

This index reflects the relative degree of optimism concerning future price growth as reflected in the Internet chatter. Investors in the market should have a qualitative

[7] Another popular online search engine in China is Baidu.com. However, Baidu does not provide the search function we need – counting the total entries of the key words during a specified period in the past. Micro-blogs are a popular online social discussion forum nowadays in China. But it only exists for a very short existence period (from 2010) and it does not have a good built-in search engine, which prevents us from directly using it. Google search is suitable for constructing our confidence index which counts the number of articles with the key words appearing in the three major local newspapers' websites and all kinds of online forums, blogs and micro-blogs. As long as people discuss those articles in those places, Google search will find those webpages and return the number of total entries.

sense of this ratio (more optimistic or less optimistic) though they may not know the exact number. The index captures the intensity that people are talking about those real estate articles and linking to them.

Figure 2 shows the quarterly confidence indices for the 35 Chinese cities. In our sample by city/quarter, 91.5% of all the confidence index values are larger than 0.5 (positive entries more than negative ones). This means that most of the time that people are quite optimistic about future price appreciation.

*** Insert Figure 2 here ***

We posit that our confidence index's dynamics are mainly determined by evolving public opinion concerning the direction of local and national housing policy. One way to test this conjecture is to compare our aggregate confidence index to the well known policy uncertainty index created by Baker, Bloom and Davis (2012). In their research around the world, they have documented the causes and the consequences of the evolution of their index.

We use are 35 cities' population as weights to compute an aggregate "national" confidence index and compare it with China's policy uncertainty index compiled by Baker, Bloom and Davis (BBD) (Figure 3).[8] Baker et. al. only report the policy uncertainty index for the whole economy but do not construct a real estate specific index. We posit that such two uncertainty measures should be correlated. Our confidence index is negatively correlated with the BBD policy uncertainty index with a correlation coefficient of -0.51 (significant at 1% confidence level). This is intuitive because people will be more pessimistic if they have to deal with more policy uncertainty in the market.

[8] The index is on the website: http://www.policyuncertainty.com/china_monthly.html. Also see: Baker, Scott, Nicholas Bloom, Steven J. Davis, and Xiaoxi Wang, 2013. "A Measure of Economic Policy Uncertainty for China," work in progress, University of Chicago.

To better understand this negative correlation, here we provide some facts about China's urban housing market during this period. During the 2008 Global Financial Crisis, there was a pessimistic outlook across the whole economy, and we see a large jump in the BBD policy uncertainty index, and at the same time a significant drop in our housing market confidence index. Since real estate investment could effectively stimulate China's economy, the central government decreased the interest rate and also relaxed the regulations in the real estate market after the Crisis. That may explain why we see a rising confidence index as well as a decreasing BBD index in 2009. Later, housing prices increased so much that the central government had to face the housing affordability problem of the middle class and the poor were bearing. It then imposed more regulation policies (such as purchase restriction) to cool down the real estate market. Many such regulations were announced quite suddenly without any early sign so the policy uncertainty was high. Our confidence index dropped and the BBD index rose correspondingly.

*** Insert Figure 3 here ***

To learn more about our confidence index, we calculate its temporal autocorrelation within a city and its cross-city correlation. Similar to some macro-economic variables, such as GDP and housing price, the confidence index is also highly auto-correlated based on our estimates of AR(1) models, and it has a unit root (I(1)). Therefore in the empirical section, we follow Soo (2013) and first difference this index in all of the estimation equations to obtain a stationary series.

We examine the market confidence index's effects on the price and quantity outcomes in the market for newly-built housing units in 35 Chinese major cities during 2006 and 2013. We focus on those cities because we can access quality-controlled quarterly housing price indices for newly-constructed units (*Housing Price*) and the quantities of new housing sales (*Housing Sales*) for them. These variables will be the dependent variables in our empirical equations.

Using data from the year 2000 Census we calculate the share of young people (20-35 years old, *Young%*), and the share of young males in each city (*Young_Male%*). We use the housing supply elasticity (*Supply Elasticity*) estimates from Wang et. al. (2012) as a measure of land scarcity in a city. These variables vary across cities but not within cities. We are interested in the confidence's heterogeneous effect in different cities, and we test for this by interacting our city/quarter confidence index with these city specific variables.

We include three variables to control for market fundamentals, city average household income (*Income*), the real interest rate (*Interest*), and the exogenous demand growth in local labor market (*Labor Demand Growth*). Given a city's base year industrial composition and the nation's overall growth by industry, this last variable measures whether a specific city's labor demand is rising. For example, if steel production at the national level is rising and a specific city is a center of steel production then this index predicts that this city will be booming. We follow Bartik (1991) and Blanchard and Katz (1992) to construct this exogenous labor demand growth variable where we weight national industry growth by the city's base year share of employment in that industry:

$$Labor\ Demand\ Growth_{it} = \sum_{j=1}^{J} Employment_{ij,base} \cdot Growth_{jt} \qquad (2)$$

Where, $Labor\ Demand\ Growth_{it}$ is the labor demand index for city i in year t; $Employment_{ij,base}$ is the employment share of industry j in city i in the base year (year 2006); $Growth_{jt}$ is the national employment growth rate of industry j in year t.

Table 1 provides the variable definitions and summary statistics.

*** Insert Table 1 here ***

Does the Confidence Index Predict Price and Quantity Dynamics?

We test whether controlling for the fundamentals in the housing market, whether our confidence index is positively associated with future housing price appreciation and the quantity of new housing sales. We will estimate the following empirical equations (Equation (3)-(4)):

$$\Delta Housing\ Price_{i,t} = \alpha_0^{HP} + \beta^{HP} \cdot \Delta Confidence_{i,t-1} + \gamma^{HP} \cdot \Delta Fundamentals_{i,t} + \sum_{j=1}^{2} \lambda^{HP} \cdot \Delta Housing\ Price_{i,t-j} + \omega_t + \varepsilon_{i,t} \quad (3)$$

$$New\ Housing\ Sales_{i,t} = \alpha_0^{HS} + \beta^{HS} \cdot \Delta Confidence_{i,t-1} + \gamma^{HS} \cdot \Delta Fundamentals_{i,t} + \sum_{j=1}^{2} \lambda^{HS} \cdot Housing\ Sales_{i,t-j} + \omega_t + \varepsilon_{i,t} \quad (4)$$

Where Δ denotes the first difference by quarter. *Fundamentals* include the changes in observable fundamentals that drive housing price change over time, including the exogenous labor demand shock, log(*Labor Demand*), city average household income change, Δlog(*Income*), and the lagged interest rate change (we use the lagged term here to mitigate the endogenous problem due to interest regulation), Δ*Interest_lag1*. Housing price growth and transaction volume may both bear seasonal patterns so we also include a set of quarterly fixed effects, w_t (In Winter, especially during Chinese New Year, the real estate market is relatively cold with less transactions and lower prices; while in Fall the market is relatively hot). We include the first-order and second-order lagged terms of the dependent variable in both the housing price and housing sales regressions to account for momentum in real estate markets (Case and Shiller 1989, Shiller 2008). The standard errors are clustered by city.

Column (1) in Table 2 presents the OLS estimation results of equation (2) to test for the association between our confidence index and housing price changes in the

housing market. The dependent variable is the quarterly change of housing price in log term. We include our housing price confidence index (one quarter lagged) as well as the fundamental variables and the lagged terms of the dependent variable on the right hand side. The confidence index has a positive sign and its coefficient is statistically significant at 5% level. Among the three fundamentals, only labor market demand growth is statistically significant. Housing price shows clear serial correlation patterns. This regression can explain 12.6% of the housing price variation.

The regression in column (1) is subject to the common problem of omitted variables. The confidence index may proxy for unobserved dynamic city specific factors. This is a common challenge such "consumer confidence" studies face (Ludvigson, 2004). Another issue is the possibility of reverse causality – households form their expectation based on housing market signals.[9] Here we first employ the econometric technique of system-GMM estimator developed for dynamic panel model (Bond, 2002; Bond et. al., 2001) to address this possible endogeneity issue.[10] Column (2) reports the GMM estimation results. They are similar with the OLS results. The confidence index has a positive sign and its coefficient is statistically significant at 5% level. Based on the GMM estimation, a one standard deviation increase in the quarterly confidence index change is associated with a 0.29 percent growth in housing prices (equivalent to 0.09 of a standard deviation of the price growth variable).

[9] We acknowledge that our confidence index may be caused by past housing price dynamics. In this "adaptive expectations" case, we would misinterpret the causal effect of city wide optimism when in fact the price series simply reflects auto-correlation. Though we use time lag (current market outcomes and lagged confidence index) to mitigate this problem, these two time series feature significant serial correlation so we cannot fully rule out the possibility of simultaneous causality. It is important to note that our empirical results in Table WA1 in the Web Appendix show that the lagged housing price change has a very weak prediction power on the change in the confidence index.

[10] The GMM estimator uses lagged explanatory variables and lagged dependent variables as instruments. Since lagged time series variables in level only provide "weak instruments" for subsequent first differences, the system-GMM estimator combines the regression equations in differences and in levels into one system. The Hansen over-identification test and the Arellano–Bond test for AR(1) and AR(2) serial correlation in the residuals provide an assessment of whether the chosen identification strategy of the system-GMM estimator is valid.

Column (3) and column (4) of Table 2 present the quantity regressions using OLS and GMM estimators respectively. The dependent variable is how many units were sold in that quarter (in log). Higher housing market confidence index in the previous quarter push up transactions in the quarter after. This effect is not statistically significant in the OLS regression (column (3)) but it is quite significant (at the 1% level) in the GMM regression (column (4)). Rising interest rates will significantly discourage market transactions. A one standard deviation increase in the quarterly confidence index change is associated with an increase of 0.049 of a standard deviation of the housing sales variable.

*** Insert Table 2 here ***

A Border Pairs Test of the Role of Policy Uncertainty in Explaining Confidence Dynamics

Researchers seeking to measure the causal effects of consumer or investor confidence on economic outcomes must defend against the possibility that the confidence measure merely proxies for an unobserved third factor. In this subsection, we introduce a "border pairs" strategy that exploits a regression discontinuity design to test whether our confidence index proxies for spatially correlated omitted factors.

Hong Kong and Macau are geographic neighbors of Shenzhen and Guangzhou. Since they trade with each other, there should be some spatial correlation between the unobserved economic fundamentals. But Hong Kong and Macau do not belong to Mainland China so they are not subject to real estate market regulation policies the Chinese central government imposes on mainland cities. Therefore, we examine whether the real estate market confidence indices of Guangzhou and Shenzhen predict housing price dynamics in Hong Kong and Macau. If we find significant correlations here, it suggests that our confidence index reflects such unobserved fundamentals. Otherwise, our index may mainly represent local people's reflection on Chinese governments' policies that do not transmit to the other side of the political boundary.

We collect the housing price indices in Hong Kong and Macau and also construct our confidence indices for these two cities. In Table 3, the first column shows that the confidence index of Hong Kong and Macau can predict the housing price dynamics in their own city (the correlation is larger than that in the reference cities, Guangzhou and Shenzhen, see column (4)). Column (2) and (3) show that neither the Guangzhou index nor the Shenzhen index can predict these two cities' housing price changes. These findings favor our hypothesis that our confidence index does contain additional information of policy uncertainty, rather than just proxying for unobserved fundamentals.

*** Insert Table 3 here ***

Testing for The Confidence Index's Heterogeneous Effects

In section II, we discussed how ongoing research has identified both demand side and supply side factors as playing key determinants in explaining China's house price dynamics. In this section, we test for interaction effects such that our confidence index has differential effects on a city's real estate market dynamics depending on underlying demand and supply side factors.

On the demand side, demographics play an important role in China today. Wei and Zhang (2011) state that, given the combination of the nation's one-child policy and the high male to female ratios in big cities, Chinese parents with a son raise their savings in a competitive manner in order to improve their son's relative attractiveness for marriage. A large share of such savings will be used to buy a house which is regarded in China as a "necessity" a man needs to marry a woman. Such young men seek a home because of their demand for status and the belief that that increased status raises their marriage prospects. In this sense housing is an input in the production of status that increases a young man's marriage prospects (for a hedonic model of status see Becker,

Murphy and Werning 2005). If parents and their sons believe that housing price will keep rising, these young people will transition to home ownership at an earlier age. This amplified demand will push up housing prices. We collect the share of young people (*Young%*) and the share of young males (*Young_male%*) in each of our 35 cities to test this demand-side heterogeneity across cities.

Given a demand shock, cities with smaller housing supply elasticity (*Supply Elasticity*) will see a larger price appreciation and a smaller quantity of new construction. Here our confidence index proxies for a type of demand shock. The marginal housing investors in the cities with more constrained supply will be more anxious to buy and be willing to pay a higher price if they search online to find that others also think housing price will continue to rise (a higher confidence index).

The magnitude of the β coefficients in the above Equation (3) and (4) may vary across cities with heterogeneous demand and supply factors. We test the above heterogeneous effects of confidence on market outcomes by interacting our confidence index with those variables (Equation (5) and (6)).

$$\Delta Housing\ Price_{i,t} = \alpha_0^{HP} + \beta^{HP} \cdot \Delta Confidence_{i,t-1} + \lambda^{HP} \cdot (Z_i \cdot \Delta Confidence_{i,t}) + \gamma^{HP} \cdot \Delta Fundamentals_{i,t} + \sum_{j=1}^{2} \lambda^{HP} \cdot \Delta Housing\ Price_{i,t-j} + \omega_t + \varepsilon_{i,t} \quad (5)$$

$$New\ Housing\ Sales_{i,t} = \alpha_0^{HP} + \beta^{HP} \cdot \Delta Confidence_{i,t-1} + \lambda^{HP} \cdot (Z_i \cdot \Delta Confidence_{i,t}) + \gamma^{HP} \cdot \Delta Fundamentals_{i,t} + \sum_{j=1}^{2} \lambda^{HS} \cdot Housing\ Sales_{i,t-j} + \omega_t + \varepsilon_{i,t} \quad (6)$$

Table 4 shows the price and sales regression results. We only report OLS results here. We also run all regressions using GMM estimator and obtain similar results (the coefficients of key variables are of the similar magnitudes with the same confidence level), and those GMM results are available upon request. In column (1) and (4), we interact our confidence index with a city's housing supply elasticity. Given a unit increase in the confidence index, a city with more constrained supply will face a larger

price appreciation but a smaller quantity of new construction. The quantity effect is significant at 10% level when employing both regression techniques. For column (2), (3), (5) and (6), we do see that in the cities with larger share of young people (*Young%*), especially young males (*Young_male%*), our optimistic confidence measure significantly pushes up housing price appreciation as well as new construction.[11] The estimated coefficients in column (1) to (3) show that one standard deviation increase in the quarterly confidence index change in the cities with the lowest supply elasticity, highest young people ratio and highest young males ratio will trigger an increase of 0.32, 0.57 and 0.55 of a standard deviation of the price growth variable, respectively.

*** Insert Table 4 here ***

Exploring the Relationship Between Household Beliefs and the Housing Market Confidence Index

Scholars such as Case and Shiller (see Case et. al. 2012) and Manski (2004) have helped to stimulate an increased interest among economists in eliciting household

[11] The positive associations between our confidence index and market outcomes we report above may be driven by the correlations between the confidence index and market fundamentals. Following the method of Baker and Wurgler (2006) and Chauvet et. al. (2014) we develop an orthogonalized confidence index (in first difference), $\triangle Confidence\ index_o$. $\triangle Confidence\ index_o$ is the residual from a regression of $\triangle Confidence\ index$ on key fundamental variables. The regression result is provided in Table WA1 in the Web Appendix, where we can see there is a very small correlation between fundamentals (and also the lagged housing price change) and our confidence index. All explanatory variables are insignificant, and the R square is very small. Overall, the correlation between the orthogonalized confidence index and the original confidence index (both in first difference) is 0.98, suggesting that the observed market fundamentals have a weak relationship with our confidence index. We re-estimate Equation (3)-(4) with $\triangle$Confidence index replaced by $\triangle Confidence\ index_o$ and all other variables unchanged (Table WA2 in the Web Appendix). The results are similar to those showed in Table 2 and 3 that the change in confidence is positively correlated with housing price appreciation and the quantity of new housing sales, and the quality of housing sales. Nevertheless in this step we still cannot rule out the possibility that our confidence index proxies for unobserved policy uncertainty.

beliefs about future random variables such as house prices. In this sub-section, we report results from a recent survey we conducted in seven Chinese cities. We use the results from this expectations survey to re-examine some of the relationships we reported above.

This survey was conducted in 2012 by the National Bureau of Statistics of China.[12] Each city survey yielded roughly 500 respondents. In this seven city survey, at the end of each quarter we asked the respondents "By what percentage do you think the housing price in your city will grow in the next year (in percentage)?" (*Expectation*), and "When do you plan to buy a house in the future?" (*Purchase_plan*, from 1 to 4, indicating "will buy a house 5 years or even longer years later", "will buy a house around 4-5 years from now", "will buy a house around 2-3 years from now", "will buy a house in this year"). This is a panel data set covering four quarters. These two questions allow us to test the implicit assumption we have made throughout this paper that our city/quarter confidence index is positively correlated with average household optimism about future real estate price appreciation. Such optimists should be more likely to buy a home earlier.

Using this household survey, we first examine whether city *i*'s confidence index in quarter *t* is positively correlated with the housing price expectation of the individuals in that city. We regress individual *k*'s expectation on his/her city *i*'s confidence index in that quarter (*t*), the lagged housing price and interest rate, and a bundle of household attributes (*X*) including household annual income, the household's gender, age and education attainment (Equation (7)). City fixed effects are controlled for and the standard errors are clustered by city. In the second step we further test that, if an individual expects that housing price will appreciate more, will he/she plan to buy a house earlier (Equation (8)). We estimate an ordered logit model in which we include

[12] The National Bureau of Statistics of China (NBSC) conducted this survey for us. Three first-tier cities (Beijing, Shanghai, Tianjin) and four second-tier cities (Chengdu, Xi'an, Wuhan, Shenyang) were selected. Each city's sample includes roughly 500 respondents. Households were randomly selected from each city. NBSC officials came to those respondents' home and assisted them to fill in the questionnaire.

the same control variables as those included in Equation (7).

$$Expectation_{kjt} = \alpha_0^e + \beta^e \cdot Confidence_{kjt} + \lambda^e \cdot \log(Housing\ Price)_{j,t-1} + \eta^e \cdot \log(Interest)_{j,t-1} + \gamma^e \cdot X_{kj} + c_j + \varepsilon_{kjt} \quad (7)$$

$$Purchase\_Plan_{kjt} = \alpha_0^p + \beta^p \cdot Expectation_{kjt} + \lambda^p \cdot \log(Housing\ Price)_{j,t-1} + \eta^p \cdot \log(Interest)_{j,t-1} + \gamma^p \cdot X_{kj} + c_j + \varepsilon_{kjt} \quad (8)$$

Results are shown in Table 5. As shown in column (1), respondents who live in cities with a higher confidence index are more likely to state that they expect greater price appreciation. Richer households are more optimistic, but other households' attributes do not matter much. In the ordered logistic regression in column (2), households with greater price appreciation expectation do plan to buy homes earlier.

*** Insert Table 5 here ***

The evidence reported in Table 6 indicates that our Google Index is correlated with household stated expectations.

Conclusion

Macro economists have documented the association between consumer confidence dynamics and durables purchases. We find that such dynamics also exist in China's urban housing market. This is a market featuring high policy uncertainty. Market participants recognize that they "know that they do not know" the main factors determining pricing dynamics. Such individuals have strong incentives to seek out additional information related to other people's thoughts on how those policy uncertainty influences future housing price and quantity dynamics.

The Internet offers a low cost way of such social learning. Building on a recent U.S literature, we build a 35 Chinese city real estate confidence index using Internet

search activity data. This index represents the "collective wisdom" on the Internet and measures the degree of optimism in a local market at a point in time. We document that this confidence index has predictive power over subsequent house price appreciation and new housing construction even controlling for a set of "fundamental factors". The evidence suggests that this confidence index does contain additional information about the future path of housing market price and quantity growth. We also show that this index has heterogeneous impacts on local real estate outcomes – Its correlation is further amplified in cities featuring a larger share of young men who are eager to buy homes to raise their marriage prospects, and also an inelastic housing supply lead to a larger positive correlation between our confidence index and local price increases. Our findings based on the border pairs analysis suggests that local investor confidence dynamics is driven by changing sentiment about the direction of government policy. This claim merits future research.

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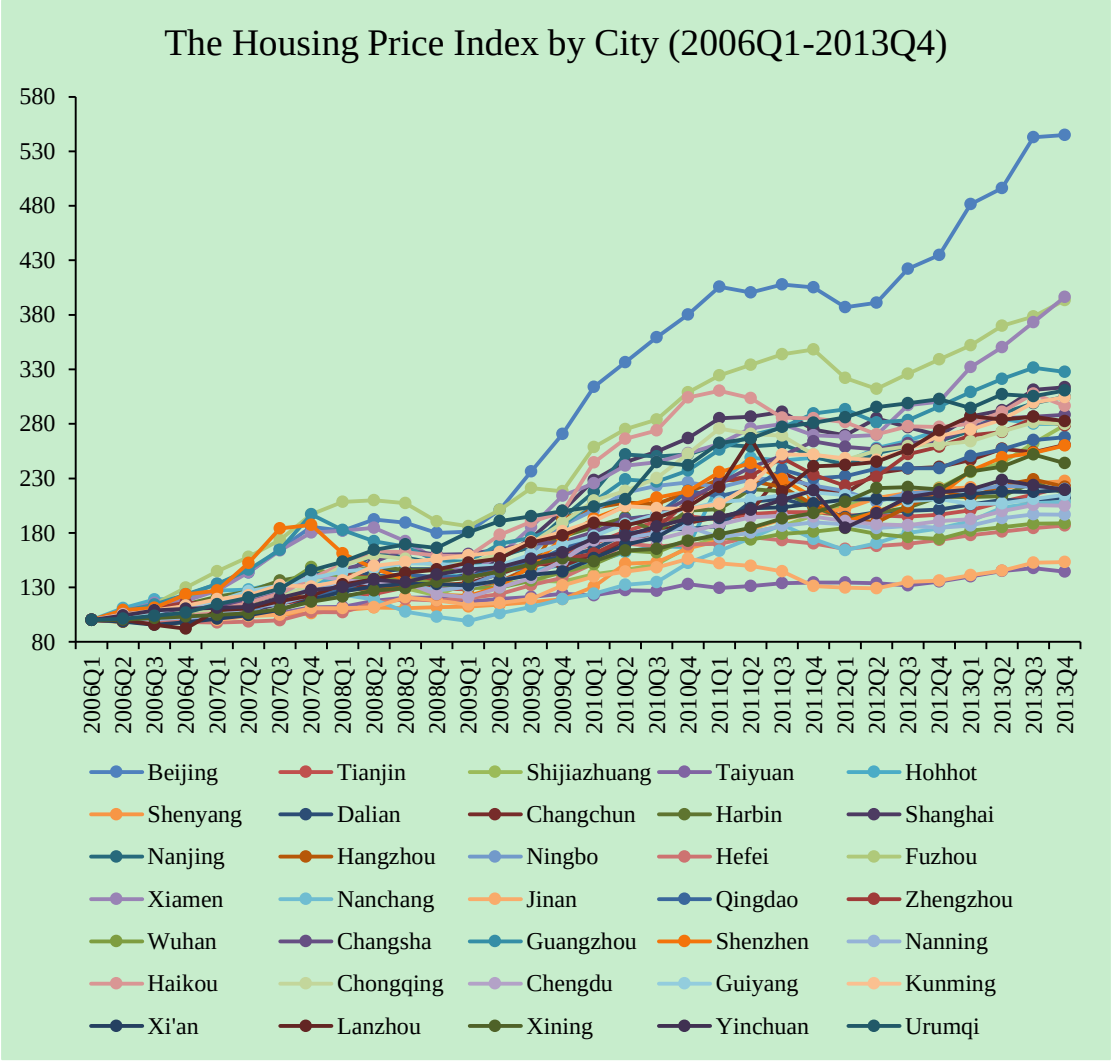


Figure 1 Hedonic Housing Price Indices Across 35 Major Chinese Cities

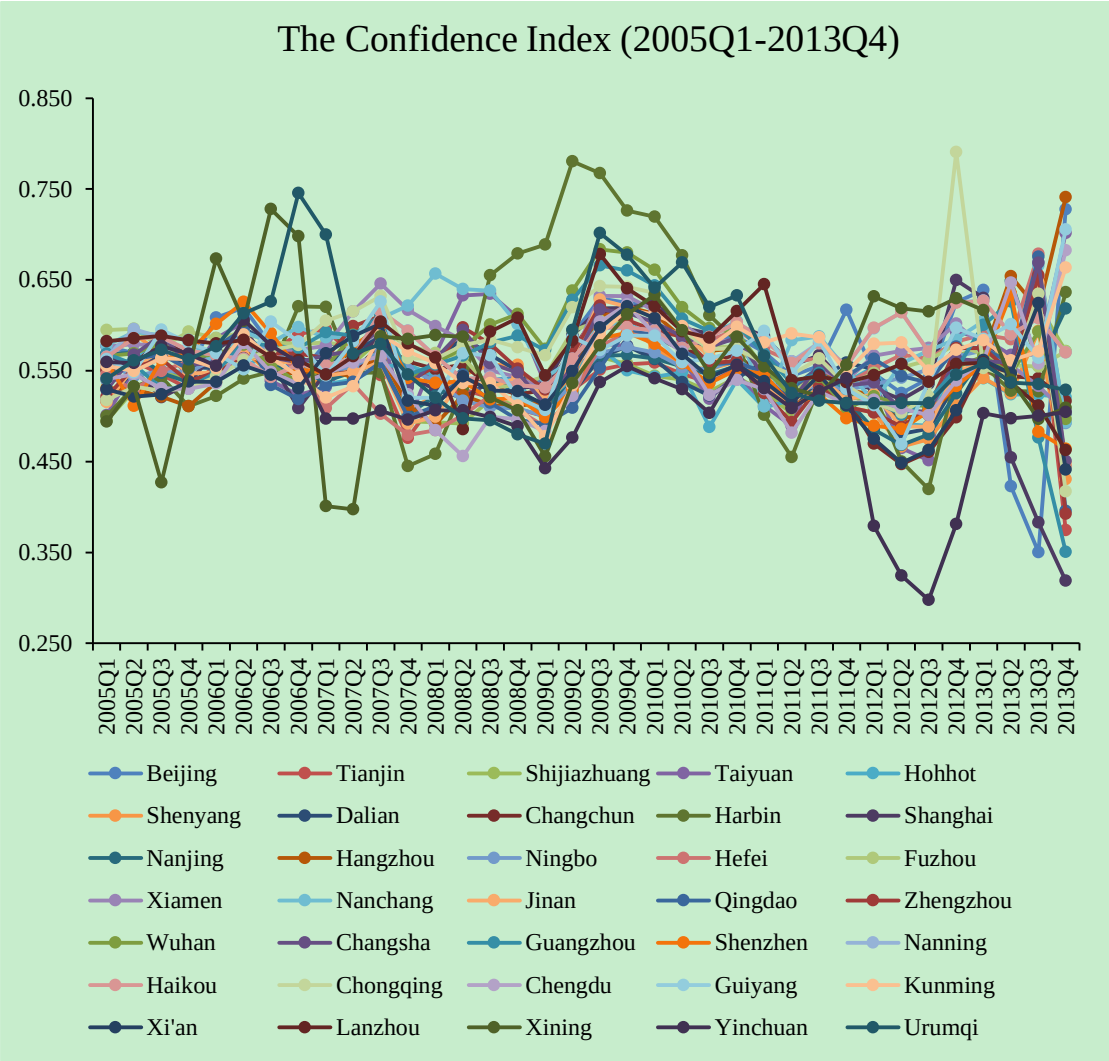
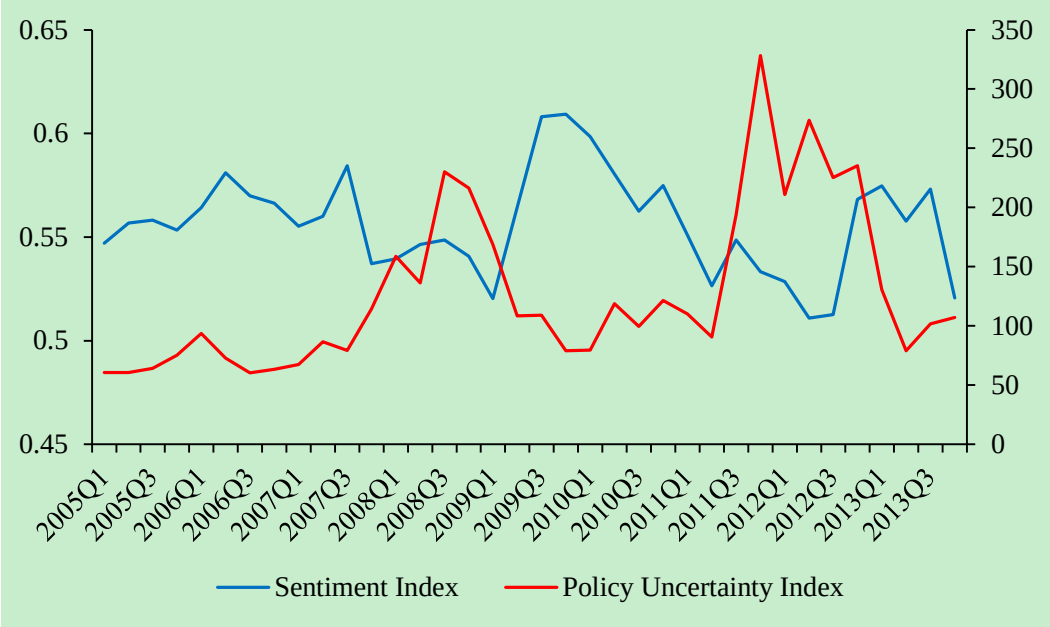


Figure 2　Housing Confidence Index Dynamics



Corr(*SI*, *PUI*)= -0.512 (p-value: 0.0014)

Figure 3
The Correlation between Confidence Index and Policy Uncertainty Index[1]

[1] Data source: http://www.policyuncertainty.com/china_monthly.html
Citation: Baker, Scott, Nicholas Bloom, Steven J. Davis, and Xiaoxi Wang, 2013. "A Measure of Economic Policy Uncertainty for China," work in progress, University of Chicago.

Table 1 Variable Definitions and Summary Statistics

		Obs.	Mean	Std. Dev.	Min	Max
Confidence Indices:						
Confidence index	Housing price confidence index	1120	0.56	0.05	0.30	0.79
△Confidence Index$_{t-1}$		1120	0.0035	0.069	-0.43	0.52
Housing Market Indicators:						
Housing Price	Quality-controlled hedonic housing price index (2006Q1-2013Q4, 2006Q1=100)	1116	179.52	67.04	92.18	544.95
△log(Housing Price)		1095	0.03	0.046	-0.20	0.30
Housing Sales	Number of apartment units sold	1116	12185.11	10009.73	305	74711
log(Housing Sales)		1116	9.05	0.90	5.72	11.22
Fundamentals:						
Labor Demand Growth	Bartik index measuring exogenous demand shock in local labor market (See Equation (2))	1120	0.04	0.04	-0.05	0.14
Income	City average quarterly per capita disposable income (RMB yuan)	1120	5987.22	2315.77	2210.94	15274.64
Interest	Interest rate in real term	1120	0.00	0.02	-0.05	0.05
Supply Elasticity	Land supply elasticity (Data source: Wang S, Chan S H, Xu B (2012))	35	0.85	0.11	0.57	0.99
Young%	The share of young people (20-35y) in the city (2000 census)	35	0.30	0.06	0.24	0.59
Young_Male%	The share of young males (20-35y) in the city (2000 census)	35	0.16	0.03	0.12	0.29

Table 2 The Confidence Index Predicts Price and Quantity Outcomes in the Housing Market (Panel, all cities, 2006Q1-2013Q4)

Dependent Variable:	⊿log(*Housing Price*)		log(*Housing Sales*)	
	OLS	System GMM	OLS	System GMM
	(1)	(2)	(3)	(4)
log(*Labor Demand Growth*)	0.00749*	0.0140*	0.114**	0.0855*
	(1.70)	(1.75)	(2.63)	(1.94)
⊿*Confidence index*_lag1	0.0628**	0.0602**	0.0520	0.643**
	(2.30)	(2.29)	(0.36)	(2.28)
*Dependent Variable*_lag1	0.298***	0.174*	0.737***	0.630***
	(4.44)	(1.84)	(25.58)	(9.27)
*Dependent Variable*_lag2	0.0556	0.146**	0.160***	-0.0192
	(1.49)	(2.61)	(5.59)	(-0.40)
⊿log(*Income*)	-0.000872	-0.000269	0.187	0.133
	(-0.05)	(-0.02)	(1.18)	(0.90)
⊿*Interest_lag1*	0.0839	0.311	-0.412***	-0.344***
	(1.03)	(1.69)	(-14.45)	(-11.34)
Constant	0.0115***	0.0581**	1.004***	3.590***
	(3.99)	(2.12)	(9.27)	(5.46)
Quarter fixed effect	Yes	Yes	Yes	Yes
Arellano-Bond test for AR(1) in		-3.12***		-4.16***
first differences: z (p-value)		(0.002)		(0.000)
Arellano-Bond test for AR(2) in		-1.18		-1.55
first differences: z (p-value)		(-0.240)		(0.121)
Hansen test of overid. Restriction:		30.50		32.84
chi2(p-value)		(0.247)		(0.971)
Observations	977	977	978	978
Adjusted R^2	0.126		0.812	

Notes: (1) t-statistics are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level;*: significant at the 10% level. (3) Standard errors are clustered by city for the OLS regressions. (4) For the System-GMM regressions, AR(1) and AR(2) are the Arellano-Bond test for autocorrelation in the estimation errors and Hansen test is the over identification test. If we reject the AR(1), accept AR(2) and reject the Hansen test, than the model specification is acceptable (Bond, 2002; Bond et. al., 2001).

Table 3 "Border Pairs" Tests – The Correlation between the Confidence Index and Housing Price Appreciation in Hong Kong and Macau

The Dependent Variable: ⊿log(*Housing Price*)

	Hong Kong and Macau			*Reference Cities*
	(1)	(2)	(3)	(4)
⊿*Confidence index*_lag1	0.489*			0.293**
	(1.84)			(2.30)
⊿*Confidence index*_lag1 (Guangzhou)		-0.190		
		(-0.54)		
⊿*Confidence index*_lag1 (Shenzhen)			0.0448	
			(0.15)	
log(*Labor Demand Growth*)				0.0191
				(1.17)
⊿log(*Housing Price*)_lag1	1.029***	1.070***	1.033***	0.610***
	(7.09)	(6.38)	(6.39)	(4.70)
⊿log(*Housing Price*)_lag2	-0.382**	-0.444**	-0.396**	-0.219*
	(-2.16)	(-2.31)	(-2.14)	(-1.75)
⊿log(*Income*)	0.340	0.458	0.508*	-0.000603
	(1.16)	(1.56)	(1.86)	(-0.00)
⊿*Interest*_lag1	0.0242	0.00116	-0.0115	-0.00942
	(0.62)	(0.03)	(-0.31)	(-0.02)
Constant	0.0669**	0.0748*	0.0757*	0.0776
	(2.31)	(1.71)	(1.77)	(1.42)
Quarter fixed effect	Yes	Yes	Yes	Yes
Observations	52	52	52	56
Adjusted R^2	0.648	0.622	0.618	0.439

Notes: (1) t-statistics are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level;*: significant at the 10% level. (3) Reference cities include Guangzhou and Shenzhen.

Table 4 The Heterogeneous Effects of the Confidence Index on Market Outcomes

Dependent Variable:	Δlog(*Housing Price*)			log(*Housing Sales*)		
	(1)	(2)	(3)	(4)	(5)	(6)
log(*Labor Demand Growth*)	0.00800*	0.00745*	0.00751*	0.112**	0.115**	0.115**
	(1.82)	(1.73)	(1.74)	(2.59)	(2.53)	(2.53)
*ΔConfidence index*_lag1	0.525**	-0.274***	-0.302***	-1.970	-0.924**	-0.976**
	(2.29)	(-3.20)	(-3.17)	(-1.64)	(-2.04)	(-2.08)
*ΔConfidence index*_lag1**Supply Elasticity*	-0.550**			2.405*		
	(-2.11)			(1.74)		
*ΔConfidence index*_lag1**Young%*		1.114***			3.069*	
		(4.21)			(1.96)	
*ΔConfidence index*_lag1**Young_Male%*			2.317***			6.200*
			(4.03)			(1.99)
*Dependent Variable*_lag1	0.299***	0.290***	0.290***	0.738***	0.737***	0.737***
	(4.57)	(4.53)	(4.53)	(26.21)	(24.76)	(24.70)
*Dependent Variable*_lag2	0.0571	0.0530	0.0532	0.158***	0.159***	0.159***
	(1.52)	(1.44)	(1.45)	(5.60)	(5.45)	(5.44)
Δlog(*Income*)	-0.00253	-0.00131	-0.00123	0.194	0.182	0.181
	(-0.16)	(-0.08)	(-0.08)	(1.21)	(1.16)	(1.15)
ΔInterest_lag1	0.0818	0.0706	0.0705	-0.409***	-0.411***	-0.412***
	(0.99)	(0.88)	(0.88)	(-14.40)	(-12.79)	(-12.77)
Constant	0.0116***	0.0125***	0.0126***	1.005***	1.007***	1.007***
	(4.12)	(4.59)	(4.61)	(9.29)	(9.20)	(9.19)
Quarter fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	977	977	977	978	978	978
Adjusted R^2	0.136	0.135	0.135	0.812	0.812	0.812

Notes: (1) t-statistics are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level;*: significant at the 10% level. (3) Standard errors are clustered by city. (4) The results reported in this table are based on OLS estimates of equations (5) and (6) in the text.

Table 5 Market Confidence Influences Individuals' Expectations

Dependent Variable	*Expectation*	*Purchase Plan*
	OLS	Ordered Logistic Regression
	(1)	(2)
Confidence index	47.81***	
	(5.42)	
Expectation		0.0142***
		(2.92)
Lagged housing price (log(*HP*)_lag1)	-51.13***	-1.112
	(-5.22)	(-0.46)
Lagged Interest rate in real term (INTEREST_lag1)	-3.415***	-4.235
	(-2.64)	(-0.92)
Whether the household owns a house now	0.228	-0.0860
	(0.66)	(-0.81)
log(*Household annual income*)	0.249	0.287***
	(0.97)	(2.82)
Household head's age	0.192**	0.0317
	(2.35)	(1.12)
Household head's age Square	-0.00181**	-0.000286
	(-2.31)	(-1.01)
Household head's gender (male=1)	0.237	0.124
	(0.84)	(1.34)
Whether the household head holds a graduate degree (yes=1)	0.214	0.102
	(0.53)	(0.80)
Constant	259.4***	
	(5.12)	
City fixed effect	Yes	Yes
Observations	5218	1747
Adjusted R^2/ chi2	0.109	55.63

Notes: (1) t-statistics are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level;*: significant at the 10% level. (3) Standard errors are clustered by city. The data are from a seven city survey. The unit of analysis is a household. In column (1), the dependent variable is the respondent's expectation about his city's housing price appreciation rate in the next 12 months (%). In column (2), the dependent variable is an ordered variable that measures how soon a household plans to buy an apartment.

Web Appendix Table

Table WA1 The Correlation between Confidence Index and Fundamentals

The Dependent Variable: *⊿Confidence index*

	(1)
log(*Labor Demand Growth*)_lag1	0.000171
	(0.04)
*⊿*log(*Housing Price*) _lag1	-0.0432
	(-0.67)
*⊿*log(*Income*) _lag1	-0.0648
	(-1.08)
*⊿Interest*_lag1	-0.114
	(-0.55)
Constant	0.0107
	(0.62)
Quarter fixed effects	Yes
Observations	977
Adjusted R^2	0.002

Notes: (1) t-statistics are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level;*: significant at the 10% level. (3) Standard errors are clustered by city.

Table WA2 The Orthogonalized Confidence Index Predicts Price and Quantity Housing Market Outcomes (Panel, all cities, 2006Q1-2013Q4)

The Dependent Variable	⊿log(*Housing Price*)		log(*Housing Sales*)	
	OLS	System GMM	OLS	System GMM
	(1)	(2)	(3)	(4)
log(*Labor Demand Growth*)	0.00740*	0.0146*	0.117**	0.0849***
	(1.69)	(1.71)	(2.68)	(2.86)
⊿*Confidence index_o*_lag1	0.301***	0.149	-0.106	0.485*
	(6.13)	(1.49)	(-0.67)	(1.76)
lag1. Dependent Variable	0.0461	0.140**	0.749***	0.614***
	(1.12)	(2.30)	(26.45)	(10.19)
Lag2. Dependent Variable	0.0669***	0.0583*	0.152***	-0.0485
	(2.92)	(1.98)	(5.10)	(-1.02)
⊿log(*Income*)	0.00185	0.00168	0.182	0.113
	(0.11)	(0.12)	(1.23)	(0.77)
⊿*Interest_lag1*	0.129	0.104	-0.413***	-0.375***
	(1.34)	(0.85)	(-14.27)	(-11.28)
Constant	0.0132***	0.0601**	0.962***	4.283***
	(3.68)	(2.12)	(9.26)	(6.79)
Quarter fixed effect	Yes	Yes	Yes	Yes
Arellano-Bond test for AR(1) in first differences: z (p-value)		-2.94*** (0.003)		-4.13*** (0.000)
Arellano-Bond test for AR(2) in first differences: z (p-value)		-1.20 (0.229)		-1.50 (0.134)
Hansen test of overid. Restriction: chi2 (p-value)		29.97 (0.186)		33.21 (0.948)
Observations	977	977	978	978
Adjusted R^2	0.124		0.812	

Notes: (1) t-statistics are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level;*: significant at the 10% level. (3) Standard errors are clustered by city for the OLS regression.