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Capital Flows, Asset Prices, and the Real Economy: A “China Shock” in the U.S. Real Estate Market*

Zhimin Li[†] Leslie Sheng Shen[‡] Calvin Zhang[§]

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Abstract

We study the effects of foreign real estate capital flows on local asset prices and employment using detailed housing transactions data. We document (i) a “China shock” in the U.S. real estate market after 2007 driven by the Chinese government’s house purchase restrictions and (ii) “home bias” in foreign Chinese housing purchases in the United States as they are concentrated in ZIP codes historically populated by ethnic Chinese. Exploiting the quasi-random temporal and spatial variation of real estate capital inflows from China, we find that foreign Chinese housing purchases have a positive and significant effect on local housing and labor markets. A one standard deviation increase in exposure to these purchases explains 24% and 18% of the cross-ZIP-code variation in local house prices and employment, respectively, with the employment effect transmitted through a housing net worth channel. We also show that these purchases drive out lower-income residents. Our results highlight the role of foreign real estate capital flows in both stimulating the real economy and inducing gentrification in local economies.

JEL Classification: E20, F61, J21, R21

Keywords: Capital flows, house price, employment, China shock

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I Introduction

A nontraditional form of international capital flows—residential real estate capital inflows—has become increasingly prominent. Ranging from 3% to 11% of gross capital inflows into the United States over the past decade, these flows possess characteristics of both foreign portfolio investment and foreign direct investment (FDI)—two traditional forms of international capital flows typically viewed as mutually exclusive.¹ Residential real estate capital flows are often contentious, as they are perceived to drive up housing costs for domestic residents and increase the volatility of local housing markets. In response, a number of countries have enacted regulations in the form of a stamp tax or additional duty on purchases by foreign buyers.² Despite their unique characteristics and prominence as a policy concern, we still have a rather limited understanding of the significance of residential real estate capital flows. This paper provides the first direct estimate of the impact of residential real estate capital flows on local asset prices and the real economy in the United States.³

Using detailed real estate transactions data in California from 2001 to 2013, we point out an unprecedented surge in housing purchases by foreign (non-resident) Chinese over the period of 2007-13—a “China shock” in the U.S. real estate market.⁴ We further highlight the concentration of their purchases in ZIP codes historically populated by ethnic Chinese—“home bias” in foreign Chinese housing purchases. We exploit the quasi-random temporal and spatial variation of real estate capital inflows from China to study their impact on local asset prices and labor markets. Our results show that these capital inflows increase local house prices significantly and, more strikingly, have a strong positive effect on local employment. We further shed light on the mechanism underlying the real economic effects and the distributional consequences of these capital flows. We show that the employment effect appears to be transmitted through a housing net worth channel, and that in contrast to

¹ Estimates of the share of residential real estate capital inflow in gross capital inflows are based on data published by the IMF Balance of Payments and the National Association of Realtors (NAR).

² A number of national and local governments around the world, including Singapore, Australia, New Zealand, Hong Kong, London, Vancouver and Toronto, have implemented or are considering laws to curb foreign investment in local housing markets. For example, in 2011, the Singaporean government introduced an additional buyer’s stamp duty of 10% of the purchase price to foreigners who buy residential property and increased it to 20% of the purchase price by 2018. In 2016, the British Columbia provincial government in Canada imposed an additional property transfer tax of 15% on all residential property purchased by foreign buyers.

³ An emerging literature studies the effect of foreign investment on housing markets. For example, Badarınza and Ramadorai (2018) and Sa (2016) study the effect of foreign investment on housing prices in localities in England and Wales. However, the papers in this line of literature either indirectly proxy for foreign investment or focus on commercial investment. Also, all of these papers center the analysis on housing market effects only.

⁴ In this paper, “foreign Chinese” denotes non-resident Chinese, and “ethnic Chinese” denotes Chinese who regularly reside in the United States.

the positive real effects, real estate capital inflows crowd out low-income local residents and thereby induce gentrification. Our results highlight the real and distributional consequences of a China shock on the finance side for foreign economies.

While the surge in foreign Chinese housing purchases in the United States has grabbed many headlines in the popular press over the past decade, our paper is the first to provide a formal quantification of the phenomenon and assess its impact on the real economy.⁵ The key difficulties to studying this issue lie in the lack of detailed data on real estate capital inflows and the lack of exogenous shocks to establish the causal relationship. The only available data on foreign purchases of U.S. residential real estate are the annual estimates published by the National Association of Realtors (NAR), but they are based on voluntary realtor survey responses, which typically have low response rates, e.g., 3% in 2016. To overcome the challenge, we turn to transactional-level data on real estate purchases to identify foreign homebuyers. Even though information on the origin of the buyers is often unavailable in housing purchase records due to legal restrictions, we devise a three-step algorithm to impute the amount of housing purchases by foreigners. First, we identify the ethnicities of buyers by applying the ethnic name-matching technique from Kerr (2008a) to their first and last names. We keep only transactions made by buyers belonging to one of the eight non-Anglo-American ethnic groups with a probability of one. Second, we only keep transactions that are made in all cash, as foreigners have limited access to U.S. mortgage markets. Third, to avoid counting purchases made by non-Anglo-Americans who normally reside in the United States, we adjust our estimates downward the amount of all-cash home purchases made by resident non-Anglo-Americans. Using the algorithm, we construct our two measures of foreign housing purchases: foreign housing transaction value (FHTV) and foreign housing transaction count (FHTC). The former aims to capture residential real estate capital inflow, and the latter aims to capture the quantity margin of foreign housing transactions.

Using the measures, we document two facts about housing purchases by foreigners in the United States. First, we point out a China shock in the U.S. real estate market: Housing purchases by foreign Chinese in California began to surge in 2007 and soared as much as twentyfold in terms of transaction share by value and count over the period of 2007-13, reaching almost 4% of total housing transactions. The persistence of housing purchases by foreign Chinese during the entire sample period, which includes the periods of both the

⁵ See, for example, “Chinese buying up California housing,” 25 Nov. 2013, *CNBC*; “Chinese take lead among foreign buyers of U.S. homes,” *Financial Times*, 18 Jun. 2015; and “Chinese cash floods U.S. real estate market,” *The New York Times*, 28 Nov. 2015. According to the NAR, Chinese have taken the lead among all foreign buyers of U.S. real estate by a wide margin in both value and quantity. Foreign Chinese buyers spent \$28.6 billion on residential property in the United States in 2014—a 30% increase from the previous year and more than two and a half times the amount spent by Canadians, the next biggest group of foreign buyers of real estate in the United States.

financial crisis and the recovery in the United States, reveals the non-cyclical nature of residential capital inflows. This characteristic differentiates them from traditional forms of international capital flows, which tend to be pro-cyclical. While our paper focuses on the external impacts of the surge and not on its cause, we provide evidence suggesting that the two phases of housing purchase restrictions (HPRs) introduced by the Chinese government to control housing price inflation since 2006 are the primary drivers of the persistent surge in housing purchases by foreign Chinese in the United States.

Second, housing purchases by foreign Chinese exhibit a form of home bias. The surge in foreign Chinese housing purchases has been concentrated in locations historically populated by ethnic Chinese: Housing purchases by foreign Chinese make up almost 8% of total housing transactions in ZIP codes in the top decile of historical ethnic Chinese population shares, compared with less than 1% in ZIP codes in the bottom decile.⁶

The two new facts—a China shock in the U.S. real estate market, and home bias in foreign Chinese housing purchases—reveal variations in these purchases in both the time-series and cross-sectional dimensions, which we exploit to estimate the effects of Chinese capital flows into the U.S. residential real estate market on local house prices and employment. We include the China shock in the U.S. real estate market in the empirical framework using a binary variable that takes the value 1 for the years after (and including) 2007. The challenge in empirically establishing the causal relationship between foreign Chinese capital inflows and the local economy lies in an issue of endogeneity: It is difficult to distinguish whether the increase in housing purchases by foreign Chinese is affecting the local economy, or whether foreign Chinese select into neighborhoods that are more prosperous. As a solution to the issue, we use historical ethnic Chinese population share at the ZIP-code level as an instrument for differential exposure to real estate capital inflows from China, exploiting the home bias stylized fact.⁷ This instrument is akin to a Bartik instrument, as the underlying identifying assumption of our instrument also is in terms of cross-sectional local shares. The combination of an event-study framework and an instrumental variable (IV) approach enhances identification compared with a traditional time-series analysis. Furthermore, our preferred specification controls for county-year fixed effects and time-varying ZIP-code-level

⁶ Burchardi et al. (2019) found a similar pattern in the context of foreign direct investment (FDI). They show that the number of residents with ancestry from a given foreign country in U.S. counties strongly predicts local firms' FDI with that country. Such pattern is consistent with the "preferred habitats" theory in finance, which predicts that heterogeneous investors prefer different subsets of assets within a broader asset class (Dorn and Huberman, 2010; Greenwood and Vayanos, 2010). Explanations for this behavior include networks, cultural familiarity, or low information frictions, all of which could apply to our context.

⁷ As we explain in detail in Section III, the full IV we use is the aggregate housing transaction value in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. But the former component of the instrument, aggregate housing transaction value in California, is absorbed by county-year fixed effects in our preferred specification.

characteristics that may systematically affect local house markets and labor markets, including pre-sample period population, education, and trends of income and the outcome variables for house prices and employment. The controls allow us to focus exclusively on within-county cross-ZIP-code variation based on historical ethnic Chinese population distribution and relieve concerns about confounding factors such as heterogeneous land policy or county-level economic conditions.

We first find that capital inflows from China significantly increased local house prices, as measured by either Zillow Home Value Index or housing transaction values from DataQuick. A one standard deviation increase in exposure to real estate capital inflows from China, as measured by transaction value, explains 24% of the cross-ZIP-code variation in local house prices and raises the home price in an average ZIP code by \$83,000, or 15%.

We further show that these capital flows have real economic effects. Using employment data from the U.S. Census Bureau, we find that foreign Chinese housing purchases significantly increase local total employment, controlling for county-year fixed effects and pre-sample period ZIP-code-level population, education, and income and employment trends. A one standard deviation increase in exposure to real estate capital inflows from China explains 18% of the cross-ZIP-code variation in local employment, and raises the total employment level in a ZIP code by 18% on average. Given part of the sample period coincides with the U.S. financial crisis, the result can also be interpreted as real estate capital inflows play a stabilizing role during domestic economic downturns. Note that these estimates represent local general equilibrium effects on local housing and employment markets and may understate the true magnitude of the impact of Chinese capital inflows, as they do not capture the aggregate effects across all U.S. regions.

Our results are robust to identification validity testing and alternative regression specifications. First, we show that the increase in housing purchases by foreign Chinese after 2007 is not correlated with local employment and income in the period before 2007. This finding alleviates the concern that neighborhoods that attracted more capital inflows from China might be systemically different from the rest in economic conditions. Second, we instrument for local economies' differential exposure to real estate capital inflows from China using an alternative IV—China's gross domestic product (GDP) weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. This instrument allows us to isolate the variation in the surge in foreign Chinese housing demand driven solely by factors related to China, including changes in China's homebuying regulations and capital flow regulations. We obtain similar results. Third, we address concerns related to measurement error in the foreign housing transaction measures and show that it does not significantly bias our results.

Given the robust findings on the impact of foreign Chinese housing purchases on local house prices and labor markets, we next turn to study the mechanisms that transmit the housing price effect to the real economy. An obvious explanation is a direct migration channel: Foreign Chinese housing purchases imply migration inflow into the corresponding neighborhoods, which would push up demand for local goods and thereby local employment. However, we find no evidence in support of the migration channel.

Instead, we find evidence that the housing net worth channel plays a key role in linking foreign Chinese real estate capital inflows to local employment. Theory suggests that housing net worth could affect employment by influencing consumer demand through either a direct wealth effect or less binding borrowing constraints (due to the rise in the collateral value) in recipient regions (Mian et al., 2013; Mian and Sufi, 2014). We test for this mechanism by estimating the impact of foreign Chinese housing purchases on local nontradable-sector employment and tradable-sector employment separately. Any effect of housing net worth fluctuations on local employment should show up foremost in nontradable sectors, as employment in these industries depends primarily on local demand, while the production of tradable goods is more diffused across geographical space. Consistent with this conjecture, we find that real estate purchases by foreign Chinese significantly increase employment in the local nontradable sectors, whereas the effects on tradable sectors are negligible and insignificant. This result holds even when we exclude construction-sector employment from the nontradable-sector employment measure.

In addition to studying real economic effects, we explore the distributional consequences of foreign Chinese real estate capital inflows. We show that foreign Chinese house purchases crowd out local residents on net, and this crowding-out effect is concentrated in the lower-income groups. This effect suggests that real estate capital inflows could adversely affect housing affordability and induce gentrification, in contrast to their positive real effects.

To provide a better understanding of the economic mechanism driving the empirical results, we build a simple model that clarifies the transmission of foreign housing demand shock to local asset prices and employment. It highlights that foreign Chinese real estate capital inflows increase local employment in the nontradable sector via two opposing forces: the housing net worth channel and the crowding-out channel. On the one hand, an exogenous increase in foreign housing demand raises local house prices, which increases the housing net worth of local residents and their demand for the local nontradable good (housing net worth channel). At the same time, higher housing prices lead to higher living costs in the region, which drive out some local residents and decrease the demand for the local nontradable good (crowding-out channel). If the former effect dominates, we see an increase in local nontradable-sector employment in the recipient regions of foreign real estate capital flows.

This paper connects several strands of literature and has important policy implications. Foremost, it contributes to a growing literature on the effects of housing purchases by foreigners on house prices. Recent studies show that foreign buyers significantly push up house prices in large cities in Europe, including London (Sa, 2016; Badarinza and Ramadorai, 2018) and Paris (Cvijanovic and Spaenjers, 2015). Our work provides first empirical evidence on the causal effect of foreign real estate capital inflows on house prices in the United States.⁸ Moreover, our work is the first to develop an algorithm to directly identify buyer origins from housing transaction data, a main advantage over previous studies that have so far offered indirect evidence of the impact of foreign buyers' purchases (e.g., Cvijanovic and Spaenjers, 2015; Sa, 2016; Badarinza and Ramadorai, 2018). This method enables direct estimation of the elasticity of housing prices with respect to foreign real estate capital inflows, which would not be possible with indirect approaches.

More importantly, we contribute to this literature by going beyond the asset price effects and studying the consequences of foreign housing purchases for the local real economy as well as the underlying mechanisms. In that sense, this paper also adds to the line of research exploring the effects of housing market fluctuations on the real economy (see Davis and Van Nieuwerburgh 2015 for an overview). Green (1997), Case (2000), and Glaeser and Parker (2000) are among the earlier works to suggest a link between real estate investment and the macroeconomy. Recent studies by Mian et al. (2013) and Mian and Sufi (2014) argue that the deterioration in household balance sheets due to the housing market crash during the 2007-09 financial crisis induced a sharp decline in U.S. consumption and employment. Our paper provides evidence supporting such a housing net worth channel, but in the context of a positive housing price effect driven by foreign capital inflows. For policymakers, our findings of real economic effects from foreign housing purchases bring a new angle to the ongoing policy debates on the need for government regulations to curb foreign housing purchases.

This paper also contributes to the literature on the effects of capital inflows on the real economy. Unprecedented volume and varied types of international capital have flowed across national borders over the past three decades.⁹ The real economic consequences of these flows are at the heart of a passionate debate among researchers and policymakers. One view argues that capital inflows improve the real economy by augmenting saving and enhancing capital allocation efficiency in the recipient countries (Fischer, 1997; Summers,

⁸ Favilukis and Van Nieuwerburgh (2017) calibrate a spatial equilibrium model with heterogeneity among residents to study the welfare implications of out-of-town buyers of the New York City housing markets, but their focus is not providing causal evidence.

⁹ Based on data from the IMF International Financial Statistics database, gross capital inflows increased from \$0.4 trillion in 1980 and \$3.7 trillion in 2000 to \$11 trillion in 2007—an amount equivalent to 19% of world GDP. Of this amount, almost 90% of gross capital inflows went to developed economies.

2000; Harrison et al., 2004; Tong and Wei, 2010). Other studies caution that capital inflows could fuel booms in asset prices and impose downside risks to financial stability and economic performance (Stiglitz, 2002; Aizenman and Jinjark, 2009; Gourinchas and Obstfeld, 2012). A third view contends that capital flows have no significant impact after controlling for other variables, such as initial income level (Rodrik, 1998). The wide range of views arises in part from the difficulty of evaluating the causal impact of foreign capital inflows on the real economy. Traditional time-series analysis at the aggregate level suffers from the issue of simultaneity, because the timing of capital inflows is rarely exogenous, and unobserved factors may concurrently affect capital flows and the real economy. In this paper, we turn to micro-level evidence and apply a cross-sectional strategy to estimate the effect of capital inflows on local economies, using foreign Chinese real estate capital inflow into the United States as a natural experiment. We find that residential real estate capital inflows have an expansionary effect on local real economies during both the financial crisis and the normal period. This finding suggests that foreign capital inflows can play a stabilizing role in economic downturns.

Finally, our work contributes to the literature on the external impacts of China’s integration into the global economy. The existing literature focuses mainly on the effects of rising Chinese import competition on local labor markets in the United States (Autor et al., 2013; Acemoglu et al., 2016) and in Europe (Balsvik et al., 2015), with most finding that Chinese imports leave negative effects on local economies abroad.¹⁰ While China’s trade with the rest with the world has been notable, China also has been increasingly integrated into global finance. This paper is the first academic study that examines the local economic effects of a China shock on the finance side—the surge of residential real estate capital inflows from China in the United States. In contrast to existing studies on the China shock, we find positive effects on local employment, especially in nontradable sectors, but these gains come at the cost of gentrification by driving out poorer households. Optimal policy that aims to manage real estate capital flows should consider both the pros and cons of local labor market impacts.

The remainder of the paper proceeds as follows. Section II describes our data, the construction of the residential capital inflows measure, and two new facts based on the measure—the China shock in the U.S. real estate market, and home bias in foreign Chinese housing purchases. Section III discusses the identification strategy and the results on the effects of foreign Chinese housing transaction on local housing markets and local employment. Section IV investigates mechanisms linking the foreign Chinese housing purchases and the

¹⁰ Besides labor market effects, subsequent papers find rising Chinese import competition significantly affects innovation (Autor et al., 2017), electoral consequences (Autor et al., 2017), and marriage market outcomes (Autor et al., 2018).

real economy and explores distributive consequences. Section V presents a simple model rationalizing the empirical findings. Section VI concludes.

II Data, Measurement, and Stylized Facts

Given our objective to study the asset price and economic effects of residential home purchases by foreigners in the United States, we need measures capturing these foreign purchases. A key challenge in generating such measures is that U.S. county offices do not collect data on homebuyers' country of origin because of legality restrictions. The only available data are aggregate estimates published annually by the NAR based on voluntary survey responses from realtors, but the survey response rate tends to be very low (e.g., 3% in 2016). To overcome the data limitation, we use transaction-level data and develop a three-step procedure to impute the amount of foreign real estate purchases. We show that the only group of foreigners that significantly increased real estate purchases in the United States over the sample period of 2001–13 is the Chinese. In particular, we document two new stylized facts—a China shock in the U.S. real estate market and home bias of foreign Chinese home purchases. Given the dominance of the Chinese as the key foreign buying group, we focus our study on the impact of their real estate purchases on local asset price and the real economy in the subsequent empirical analysis.

II.A Real Estate Transaction Data

Our main data source to impute real estate purchases by foreigners is the housing transaction data from DataQuick, which contains the universe of purchase records collected from county register of deeds and assessor offices throughout the United States. For each home sale, the data includes the sales price, the closing date, the precise address of the home, home characteristics, information on home financing, and names of the buyers and sellers. In our analysis, we focus on housing transactions in the three largest Core-Based Statistical Areas in California (Los Angeles, Long Beach, Riverside; San Jose, San Francisco, Oakland; and San Diego, Carlsbad, San Marcos), covering 17 counties and 912 ZIP codes. We restrict our sample to single-family residential homes. The final dataset contains 1,796,669 residential housing transactions over the period 2001–13.

II.B Imputation Using Three-Step Procedure

Using the housing transaction data, we next develop a three-step procedure to impute the amount of real estate purchases by foreigners. Specifically, we construct measures that

capture FHTV and FHTC. The former can be viewed as a measure of real estate capital inflows; the latter measure captures the quantity or extensive margin of foreign real estate investment.

First, we identify the ethnicities of the homebuyers in our sample using the ethnic name-matching algorithm from Kerr (2008a), Kerr (2008b), and Kerr and Lincoln (2010).¹¹ The algorithm applies the ethnic-name database from the Melissa Data Corporation and manually codes any remaining unmatched names.¹² Exploiting the fact that certain names are unique or more common to one ethnicity, this algorithm assigns each homebuyer a probability of belonging to a specific ethnicity based on the buyer’s first and last names, with the probabilities summed up to one. If a name is unique to one ethnicity, the buyer will be assigned to the respective ethnicity with a probability of one. For names common among multiple ethnicities, the technique uses the demographic breakdown in the metropolitan statistical area (MSA) where the property is located for assigning probabilities. For example, a person with the name Sheng Shen would be assigned to the Chinese ethnicity group with a probability of one. Someone with the name Leslie Shen, which could be of Chinese or American ethnicity, would be assigned to each of the two ethnic groups with probabilities based on the proportion of Chinese and Americans in the MSA where the purchase took place. In total, eight ethnicities are distinguished by the name-matching technique: Anglo-Saxon/English, Chinese, European, Hispanic, Indian, Japanese, Korean, and Russian.¹³ The match rate on the names from the housing transaction data sample is 97%. As the first step of constructing measures of foreign housing transactions, we keep only transactions made by buyers belonging to one of the eight ethnic groups with a probability of *one*.

Second, we keep only housing transactions made by non-Anglo-Americans that are in *all cash*. This step is motivated by the fact that foreigners have limited access to the U.S. mortgage market: Non-U.S. citizens without lawful residency in the United States are not eligible for Fannie Mae, Freddie Mac or Federal Housing Administration home loans, and it is difficult for them to finance homes through private lenders.¹⁴ Furthermore, the NAR reports that most non-resident foreign buyers make all-cash home purchases, while a much smaller fraction of resident foreign buyers pay all cash. According to the “2014 Profile of

¹¹ We thank William Kerr for running the buyer names from our sample through his ethnic name-matching algorithm.

¹² See Kerr (2008b) and Kerr (2008a) for more comprehensive details on the name-matching process and descriptive statistics from their matching exercises. Kerr (2008b) originally created the algorithm to identify the ethnicity of inventors granted patents by the U.S. Patent and Trademark Office. Kerr and Lincoln (2010) use it to investigate the impact of H-1B Visa reforms on Chinese and Indian inventors and patents.

¹³ A number of recent academic papers use similar ethnic name-matching algorithms to impute individuals’ race or ethnicity, such as Diamond et al. (2019).

¹⁴ Mortgages to foreigners through private lenders carry high interest rates and require borrowers to make large down payments in the range of 30% to 50%.

International Activity in U.S. Residential Real Estate” published by the NAR, 76% of non-resident foreign buyers made all-cash purchases, while 33% of resident foreign buyers paid all cash. We recognize that this filtering may make our measures be on the conservative side of the true magnitude because they do not reflect purchases made by foreigners who manage to get mortgages from U.S. private lenders. Nevertheless, focusing on cash-only transactions allows us to identify foreign purchases more accurately, especially considering the opacity of the mortgage market for non-resident foreigners. Moreover, given the small size of non-all-cash transactions made by non-resident foreigners, they likely play a minor role in driving aggregate housing prices and the real economic conditions. Based on the second step of the imputation procedure, our final measures of $FHTV$ and $FHTC$ are equivalent to foreign housing all-cash transaction value ($FHCTV$) and foreign housing all-cash transaction count ($FHCTC$), respectively, for each non-Anglo-American foreign ethnic group (i):

$$FHTV_i \equiv FHCTV_i, \quad (1a)$$

$$FHTC_i \equiv FHCTC_i. \quad (1b)$$

Third, we recognize that restricting the sample to all-cash purchases by non-Anglo-Americans is a necessary but not sufficient criterion for identifying foreign real estate transactions, as the sample may still include purchases by *resident* non-Anglo-Americans—those who normally reside in the United States. In other words, each non-Anglo-American foreign ethnic group i ’s housing transaction value and count ($FHTV$ and $FHTC$) is the difference between its total housing transaction value and count (HTV and HTC), respectively, and those of its U.S. resident population ($RHTV$ and $RHTC$):

$$FHTV_i = HTV_i - RHTV_i, \quad (2a)$$

$$FHTC_i = HTC_i - RHTC_i. \quad (2b)$$

To address the issue, we estimate the amount of all-cash home purchases made by resident non-Anglo-Americans and adjust our measures downward accordingly. Our estimates are based on the assumption that the propensity to make all-cash purchases is similar between Anglo-Americans (A) and resident non-Anglo-American foreign ethnic groups (i):

$$\frac{HCTV_A}{HTV_A} = \frac{HCTV_i}{HTV_i}, \quad (3a)$$

$$\frac{HCTC_A}{HTC_A} = \frac{HCTC_i}{HTC_i}. \quad (3b)$$

where $HCTV$ denotes housing all-cash transaction value, HTV denotes total housing trans-

action value, $HCTC$ denotes housing all-cash transaction count, and HTC denotes total housing transaction count. This assumption is motivated by the fact that U.S. citizens and non-U.S. citizens with lawful residency in the United States have similar access to domestic home loans. We also observe evidence in support of this assumption in the data. As shown in Appendix Figure A.1, most non-Anglo-American foreign ethnic groups behave similarly to Anglo-Americans in their propensity for making all-cash real estate purchases, as measured by both value and count. The only exception is the Chinese after 2007, when their share of all-cash housing transactions surged relative to Americans and all other groups. Given reports from the NAR, we conjecture that the divergence is driven by purchases by non-resident foreign Chinese.

Given the identity and assumptions specified in Equations (1a), (1b), (2a), (2b), (3a), and (3b), we derive the formulas for estimating $FHTV$ and $FHTC$ for each foreign ethnic group:¹⁵

$$FHTV_{izt} = \left[HTV_{izt} - \frac{HCTV_{Azt}}{HTV_{Azt}} \times HTV_{izt} \right] \frac{HTV_{Azt}}{HTV_{Azt} - HCTV_{Azt}}, \quad (4a)$$

$$FHTC_{izt} = \left[HTC_{izt} - \frac{HCTC_{Azt}}{HTC_{Azt}} \times HTC_{izt} \right] \frac{HTC_{Azt}}{HTC_{Azt} - HCTC_{Azt}}, \quad (4b)$$

where A denotes the Anglo-American ethnic group, i denotes the seven foreign ethnic groups (Chinese, European, Hispanic, Indian, Japanese, Korean, and Russian), z denotes ZIP code, t denotes year, HTV denotes total housing transaction value, $HCTV$ denotes housing all-cash transaction value, HTC denotes total housing transaction count, and $HCTC$ denotes all-cash housing transaction count. The first term in Equations 4a and 4b adjusts each foreign ethnic group's total housing transaction value and count, respectively, by the proxy for transactions made by its U.S. resident population; the second term is a re-scaling factor.

It is worth noting that our measures seek to directly capture foreign Chinese capital inflows to residential real estate, a key advantage over studies that provide indirect evidence on the impact of such inflows (e.g., Badarinza and Ramadorai (2018)).¹⁶ The cost of this method is that we do not capture commercial buyers or purchases with suspicious offshore vehicles (e.g., for tax avoidance). This issue should not be a problem for our case because we focus on single-family homes, and commercial purchases tend to be concentrated in high-end properties. Indeed, only about 6% of transactions in our sample originate from

¹⁵ To take advantage of the granularity of our data, we empirically estimate $FHTV$ and $FHTC$ at the ZIP code by year level. The derivation of Equations 4a and 4b proceeds as follows. From Equation 2a, $FHTV_{izt} = HTV_{izt} - \frac{HCTV_{Azt}}{HTV_{Azt}} \times RHTV_{izt} = HTV_{izt} - \frac{HCTV_{Azt}}{HTV_{Azt}} \times (HTV_{izt} - FHTV_{izt})$. Solving for $FHTV_{izt}$ yields Equation 4a. The derivation for Equation 4b formula is similar.

¹⁶ Relative to previous studies, we also examine local economic effects beyond house prices.

business entities.¹⁷ As such, the measurement error arising from not being able to account for commercial purchases is likely small in our case. Moreover, we later find that our results using transaction quantity are just as strong, if not stronger, than those using transaction values.

Using the two measures, we next examine home-purchasing behavior by foreigners in the United States over time and across neighborhoods.

II.C Two Stylized Facts

Fact 1: A China Shock in the U.S. Real Estate Market. We begin by examining the evolution of the share of housing transactions made by foreigners in the California real estate market over the 2001–13 period. Figure I(a) illustrates the share, as measured by dollar value, made by seven foreigner groups: Chinese, European, Hispanic, Indian, Japanese, Korean, and Russian. While purchases by six of seven groups appear negligible over the entire period, home purchases by foreign Chinese increased sharply in during 2007–13. The percentage of housing transactions by foreign Chinese was comparable with the other groups before 2007, but it soared in 2007 and stayed persistently high until the end of the sample period in 2013, reaching almost 4% of total housing transaction value and count in California and overtaking all other foreign ethnic groups as the lead buying group in the market. That is almost a twentyfold increase in transaction value. This observation is consistent with reports from the NAR that the Chinese have become the lead group of foreign buyers in the U.S. real estate market.

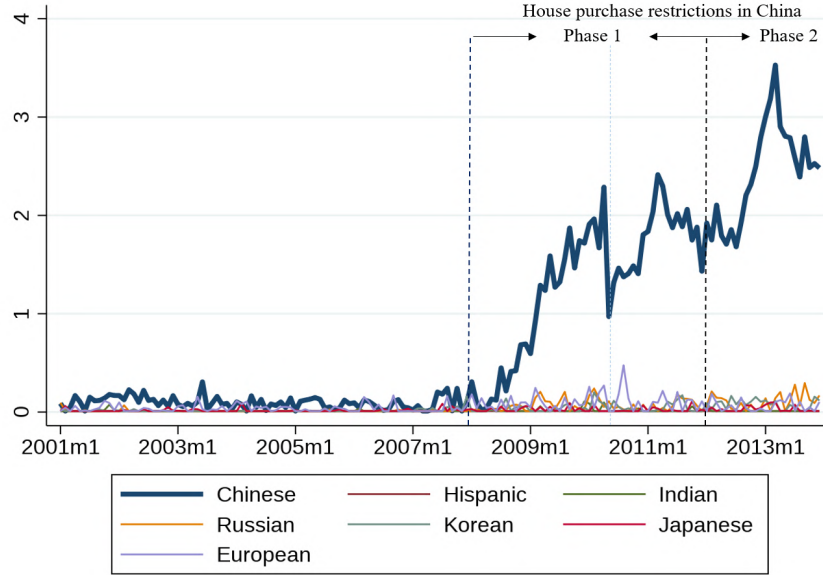
Figure I(a) also can be viewed as an illustration of residential real estate inflows from China. It reveals that this type of capital flows was persistent during the U.S. financial crisis. The non-cyclical nature of residential capital inflows differentiates them from traditional forms of international capital flows, which tend to be pro-cyclical.

Figure I(b) plots the share of housing transactions, as measured by count, made by the seven foreigner groups and illustrates a similar pattern as Figure I(a). The fact that the pattern holds regardless of whether we examine housing transaction by value or count suggests that foreign Chinese have been purchasing residential real estate across a full spectrum of housing types, not only high-end real estate. In sum, we document a China shock in the U.S. real estate market since 2007.

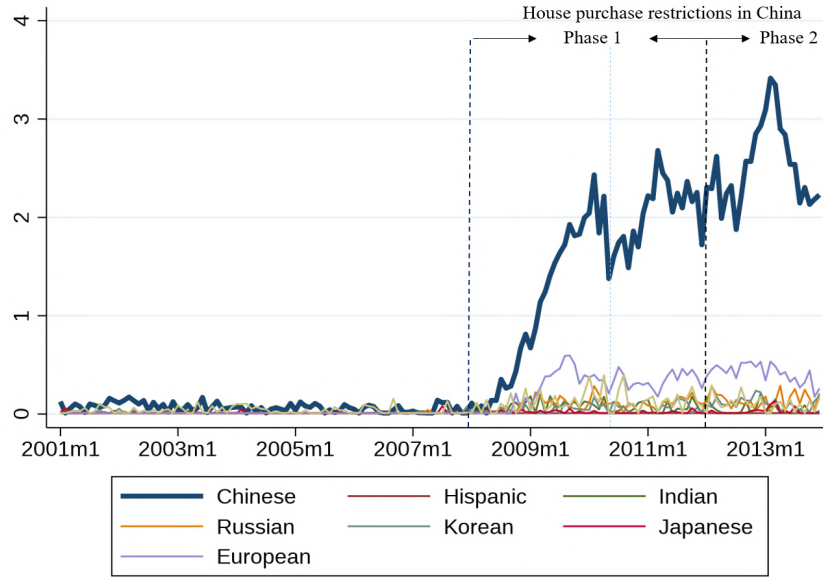
¹⁷ Our context differs from that in London studied by Badarınza and Ramadorai (2018), which has many purchases that can be traced to offshore vehicles probably because they tend to originate from politically unstable countries. In our case, because foreign Chinese buyers most likely use the home for temporary residence or children’s education, they do not have much incentive to hide their names.

Figure I. Foreign Home Purchases in the California Real Estate Market

(a) Foreign Housing Transaction Value



(b) Foreign Housing Transaction Count



Note: Figure (a) plots the share of housing transactions (by dollar value) made by seven foreign ethnic groups in the three largest Core-Based Statistical Areas (CBSAs) in California. Figure (b) plots the share of housing transactions (by count) made by foreign Chinese and buyers of other ethnicities in the three largest CBSAs in California. Vertical lines show the policy phases of China's house purchase restrictions. The sample period runs monthly from 2001 to 2013. Source: DataQuick and authors' calculations.

Fact 2: Home Bias of Foreign Chinese Housing Purchases. We further explore the spatial distribution of these home purchases and document a form of home bias: Housing purchases made by foreign Chinese tend to be concentrated in areas that had been historically populated by ethnic Chinese. Figure II(a) and (b) dissects Figure I(a) and (b), respectively, by zooming in on home purchases by foreign Chinese in ZIP codes in the top quartile of the ethnic Chinese population based on the 2000 Census Bureau data. In those neighborhoods, they made up almost 8% of the total real estate transaction value by 2013. We also observe this pattern of home bias in foreign Chinese housing purchases when illustrating them on maps. Appendix Figure A.4 illustrates housing purchases by foreign Chinese in the Los Angeles region from 2010 to 2013. Evidently, foreign Chinese home purchases tend to be clustered in ZIP codes that are historically ethnic Chinese (the ZIP codes in darker shades of blue).

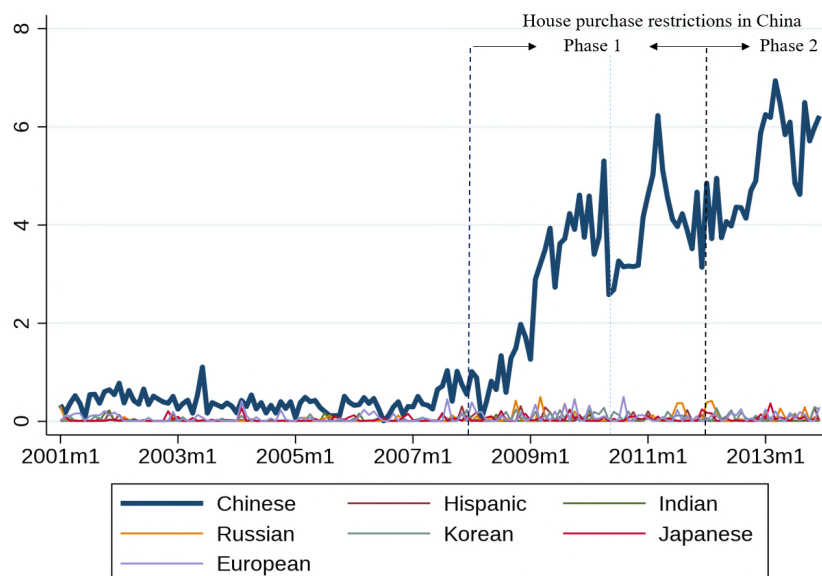
This pattern is consistent with the idea of the “preferred habitats” theory in finance, which contends that heterogeneous investors prefer a different subset of assets within a broader asset class (Badarinsa and Ramadorai, 2018). In our context, foreign Chinese may cluster their purchases in regions with a high concentration of residents with the same source-country ethnicity because of networks, cultural familiarity, or low information frictions. Moreover, this stylized fact resonates with the finding in Burchardi et al. (2019) that the ancestry composition of U.S. counties strongly predicts their foreign direct investment with the respective countries.

Why Was There a China Shock? While a rigorous study of the factors causing the surge in housing purchases by foreign Chinese is out of the scope of this paper, we provide suggestive evidence showing that a series of HPR introduced by the Chinese government likely played a key role. The policies started in 2007 with a long-term goal to rein in speculative housing demand and curb excessive home price inflation in China. A brief history of the policies is summarized here.

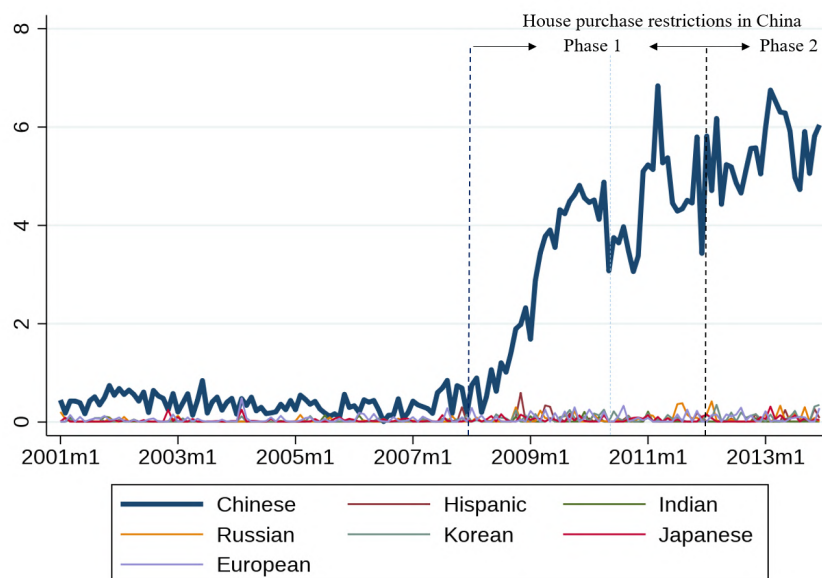
1998–2006. Before 1998, the Chinese government controlled the distribution of real estate, which was provided to employees of state-owned enterprises as part of employment benefits. In 1998, the government introduced a reform policy to commercialize real estate, allowing unrestricted buying and selling of properties for the first time in the country’s history. This, combined with high household savings, low down-payment requirement for mortgages (around 20%), and a lack of alternative investment opportunities, induced surging housing demand and skyrocketing house prices in the subsequent years. Concerned about house price inflation, the Chinese government elevated house price stability as an official initiative in the “National Eight” (*guobatiao*) views on real estate market regulation in 2005.

Figure II. Foreign House Purchases in the California Real Estate Market: Zip Codes in the Top Quartile of Ethnic Chinese Population Share

(a) Foreign Housing Transaction Value



(b) Foreign Housing Transaction Count



Note: Figure (a) plots the share of housing transactions (by dollar value) made by ethnic Chinese and buyers of other ethnicities in ZIP codes in the top quartile of ethnic Chinese population, based on the 2000 Census data, in the three largest Core-Based Statistical Areas (CBSAs) in California. Figure (b) plots the share of housing transactions (by count) made by ethnic Chinese and buyers of other ethnicities in ZIP codes in the top quartile of ethnic Chinese population. Vertical lines show the policy phases of China's house purchase restrictions. The sample period runs monthly from 2001 to 2013. Source: DataQuick and authors' calculations.

In June 2006, the Chinese government issued the “National Six” (*guoliutiao*) real estate market regulation, which restricted down payment for first homes to greater than 30%, and introduced a tax based on the original transaction price for homes resold within five years of purchase.¹⁸ These regulations marked the first set of explicit policies to curb house prices; however, it proved insufficient as prices continued to skyrocket in the subsequent year.

HPR Phase 1. In September 2007, the Chinese government introduced the most drastic measure hitherto to restrict home purchases. The People’s Bank of China and the China Banking Regulatory Commission jointly issued the No. 359 [2007] Notice to “strengthen the management of commercial real estate credit loans.” It increased the mortgage down-payment restriction for second homes to 40%, bounded the interest rate on mortgage loans to be at least 10% higher than the prevailing market rate, and capped the maximum monthly payment-to-income ratio at 50%. This policy resulted in a shrinkage in purchase volume domestically.

In May 2010, the Chinese government imposed additional restrictions, the “National Ten” (*guoshitiao*), on home purchase to curb housing demand. City residents who already own one house or condo can buy, at most, one more house or condo, and non-residents can buy, at most, one house or condo. Regardless of whether the second home was an upgrade, down payment had to be at least 50%.¹⁹ The restriction, first implemented in Beijing, extended to other major cities such as Shanghai, Guangzhou, and Shenzhen later that year. In 2011, a new set of “New National Eight” (*xin guobatiao*) regulations further increased the minimum down payment on second homes to 60% and introduced more tightening measures involving taxes, land transactions, and no mortgage beyond the second home.

HPR Phase 2. The original National Ten HPRs were set to expire by the end of 2011, but in 2012, most city governments expressed commitment to continue the regulations. Furthermore, local governments were allowed to implement even more stringent HPRs on a temporary basis based on local market conditions. In February 2013, the government issued the “New National Five” (*xin guowutiao*) to reiterate policies restricting multiple home purchases and mortgage lending. Although most HPRs in Phase 2 were similar to those in Phase 1, they reflected the government’s commitment to control domestic real estate demand for the long haul. They proved effective in inducing another wave of speculative demand damping and home price inflation slowing (Sun et al., 2017).

The timing of the two phases of HPRs by the Chinese government corresponds to the

¹⁸ The restriction did not apply to dwelling-sized homes of less than 90 m². The down payment for which was still kept at 20%.

¹⁹ If the first home was smaller than the average house size per person in a city, the second home was considered an upgrade. Before 2010, the down payment and mortgage requirements for buying such second homes were similar to those for first home purchases.

surge in housing purchases by foreign Chinese in the U.S. real estate market, as denoted by the vertical dotted lines in Figure I and Figure II. The initiation of Phase 1 of HPR in September 2017 coincides with the initial sharp surge in foreign Chinese housing purchases, as represented by the first dotted vertical line in the figures. While it may be surprising that the initial regulations in Phase 1 of HPR, which mostly toughened lending standards, could affect all-cash purchases abroad, it is conceivable that the policies negatively affected future expected return of real estate in China and made investing in real estate abroad comparatively more attractive. The timing of the more stringent HPRs in Phase 1 and policies in Phase 2 of HPR, which came around May 2010 and 2012, respectively, corresponds to two new waves of foreign Chinese home purchases in the United States, as shown by the second and third vertical dotted lines in the figures.

A few additional factors may have played a role in inducing housing purchases by foreign Chinese in the United States including the appreciation of the yuan against the dollar over the sample period and a relaxation of capital outflow regulation by the Chinese government in 2007 that increased the limit on how much Chinese citizens can exchange yuan to other currencies from U.S.\$20,000 to U.S.\$50,000 per person annually.²⁰ Besides the actual policies in China, the increasing flow of information about the U.S. housing markets for potential buyers in China could have facilitated the intensification and persistence of foreign Chinese house buying in the United States since 2007. Numerous Chinese websites that advise buying opportunities in the United States emerged around the period, including fang, anjuke, uhouzz, 58.com, acproperty.com.au, juwai, lianjia, beimeigoufang, fang.globevisa.com.cn, and glofang, among others.

Collapse in U.S. house prices during the Great Recession may have also encouraged foreign demand in U.S. real estates. However, the influence is likely secondary given that housing purchases by foreign Chinese in the United States were persistent over the entire period of 2007–13 and even magnified after 2011, when the Chinese government implemented a second round of HPRs domestically. Moreover, the intensification and persistence of housing purchases were not seen in other ethnicities.

In sum, the series of real estate regulatory measures by the Chinese government likely played a key role in shifting housing demand into foreign markets, leading to the persistent surge in housing purchases by foreign Chinese in the U.S. real estate market over the period. Nevertheless, the focus of this paper is not to analyze the factors that contributed to the surge in foreign Chinese house purchases but to understand the effects of the surge on the U.S.

²⁰ To circumvent capital controls, people often divide currency conversions among relatives and friends and pool them afterward. They could also find ways to transport the money to Hong Kong, which does not impose limits on foreign exchanges.

economy. To do so, we exploit the two stylized facts—a China shock in the U.S. real estate market and home bias in foreign Chinese housing purchases—in our empirical methodology to study the causal effects of housing purchases by foreign Chinese on U.S. local housing and labor markets.

II.D Key Variables and Summary Statistics

Given dominance of home purchases by foreign Chinese relative to all other foreigner groups, we focus the subsequent analysis on the effects of foreign Chinese housing on local housing prices and labor markets. The main regressors we use are Chinese housing transaction value (CHTV) and Chinese housing transaction count (CHTC), as defined in Equations (4a) and (4b) for $i = \text{Chinese}$:

$$CHTV_{zt} = \left[HTV_{czt} - \frac{HCTV_{Azt}}{HTV_{Azt}} \times HTV_{czt} \right] \frac{HTV_{Azt}}{HTV_{Azt} - HCTV_{Azt}}, \quad (5a)$$

$$CHTC_{zt} = \left[HTC_{czt} - \frac{HCTC_{Azt}}{HTC_{Azt}} \times HTC_{czt} \right] \frac{HTC_{Azt}}{HTC_{Azt} - HCTC_{Azt}}, \quad (5b)$$

where A denotes the Anglo-American ethnic group, c denotes the foreign Chinese group, z denotes ZIP code, t denotes year, HTV denotes total housing transaction value, $HCTV$ denotes all-cash housing transaction value, HTC denotes total housing transaction count, and $HCTC$ denotes all-cash housing transaction count.

The two key sets of outcome variables in the analysis are ZIP-code-level house prices and employment. For the former, we use the Zillow Home Value Index for single-family homes, which is a smoothed, seasonally adjusted measure of the median estimated home value across a given ZIP code. Employment data are from Zip Codes Business Patterns collected by the Census Bureau; it provides annual statistics for businesses with paid employees at the ZIP-code level and is categorized by two- through six-digit North American Industry Classification System (NAICS) code. In addition to the outcome variables, we also collect information on ZIP-code-level population and education, measured as the share of population with bachelor degrees, from the Census Bureau, as well as ZIP-code-level income from the Internal Revenue Service (IRS), to use as control variables in the empirical analysis.

Table I shows the summary statistics of our dataset. The top panel shows the dollar value and count of all housing transactions and those by foreign Chinese across the ZIP codes in the sample. Column (1) gives a sense of the aggregate figures: Over the sample period of 2001–13, there were almost 1.5 million residential housing transactions, amounting to approximately U.S.\$692 billion. Foreign Chinese made 21,842 house purchases with a total value of U.S.\$9.43 billion, making up 1.4% of the total transaction value and count on

average.

Columns (2) and (3) of Table I show the means and standard deviations of the variables at the level of ZIP-code year for 2001–13. The dataset contains 9,986 ZIP-code-year observations over the sample period. To give a sense of the evolution of foreign Chinese house purchases in the United States, we also show the means and standard deviations of the key variables for three sub-periods in Table I: the pre-China shock period of 2001–06 (columns (4) and (5)), the HPR Phase 1 period of 2007–11 (columns (6) and (7)), and the HPR Phase 2 of 2012–13 (columns (8) and (9)). Housing transactions by foreign Chinese increased dramatically after 2007. On average, while each ZIP code witnessed 1.18 housing transactions by foreign Chinese for an average value of \$0.72 million per year between 2001–06, these figures jumped to 5.07 transactions and \$1.92 million, respectively, during 2007–11, and 7.38 transactions and \$3.44 million by 2013. Compared with the 2001–16 period, the share of Chinese transactions out of all housing transactions in California in terms of value and count also increased from 0.36% and 0.30% to 1.70% and 1.91%, respectively, during HPR Phase 1 and 2.78% and 2.87% during HPR Phase 2. It is interesting to note that foreign Chinese housing transactions in value and count surged at a time when overall transactions dropped from pre-China shock levels.

The bottom panel of Table I shows summary statistics of the variables capturing U.S. local economic conditions in the dataset. Interestingly, home prices, tradable and nontradable-sector employment, and income appear similar across the three sub-periods. Nevertheless, there is considerable heterogeneity across ZIP codes, which we exploit when estimating the real impact of foreign Chinese house purchases on local real economies.

TABLE I. Summary Statistics

	Sub-period								
	Total	2001-13		2001-06		2007-11		2012-13	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Foreign Chinese trans.									
Value (\$)	9.43B	1.92M	4.82M	0.72M	1.74M	1.92M	4.22M	3.44M	7.41M
Log value	—	13.71	1.42	13.16	1.16	13.79	1.40	14.24	1.52
Counts	21,842	4.45	10.33	1.18	2.79	5.07	10.87	7.38	10.68
Log counts	—	0.71	1.34	0.05	0.94	0.86	1.36	1.25	1.41
Total Housing Trans.									
Value (\$)	692.39B	140.96M	99.58M	197.62M	122.83M	112.66M	70.80M	123.94M	83.46M
Counts	1.49M	302.83	221.40	396.27	249.69	265.36	208.41	257.13	165.11
Zillow SF home price	—	0.55M	0.36M	0.55M	0.33M	0.54M	0.36M	0.56M	0.41M
Log SF home price	—	13.05	0.58	13.09	0.52	13.03	0.58	13.03	0.63
Log total emp.	—	9.21	0.94	9.29	0.89	9.17	0.95	9.16	0.98
Log non-tradable emp.	—	8.11	0.89	8.20	0.84	8.09	0.90	8.05	0.92
Log tradable emp.	—	5.96	1.93	6.18	1.94	5.89	1.92	5.82	1.93
Household income	—	77,517	67,124	70,536	51,852	76,097	62,395	87,395	86,030
Foreclosure ratio	—	0.15	0.17	0.01	0.02	0.25	0.19	0.12	0.09

Note: This table presents summary statistics of the key variables in the dataset. Column (1) shows aggregated statistics across all ZIP codes and sample periods. Columns (2)–(9) show the annual means and standard deviations of the variables across ZIP codes for the whole sample period (2001–13), the pre-China shock period (2001–06), the HPR Phase 1 period (2007–11) and the HPR Phase 2 period (2012–13), respectively. Foreign Chinese housing transaction value and counts are constructed using the three-step method described in Section II.B. *Source:* DataQuick, Zillow, Census Bureau, Internal Revenue Service, and authors’ calculations.

III Foreign Chinese Housing Purchases, House Prices, and the Real Economy

III.A Methodology and Identification

To analyze the impact of the surge in foreign Chinese housing transactions since 2007 on U.S. local economies, we estimate the following regression equations:

$$\ln(Y_{zt}) = \alpha + \theta \ln(CHTV_{zt}) + \beta \ln(CHTV_{zt}) \times \mathbb{I}\{t \geq 2007\} + \gamma X_{z,0} + \eta_{ct} + \varepsilon_{zt} \quad (6)$$

$$\ln(Y_{zt}) = \tilde{\alpha} + \tilde{\theta} \ln(CHTC_{zt}) + \tilde{\beta} \ln(CHTC_{zt}) \times \mathbb{I}\{t \geq 2007\} + \tilde{\gamma} X_{z,0} + \tilde{\eta}_{ct} + \tilde{\varepsilon}_{zt} \quad (7)$$

where Y_{zt} denotes the home price or employment size for ZIP code z in year t ; $CHTV_{zt}$ denotes the foreign Chinese housing transaction value measure based on Equation 5a; $CHTC_{zt}$ denotes the foreign Chinese housing transaction count measure based on Equation 5b; $\mathbb{I}\{t \geq 2007\}$ is an indicator variable that takes the value 1 if the year is 2007 or later and 0 otherwise; $X_{z,0}$ are ZIP-code-level controls, including population and education (measured as the population share with bachelor degrees) from the pre-sample year 2000, and pre-sample period trend of income (calculated as the change in income between 1998 and 2001) and the respective dependent variable (calculated as the change in either the home price or employment size between 1996 and 2000); η_{ct} and $\tilde{\eta}_{ct}$ are county-year fixed effects; and ε_{zt} and $\tilde{\varepsilon}_{zt}$ are the disturbance term.

The indicator variable in Equations (6) and (7) is intended to capture the China shock in the U.S. real estate market—the first stylized fact we document in Section II.C. In a sense, the regression equation utilizes an event-study framework. Our coefficients of interest are β and $\tilde{\beta}$, which measure whether ZIP codes with more foreign Chinese housing purchases experienced a greater increase in house prices and employment after 2007, the year of the initial sharp increase in foreign Chinese transactions, controlling for county-year fixed effects and pre-sample period ZIP-code-level population, education, and trend of income and the outcome variables for house prices and employment. In other words, we assess the change in house prices and employment between ZIP codes that experienced more foreign Chinese housing purchases and the rest within the same county and year, controlling for ZIP-code-level characteristics that may systematically affect local housing and labor markets.

The regression equations will consistently estimate the coefficient of interest if foreign Chinese house purchases are not correlated with the disturbance term. This condition is unlikely to hold, despite the inclusion of county-year fixed effects and ZIP-code-level controls, due to an issue of endogeneity: It is difficult to distinguish whether the increase in foreign

Chinese purchases affected local home prices and employment, or whether foreign Chinese sought to buy homes in neighborhoods that are more likely to experience higher rates of home price appreciation or more employment. To address this concern, we exploit the second stylized fact on the home bias in foreign Chinese housing purchases and utilize cross-ZIP-code variation in the concentration of historical ethnic Chinese to identify differential exposure to real estate capital inflows from China.²¹

Specifically, we instrument foreign Chinese housing transaction value ($CHTV$) by the aggregate housing transaction value in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period: $CHNShare_{z,0} \times TTV_t$, where $CHNShare_{z,0}$ is the ethnic Chinese population share in ZIP code z from the pre-sample year 2000, and TTV_t is a time-varying measure of total housing transaction values in California. Similarly, we instrument foreign Chinese housing transaction count ($CHTC$) by the aggregate housing transaction count in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period: $CHNShare_{z,0} \times TTC_t$. When the corresponding IV is applied to Equations (6) and (7), the time-varying component of the IV, total housing transaction value or count in California (TTV_t or TTC_t), is fully absorbed by the county-time fixed effects. Therefore, our IV strategy fundamentally uses cross-sectional variation in local ethnic Chinese population share to identify foreign Chinese housing demand.

Our research design essentially combines an event-study framework and an IV approach. Identification assumes that the pre-sample period ethnic Chinese population share is uncorrelated from factors that influence local house prices and employment after 2007 after conditioning on ZIP-code-level characteristics and county-time fixed factors.²² This strategy is numerically equivalent to a Bartik (1991) instrument, whose underlying identifying assumption is in terms of cross-sectional local industry shares (Goldsmith-Pinkham et al., 2018).²³ Similar approaches that exploit historical immigrant distribution have been applied to study the impact of immigrants on the labor markets (Card, 2001) and the impact of ancestral composition on foreign direct investments (Burchardi et al., 2019).²⁴ To further

²¹ Badarinza and Ramadorai (2018) applies a similar approach using spatial variation of different ethnicities to study the impact of foreigners’ house purchases on house prices in London.

²² Because ethnic Chinese population distribution varies at the ZIP-code level, we do not control for ZIP-code fixed effects in the regression specifications. Doing so would have absorbed the “useful” variation we leverage for identification.

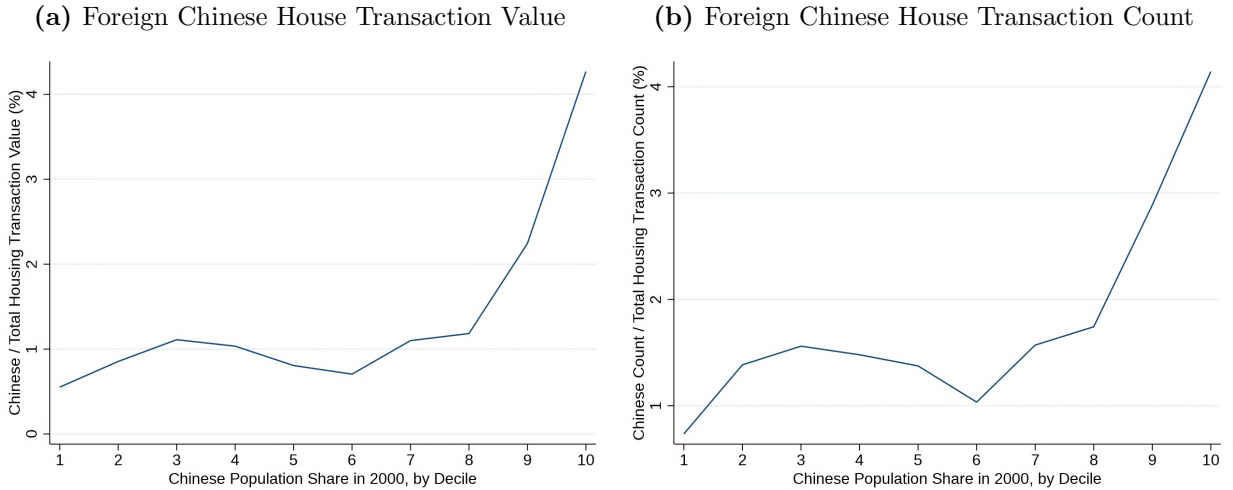
²³ A typical Bartik instrument is constructed by taking the product of ex-ante industry shares by region and industry-level aggregate shocks, so the generated variable varies at the regional level. In our context, we can interpret “industry” as foreign race or ethnicity, and we focus on one race—foreign Chinese. We take the logarithm of the IV to address the skewness of its distribution.

²⁴ In Appendix Table A.3, we check robustness by showing results from a specification that includes only county fixed effects, in which case the time-varying component of the IV, TTV_t or TTC_t , is not absorbed.

strengthen the empirical design, we exploit the timing of China’s policies on house purchase restrictions to net out the potential (secular) effect from before the policy shock by focusing on the key coefficients of the interaction terms in regression Equations (6) and (7). This strategy improves identification compared with traditional time-series analysis in the literature on estimating the effects of capital flows.

To illustrate the predictive power of the IV $CHNShare_{z,0}$, we plot the foreign Chinese housing purchases measures, $CHTV$ and $CHTC$, normalized by total housing transaction value and count, respectively, as a function of historical ethnic Chinese population share during 2007–13. As shown in Figure III(a) and (b), ZIP codes that historically had a higher concentration of ethnic Chinese population witnessed significantly more housing purchases by foreign Chinese as measured by value and count. In particular, foreign Chinese housing purchases in the 9th and 10th deciles of the historical ethnic Chinese population share are about two and four times higher than the 8th decile, respectively. Overall, the plots suggest that our IVs have strong predictive power for the foreign Chinese housing purchases. In all subsequent results tables, we report the first-stage F -statistic to show the strength of the instruments.

Figure III. Foreign Chinese Housing Transaction Share versus Historical Ethnic Chinese Population



Note: The left figure shows foreign Chinese housing transaction share, as measured by value, between 2007 and 2013 as a function of historical ethnic Chinese population based on the 2000 Census Survey. The right figure shows foreign Chinese housing transaction share, as measured by count, between 2007 and 2013 as a function of historical ethnic Chinese population.

There are a few possible threats to our identification strategy. First, the neighborhoods that historically attracted ethnic Chinese settlement could have characteristics that system-

ically differentiate their local house prices and employment from other neighborhoods. The coefficients θ and $\tilde{\theta}$ in Equations (6) and (7) capture whether neighborhoods that attracted more foreign Chinese housing demand are indeed significantly different. They appear small and mostly statistically insignificant. To further confirm that foreign Chinese are not targeting neighborhoods that tend to have better economic conditions, we test whether Chinese real estate purchases after the China shock are correlated with ex-ante local employment and income. The results show no significant link, which supports the key assumption underlying our empirical strategy: The neighborhoods that witnessed large foreign Chinese housing demand after 2007 do not systemically exhibit significantly different economic conditions. Nevertheless, we include pre-sample period ZIP-code-level controls and trends of income and the dependent variables in the empirical specifications to address any other potential differences.

Second, one may be concerned that supply-side factors such as land regulation or productivity boom in the United States confound the estimated effects from real estate capital inflows from China. For example, locations with higher ethnic Chinese population density may impose stricter land regulation and hence have a more restrictive housing supply, which would drive up house prices. Alternatively, if those locations happened to experience an employment boom in the technology sector after 2007 (e.g., the Silicon Valley boom), this boom would also confound the estimated house price and employment effects. It is worth noting that the variation we rely on for identification is at the ZIP-code level. The granularity of our data allows us to control for shocks at the county level, which ameliorates concerns about differential land policy and technology booms driving the results. Moreover, we later show that the employment effects are concentrated in the nontradable sector, which further abate confounding effects because of technology-led jobs.

Another related concern about our identification strategy may be that the surge in foreign Chinese housing purchases in more ethnic Chinese-concentrated neighborhoods is correlated with heterogeneous economic shocks across U.S. regions. As discussed in Section II.C, government policies on China’s side, rather than heterogeneous policies across U.S. ZIP codes, encouraged Chinese to invest in real estate markets overseas. We incorporate this notion that the surge in foreign Chinese housing purchases was primarily demand driven in an alternative IV: China’s GDP weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period, and use it in the regressions. All the results are robust to using the alternative IV.²⁵

²⁵ Section III.D describes more details about the robustness checks and the relevant results.

III.B Foreign Chinese House Purchases and Local House Prices

Table II shows the estimation results from our main regression Equations (6) and (7) with house prices as the outcome variable. Panel A of the table uses (log) Zillow Single-Family Home Value Index as the dependent variable, and Panel B uses housing transaction prices from DataQuick as the dependent variable. All regressions control for pre-sample period ZIP-code-level population, education, trend of income (calculated as the change in income between 1998 and 2001) and the dependent variable (calculated as the change in either house price variable between 1996 and 2000), and county-year fixed effects. Results from specifications using *CHTV* as the main regressor are shown in the odd-numbered columns, while those using *CHTC* are shown in the even-numbered columns. Across all specifications, the first-stage regression *F*-statistics are highly significant, indicating that our IV has strong predictive power for foreign Chinese housing purchases.

Columns (1) and (2) show results for the whole sample period of 2001–13. They indicate that real estate purchases by foreign Chinese induced a significant increase in local house prices. A 1% increase in housing demand by foreign Chinese, as measured by transaction value and count, increased local home prices by 0.099% and 0.173%, respectively. In terms of economic magnitude, the former estimate implies that a one standard deviation increase in exposure to foreign Chinese real estate capital inflows (as measured by log *CHTV*) explains 24% of the cross-sectional variation in Zillow Home Value Index,²⁶ and raises the home price in an average ZIP code by \$83,000 or 15%.²⁷ Similarly, a one standard deviation increase in foreign Chinese housing purchase count explains 40% of the cross-sectional variation in Zillow Home Value Index,²⁸ and raises the home price in an average ZIP code by \$144,000 or 26%.²⁹ Moreover, the coefficients on *CHTV* and *CHTC*, which capture differences in house prices between neighborhoods that attracted more foreign Chinese housing demand and others before the China shock, appear small and mostly insignificant. This finding supports the validity of our identification strategy, which relies on the assumption of parallel trends in house prices in the pre-shock period.

We further analyze whether the effects differ between the HPR Phase 1 period of 2007–11

²⁶ The corresponding calculation is $0.099 \text{ (coefficient)} * 1.42 \text{ (one standard deviation of log CHTV)} / 0.58 \text{ (one standard deviation of log Zillow Home Price Index)} = 0.24$.

²⁷ Based on the expectation formula for a lognormal distributed variable and summary statistics in Table I, the corresponding calculation is $e^{13.05+0.58^2/2+1.42*0.099} - e^{13.05+0.58^2/2} = 83,061$, which is 15% of the mean Zillow Home Value Index over the sample period.

²⁸ The corresponding calculation is $0.173 \text{ (coefficient)} * 1.34 \text{ (one standard deviation of log CHTC)} / 0.58 \text{ (one standard deviation of log Zillow Home Price Index)} = 0.40$.

²⁹ Based on the expectation formula for a lognormal distributed variable and summary statistics in Table I, the corresponding calculation is $e^{13.05+0.58^2/2+1.34*0.173} - e^{13.05+0.58^2/2} = 143,567$, which is 26% of the mean Zillow Home Value Index over the sample period.

TABLE II. Foreign Chinese Housing Demand and Local Home Prices

<i>Panel A: Home Prices (Zillow)</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*_{\text{post}}$	0.099*** (0.020)		0.084*** (0.020)		0.117*** (0.023)	
$\ln(\text{CHTV})$	-0.020 (0.028)		-0.008 (0.028)		-0.015 (0.031)	
$\ln(\text{CHTC})^*_{\text{post}}$		0.173*** (0.037)		0.160*** (0.038)		0.185*** (0.039)
$\ln(\text{CHTC})$		-0.065* (0.037)		-0.045 (0.035)		-0.047 (0.037)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post period	2007–13	2007–13	2007–11	2007–11	2012–13	2012–13
First-stage F-stat.	46.05	24.72	41.41	29.34	36.23	24.27
Obs.	3995	4053	3016	3061	2158	2180

<i>Panel B: Home Prices (Transactions)</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*_{\text{post}}$	0.142*** (0.019)		0.143*** (0.020)		0.133*** (0.019)	
$\ln(\text{CHTV})$	-0.062*** (0.024)		-0.060** (0.024)		-0.041* (0.024)	
$\ln(\text{CHTC})^*_{\text{post}}$		0.231*** (0.041)		0.243*** (0.044)		0.206*** (0.035)
$\ln(\text{CHTC})$		-0.122*** (0.035)		-0.116*** (0.034)		-0.075** (0.030)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post -eriod	2007–13	2007–13	2007–11	2007–11	2012–13	2012–13
First Stage F-stat.	47.94	24.88	43.67	29.39	38.24	3267
Obs.	4258	4322	3216	3267	2301	2328

Note: The dependent variables are log Zillow Single-Family Home Value Index in Panel A and log housing transaction values from DataQuick in Panel B. *CHTV* (*CHTC*) denotes foreign Chinese housing transaction value (count) instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), and trend of income (1998–2001) and the outcome variable (1996–2000). Panel B additionally controls for home characteristics, including the number of bathrooms, the square footage, and age of the home. Columns (3)–(6) shows the results for HPR Phase 1 and 2 periods (2007–11 and 2012–13). Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1$, $p < 0.05$, $p < 0.01$.

(columns (3) and (4)) and the HPR Phase 2 period of 2012–13 (columns (5) and (6)). For 2007–11, a 1% increase in housing demand by foreign Chinese, as measured by transaction value and count, increased local home prices by 0.084% and 0.160%, respectively. A one standard deviation increase in exposure to real estate capital inflows from China raises the average home price by \$67,000, or 12%. To provide another perspective of the economic magnitude, we use this empirical estimate to describe the heterogeneous effects of foreign Chinese real estate capital inflows on home prices across ZIP codes. Between 2007 and 2011, the difference in exposure to foreign Chinese real estate capital inflows between a ZIP code in the 90th percentile and the 10th percentile is 3.47 log points, and the corresponding difference in Zillow Home Value Index is 1.47 log points. Our estimate implies that an increase in exposure to foreign Chinese real estate capital inflows from the 10th percentile to the 90th percentile explains 20% of the variation in the 10th–90th percentile difference in home price ($0.084 \times 3.47 / 1.47 = 0.2$). Given that HPR Phase 1 coincides with the U.S. financial crisis period when the overall housing price plummeted, our result implies that the ZIP codes that received more real estate capital from China experienced a smaller decline in house prices.

Compared with HPR Phase 1, the effect of foreign Chinese housing purchases on home prices is even greater in magnitude during HPR Phase 2. As shown in columns (5) and (6) of Table II Panel A, a 1% increase in *CHTV* and *CHTC* raised home prices by 0.117% and 0.185%, respectively, during the period. A one standard deviation increase in exposure to real estate capital inflows from China raises the average home price by \$108,000, or 19%. Between 2012 and 2013, the difference in exposure to foreign Chinese real estate capital inflows between a ZIP code in the 90th percentile and the 10th percentile is 3.69 log points, and the corresponding difference in Zillow Home Value Index is 1.89 log points. Based on our estimate, the 10th–90th percentile difference in Chinese cash inflows explains 23% of the 10th–90th price wedge of the residential properties ($0.117 \times 3.69 / 1.89 = 0.23$).

In addition to using the Zillow Home Price Index as a measure for house prices, we estimate Equation (6) using housing transaction prices from DataQuick as the dependent variable. This set of regressions allows us to study the effects of Chinese capital inflows on local house prices through another lens: Do housing purchases by foreign Chinese push up the prices of newly-transacted houses on average? For these regressions, we control for home characteristics including the number of bathrooms, the square footage, and the age of the home, in addition to the baseline controls specified in Equation (6). The results, shown in Panel B of Table II, are slightly larger than those in Panel A: A 1% increase in the housing demand by foreign Chinese, as measured by transaction value and count, increases local home transaction prices by 0.142% and 0.231%, respectively, on average.

The results in Tables II are based on our preferred specification that controls for county-time fixed effects. We also conduct the analysis controlling only for county fixed effects, in which case the time-varying component of the IV, total housing transaction values in California (TTV_t) or housing transaction count in California (TTC_t), is not fully absorbed. The results, shown in columns (1)–(4) of Appendix Table A.1, are qualitatively and quantitatively similar to the baseline results.

We delve deeper into the local house price effect by exploring a potential channel through which foreign Chinese housing demand affects local house prices. Motivated by studies such as Campbell et al. (2011) and Mian et al. (2015) which show that higher local foreclosure leads to lower local house prices, we test whether foreign Chinese housing demand lowered foreclosure in the local economy. Results using log foreclosure share as the dependent variable are reported in Panel A of Appendix Table A.2.³⁰ The surge in foreign Chinese housing demand has a negative and significant relationship with local foreclosure shares. In other words, ZIP codes that received more real estate capital from China had relatively lower foreclosure rates relative to other ZIP codes. The results are similar when we use log foreclosure count as the dependent variable, as shown in Panel B of Appendix Table A.2. The results suggest that foreclosure served as a specific margin through which foreign Chinese demand affected local house prices and house net worth.

III.C Foreign Chinese House Purchases and Local Employment

The first set of results establishes that foreign Chinese home purchases strongly affect local house prices. Do they have an effect on the real economy? We proceed to study this question by analyzing local labor market effects.

We reestimate Equation (6) with ZIP-code-level employment size as the outcome variable. The results, reported in Table III, show foreign Chinese home purchases have a positive and significant effect on local labor market. A 1% increase in housing demand by foreign Chinese, as measured by transaction value and count, increases local employment by 0.119% and 0.190%, respectively, on average. A one standard deviation increase in exposure to foreign Chinese real estate capital inflows (as measured by log $CHTV$) explains 18% of the cross-sectional variation in total employment³¹ and raises the total employment level by 2,863 jobs, or 18% on average.³²

³⁰ Over the whole sample period in the data, the mean value foreclosure share in a ZIP code was 11% with a standard deviation of 15%. These shares are highly skewed with a median value of 3.6%, so we take the logarithmic value in the regression analysis.

³¹ The corresponding calculation is $0.119(\text{coefficient}) * 1.42(\text{SD of log CHTV}) / 0.94(\text{SD of log total employment}) = 0.18$.

³² Similar to the previous section, the corresponding calculation is $e^{9.21+0.94^2/2+1.42*0.119} - e^{9.21+0.94^2/2} =$

TABLE III. Foreign Chinese Housing Demand and Total Employment

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*_{\text{post}}$	0.119*		0.107*		0.138*	
	(0.062)		(0.060)		(0.072)	
$\ln(\text{CHTV})$	0.041		0.048		0.039	
	(0.100)		(0.103)		(0.106)	
$\ln(\text{CHTC})^*_{\text{post}}$		0.190**		0.184**		0.189*
		(0.087)		(0.088)		(0.097)
$\ln(\text{CHTC})$		0.016		0.028		0.043
		0.016		(0.105)		(0.112)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post period	2007-13	2007-13	2007-11	2007-11	2012-13	2012-13
First-stage F-stat.	43.43	28.16	40.22	32.21	35.54	28.39
Obs.	4272	4336	3226	3277	2310	2337

Note: The dependent variable is log total employment size. *CHTV* (*CHTC*) denotes foreign Chinese housing transaction value (count) instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), and trend of income (1998–2001) and the outcome variable (1996–2000). Columns (3)-(4) show the results for the HPR Phase 1 period of 2007–11, and columns (5)-(6) for the HPR Phase 2 period of 2012–13. Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1, p < 0.05, p < 0.01$.

As with home price effects, we further analyze the employment effects by sub-period to examine whether the impact of foreign Chinese housing purchases on local labor market differed between the HPR Phase 1 period of 2007–11 and the recovery period of 2012–13. Our results show that a 1% increase in foreign Chinese housing purchases, as measured by transaction value, raised local employment by 0.107% during HPR Phase 1 and 0.138% during HPR Phase 2. The formal estimate means that a one standard deviation increase in exposure to real estate capital inflows from China raises the total employment in a ZIP code by 2,437 jobs, or 16% on average. Because HPR Phase 1 coincides with the U.S. financial crisis, it also implies real estate capital flows from China played a stabilizing role during the domestic economic downturn. During HPR Phase 2, a one standard deviation increase in exposure to real estate capital inflows from China raises the total employment in an average ZIP code by 2,484 jobs, or 16%.³³ The results are slightly larger in magnitude for the impact of foreign Chinese housing purchases as measured by transaction count: A 1% increase in the quantity of foreign Chinese home purchase raised local employment by 0.184%, respectively, during HPR Phase 1 and 0.138% and 0.189%, respectively, during HPR Phase 2.

To further give a sense of the economic magnitude, we compare how much of the 10th–90th percentile difference in employment can be explained by the 10th–90th percentile differential in exposure to foreign Chinese real estate capital inflows. Between 2007 and 2011, the difference in total employment between the 10th and 90th percentile ZIP codes is 2.3 log points. Based on our estimate in column (3), an increase in exposure to foreign Chinese real estate capital inflows from the 10th percentile to the 90th percentile explains 16% of the 10th–90th percentile difference in total employment ($0.107 \times 3.47 / 2.3 = 0.16$). This result implies that foreign Chinese real estate capital could help buffer negative employment shocks, and that cash inflow from foreign Chinese played a stabilizing role for U.S. local economies during the financial crisis. During 2012 and 2013, the difference in total employment between the 10th and 90th percentile ZIP codes is 2.31 log points. Our estimate (in column (5)) implies that an increase in exposure to foreign Chinese real estate capital inflow from the 10th percentile to the 90th percentile explains 22% of the 10th–90th percentile difference in total employment ($0.138 \times 3.69 / 2.31 = 0.22$).

III.D Identification Validity Test and Robustness Checks

We now conduct tests to check the validity of our identification strategy and robustness of our baseline results. First, a possible threat to our identification approach is if neighborhoods

2,863, which is 18% of the mean employment level.

³³ The calculations are $e^{9.17+0.95^2/2+1.40 \times 0.107} - e^{9.17+0.95^2/2} = 2,437$ for HPR Phase 1 and $e^{9.16+0.98^2/2+1.40 \times 0.107} - e^{9.16+0.98^2/2} = 2,484$ for HPR Phase 2.

that attracted more foreign Chinese capital inflows have unobserved characteristics that systemically differentiate their local economic conditions from other neighborhoods. To address this concern, we conduct tests to examine whether changes in housing purchases by foreign Chinese after 2007 correlate with local economic conditions before then, using the following regression specification:

$$\Delta(Y_{\text{pre},z}) = \alpha_0 + \beta_0 \ln(CHTV_{07-13,z}) + \gamma_0 X_z + \eta_c + \epsilon_z$$

where $Y_{\text{pre},z}$ denotes variables capturing local economic conditions in two *pre* periods in ZIP code z : employment size and household income during 2001–06 (pre-China HPR policy shock) and 1996–2000 (pre-sample period), $CHTV_{07-13,z}$ denotes foreign Chinese housing transaction value between 2007 and 2013 for ZIP code z , X_z denotes a set of ZIP-code-level control variables—including population and education, and η_c denotes county fixed effects. The coefficient of interest is β_0 . If the ZIP codes that attracted more foreign Chinese housing purchases have systematically better economic conditions, β_0 would be positive and significant.

Table IV shows the regression results. We find that ex-post foreign Chinese housing purchases are not correlated with ex-ante local employment and household income, controlling for local population and education. The estimates for the coefficient of interest, β_0 , are statistically and economically insignificant. This result shows that the ZIP codes that attracted more ethnic Chinese settlements are not neighborhoods that have more employment opportunities or higher income on average. To put it another way, foreign Chinese do not appear to have been targeting neighborhoods that are systematically different in terms of economic conditions.

Second, one may be concerned that the surge in foreign Chinese housing purchases in 2007 is not exogenous. As we discussed in Section II.C, the primary drivers of the surge likely are changes in China’s real estate purchase regulations and capital flow regulation around 2007—factors exogenous to developments in U.S. neighborhoods. To test the plausibility of the argument, we reestimate Equation (6) using an alternative IV that is constructed based on the idea that the surge in foreign Chinese housing demand is demand-driven: China’s GDP weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. County-time dummies are not included here because it would fully absorb the time-varying component of the IV. The results are shown in Appendix Table A.3. Columns (1)–(3) show the estimates with Zillow Housing Price Index, housing transaction value, and total employment as the dependent variable, respectively. In line with the main results using the baseline IV, we find a strong positive impact of foreign Chinese housing

TABLE IV. Foreign Chinese Housing Demand and Pre-Shock Economic Conditions

	Pre-policy shock: 2001–2006				Pre-sample: 1996–2000			
	Employment		Income		Employment		Income	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln(\text{CHTV}_{07-13})$	0.005 (0.011)		0.004 (0.008)		-0.015 (0.013)		0.011 (0.010)	
$\ln(\text{CHTC}_{07-13})$		0.005 (0.012)		0.007 (0.009)		-0.017 (0.015)		0.012 (0.012)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-stat.	145.52	129.12	145.52	129.12	145.52	129.12	143.74	127.19
Obs.	637	625	637	625	637	625	635	623

Note: The dependent variable is log change in total employment size (column (1)) and income (column (2)) between 2001 and 2006. CHTV_{07-13} (CHTC_{07-13}) denotes the log change in foreign Chinese housing transaction value (count) between 2007 and 2013 instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. All regressions control for ZIP-code-level population and education and include county fixed effects. Education is measured as the population share with bachelor degrees. Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1, p < 0.05, p < 0.01$.

purchases on local house prices and employment. The coefficient of interest from regressions using the alternative IV is slightly smaller in magnitude: A 1% increase in housing demand by foreign Chinese, as measured by transaction value, increases local home prices by 0.054%, local home transaction prices by 0.105%, and local employment by 0.098%.

Third, we address concerns related to measurement error in key variables we constructed. We recognize that our second step of constructing the Chinese housing transactions measure—keeping only housing transactions by ethnic Chinese made entirely in cash—may understate the true magnitude, as it excludes purchases by non-resident foreign Chinese who managed to get mortgages from U.S. private lenders. To examine whether this filtering significantly biases our results, we conduct two robustness checks. First, we examine if there exists a trend in the share of all-cash housing transactions across ZIP codes based on their historical ethnic Chinese population share—the key source of cross-sectional variation in our empirical methodology. As shown in Appendix Figure A.2, there is not an obvious relationship, which suggests the filtering should not strongly affect the baseline results. Second, one might be concerned that purchases by non-Chinese foreigners, e.g., Europeans, are driving the results. But other foreigners’ purchases are not correlated with the concentration of historical ethnic Chinese settlements across ZIP codes—the key source of variation we use for identification in

the empirical methodology, as shown in Appendix Figure A.3. In fact, purchases by foreign Chinese and other foreigners seem to be negatively correlated across in terms of historical Chinese population share.

IV Mechanism and Implications

In this section, we explore the channels driving the quantitatively large and statistically significant effects of real estate capital inflows from China on local asset prices and employment in the United States. We provide evidence showing that migration does not appear to play a significant role, and the employment effect seems to be transmitted through a housing net worth channel. We also discuss the distributional consequences of real estate capital inflows from China.

IV.A The Migration Channel

An obvious hypothesis for the mechanism transmitting the house price effect of Chinese real estate capital inflows to the U.S. real economy is a direct migration channel: Foreign Chinese may be moving into the neighborhoods that saw more residential real estate capital inflows, and their consumption would directly push up local employment. A related explanation may be that foreign Chinese have been purchasing houses and renting them to local workers, inducing migration inflow and thereby pushing up demand for local goods and employment.

To test this line of hypothesis, we relate the foreign Chinese housing transaction measures to the number of income tax returns at the ZIP-code level, which has been used as a measure of the number of local residents (Greenland et al., 2019).³⁴ The income tax returns data are based on administrative records of individual income tax returns (Forms 1040) from the IRS. If the inflow of real estate capital from China induces (im)migration inflow, we expect a positive and significant relationship between foreign Chinese housing transaction and the number of tax filings.³⁵

Table V reports the results, for the the entire sample period in columns (1) and (2), HPR Phase 1 in columns (3) and (4), and HPR Phase 2 for columns (5) and (6). Across all periods, we do not find a positive relationship between foreign Chinese housing transactions and the number of tax filings. In fact, the results show a significantly negative relationship,

³⁴ More direct dependent variables for this test would be migration inflow and outflow counts. However, to the best of our knowledge, migration data are not collected at the ZIP code level.

³⁵ Without work visas, foreign Chinese can stay in the United States only temporarily, which is unlikely to drive the employment results. To the extent they work legally in the United States, their presence should be reflected in the income tax returns data.

suggesting that foreign Chinese house purchases drive out local residents on net. A 1% increase in foreign Chinese housing demand, as measured by transaction value and count, decreases the number of tax filings by 0.04% and 0.07%, respectively. The estimates are quantitatively similar for the two HRP phases.

TABLE V. Foreign Chinese Housing Demand and Migration Channel: Number of Tax Return Filings

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*\text{post}$	-0.044*** (0.015)		-0.041*** (0.014)		-0.048*** (0.015)	
$\ln(\text{CHTV})$	0.028 (0.019)		0.024 (0.019)		0.026 (0.020)	
$\ln(\text{CHTC})^*\text{post}$		-0.070*** (0.023)		-0.068*** (0.024)		-0.071*** (0.023)
$\ln(\text{CHTC})$		0.046* (0.024)		0.040* (0.024)		0.038 (0.024)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post period	2007–13	2007–13	2007–11	2007–11	2012–13	2012–13
First-stage F-stat.	39.59	19.82	36.33	22.10	32.13	19.95
Obs.	4021	4075	2985	3026	2069	2087

Note: The dependent variable is log income tax returns. *CHTV* (*CHTC*) denotes foreign Chinese housing transaction value (count) instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), and trend of income (1998–2001) and the outcome variable (1996–2000). Columns (3)–(6) shows the results for HRP Phases 1 and 2 (2007–11 and 2012–13). Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1$, $p < 0.05$, $p < 0.01$.

The observation that foreign Chinese housing purchases are not accompanied by an inflow of migrants could be reconciled with anecdotal evidence that foreign Chinese tend to leave their houses abroad vacant. Studies by Rosen et al. (2017) and Simons et al. (2016) find that foreign Chinese real estate buyers tend to use their purchased properties in the United States as neither primary residences nor rental properties. Instead, their housing purchases are positively related to the number of Chinese investors in the EB-5 Immigrant Investor Visa Program, who are primarily interested in obtaining a green card for their children instead of gaining actual returns on their real estate investments. The tendency of foreign Chinese real estate buyers to leave housing properties vacant also is not surprising in light of a similar practice in China: Glaeser et al. (2017) show that housing vacancy rates in China are much

higher than in the United States, reaching more than 20% in major Chinese cities in 2012. Cvijanovic and Spaenjers (2015) find similar patterns using data from Paris. They show that few properties bought by non-residents are rented, which echoes reports about foreign Chinese real estate owners acting as “absentee landlords.”

We conclude from Table V that a migration channel is not driving the relationship between foreign Chinese housing purchases and local labor markets. In fact, the results on migration indicate that any forces that might induce migration inflow, if they existed, are dominated by crowding-out effects.

IV.B The Housing Net Worth Channel

We proceed to test for another channel that potentially links foreign Chinese housing purchases to local employment conditions—a housing net worth channel. It is based on the conjecture that higher housing wealth could affect employment by changing consumer demand through either a direct wealth effect or less-binding borrowing constraints driven by the rise in collateral value (Mian et al., 2013; Mian and Sufi, 2014). One of the key predictions of this hypothesis is that the local employment impact of demand fluctuations due to housing net worth shocks should show up foremost in the nontradable sector, because the employment there depends primarily on local demand while the tradable sector is more diversified in its geographic origins of demand. In our context, the housing net worth channel hypothesis predicts that the employment increase driven by the surge in real estate capital inflows from China should be more pronounced in nontradable rather than tradable sectors.

To test this prediction, we decompose total employment into tradable-sector employment and nontradable-sector employment, and reestimate Equation (6) with tradable- and nontradable-sector employment as the dependent variables. We conduct the decomposition following the four-digit industry classification scheme in Mian et al. (2013). An industry is defined as tradable if its sum of imports plus exports exceeds \$10,000 per worker, or if the total at the NAICS four-digit industry exceeds \$500 million, while nontradable industries include the retail sector, restaurants, and sectors related to construction, real estate, or land development. The summary statistics are shown in the bottom panel of Table I.

Table VI reports the regression results. Housing purchases by foreign Chinese have a positive and significant effect on the local employment in nontradable sectors but no significant effect on tradable-sector employment. A 1% increase in $CHTV$ and $CHTC$ raises ZIP-code-level nontradable-sector employment measures by 0.152% and 0.22%, respectively (columns (1) and (2)). On the other hand, increases in housing purchases by foreign Chinese do not appear to affect local employment significantly in tradable sectors (columns (3) and

(4)).

TABLE VI. Foreign Chinese Housing Demand and Housing Net Worth Channel: Nontradable- and Tradable-Sector Employment

	Nontradable		Tradable		NT w/t Const.	
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*_{\text{post}}$	0.152** (0.061)		0.022 (0.144)		0.103* (0.062)	
$\ln(\text{CHTV})$	-0.058 (0.099)		0.332 (0.224)		-0.011 (0.101)	
$\ln(\text{CHTC})^*_{\text{post}}$		0.220*** (0.084)		0.069 (0.196)		0.168** (0.083)
$\ln(\text{CHTC})$		-0.093 (0.101)		0.350 (0.246)		-0.048 (0.103)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post period	2007–13	2007–13	2007–13	2007–13	2007–13	2007–13
First-stage F-stat.	43.04	28.00	42.22	28.15	43.20	28.13
Obs.	4270	4334	4203	4267	4270	4334

Note: The dependent variable is log nontradable- or tradable-sector employment. *CHTV* (*CHTC*) denotes foreign Chinese housing transaction value (count) instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), and trend of income (1998–2001) and the outcome variable (1996–2000). Columns show results for employment in nontradable (with and without construction) and tradable sectors. Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1$, $p < 0.05$, $p < 0.01$.

One may wonder whether the strong relationship between foreign Chinese housing purchases and nontradable-sector employment is driven by an increase in construction-sector employment, since it is plausible that higher house prices due to more foreign Chinese demand could stimulate housing construction projects. We test for this mechanism by studying whether the relationship between foreign Chinese house prices and nontradable-sector employment holds when we exclude the construction sector from the nontradable-sector employment variable. The results are reported in columns (5) and (6) of Table VI. We continue to find a positive and significant link between foreign Chinese housing purchases and nontradable-sector employment. While the magnitude of coefficients are somewhat smaller, these results show that most of employment effects are concentrated in the nontradable-nonconstruction-sector employment, which further supports the housing net worth channel hypothesis.

IV.C Distributional Consequences

Despite the positive real effects from Chinese real estate capital inflows, we next point out that these flows have potential distributional effects.

Distributional Effects across Income Groups. We first explore the distributional effects of Chinese real estate capital inflows across income groups. Our earlier results on migration flow show that foreign Chinese housing purchases have pushed out local residents on net. Are the affected residents from a particular segment of the income distribution? To study this question, we examine the effects of foreign Chinese housing purchases on the migration of low-income households and high-income households separately, using the count of income tax returns to infer migration activities.³⁶ Specifically, we breakdown the income tax returns data by income groups, categorizing residents with less than \$50,000 income as low-income earners and those with more than \$50,000 as high-income earners.

Table VII shows that the net migration outflow effect is concentrated in the low-income households. A 1% increase in foreign Chinese housing transactions, as measured by transaction value and count, decreases the number of low-income residents by 0.077% and 0.119%, respectively (columns (1) and (2)). These magnitudes are about 70% larger than those from the pooled sample regressions in Table V. On the other hand, there seems to be no significant effect on the number of high-income residents (columns (3) and (4) in Table VII). Because low-income households are more likely to be renters, these results imply that foreign real estate capital inflows are more likely to push out local renters into less costly neighborhoods.³⁷ In other words, foreign Chinese housing transactions induce gentrification effects in local economies.

Distributional Effects across Zip Codes. Next, we explore the distributional effects of Chinese real estate capital inflows across ZIP codes by illustrating the quantitative implications of our main findings using counterfactual thought experiments. Specifically, we estimate how variations in house prices and employment conditions across ZIP codes would have evolved over the sample period in two counterfactual scenarios: (I) if ZIP codes in each decile receive the same amount of real estate capital from China as the ZIP codes in the top decile of the historical ethnic Chinese population share distribution; and (II) if all ZIP codes receive the same amount of foreign Chinese real estate capital as the average amount across ZIP codes. Note that the first counterfactual scenario assumes that the aggregate inflow of

³⁶ As we noted in the Section IV.A, income tax return count is used in the literature as a measure of the number of local households.

³⁷ We do not study the effects of foreign Chinese housing purchases on rent or migration by tenancy status because, to the best of our knowledge, there are not reliable rent data at the ZIP-code level.

TABLE VII. Foreign Chinese Housing Demand and Distributional Consequences Across Income Groups

	Low Income (under \$50,000)		High Income (above \$50,000)	
	(1)	(2)	(3)	(4)
$\ln(\text{CHTV})^*_{\text{post}}$	-0.077*** (0.018)		-0.035 (0.034)	
$\ln(\text{CHTV})$	0.059** (0.024)		0.102** (0.050)	
$\ln(\text{CHTC})^*_{\text{post}}$		-0.119*** (0.032)		-0.024 (0.050)
$\ln(\text{CHTC})$		0.091*** (0.033)		0.101* (0.060)
Controls	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes
Post period	2007–13	2007–13	2007–13	2007–13
First-stage F-stat.	39.59	19.78	39.29	19.80
Obs.	4021	4075	4021	4075

Note: The dependent variables are log low-income income tax returns (less than \$50,000) in the left panel and log high-income income tax returns (more than \$50,000) in the right panel. *CHTV* (*CHTC*) denotes foreign Chinese housing transaction value (count) instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), and trend of income (1998–2001) and the outcome variable (1996–2000). Columns show results by income groups. Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1$, $p < 0.05$, $p < 0.01$.

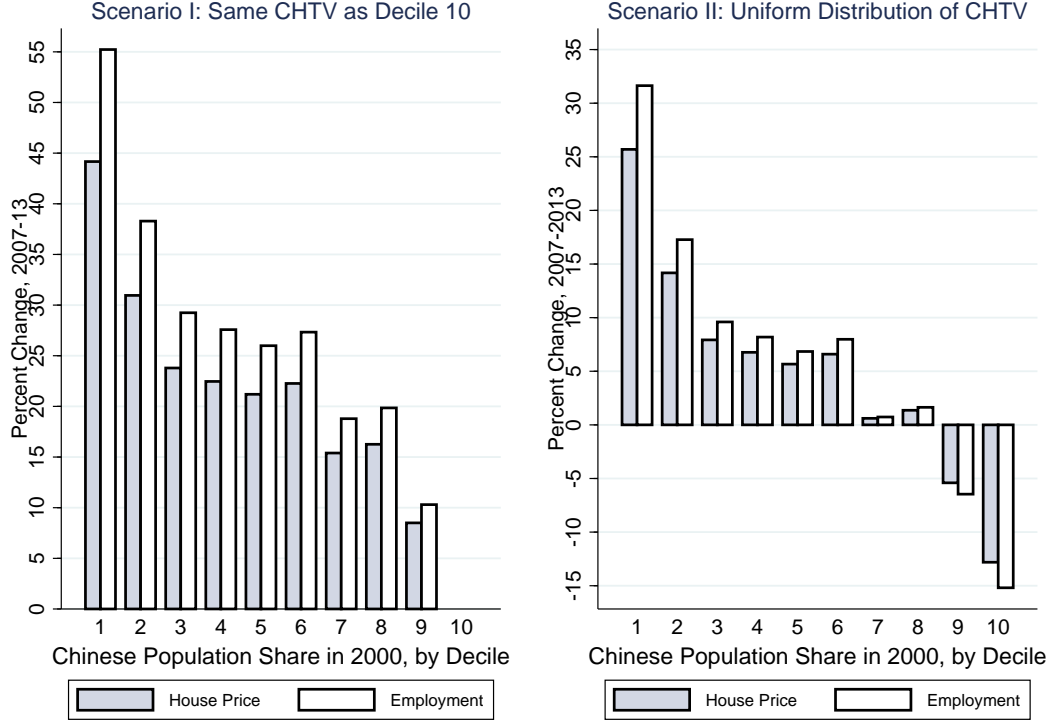
real estate capital from China is substantially higher than the actual data, and the second scenario redistributes the inflow of real estate capital from China evenly across ZIP codes, keeping the aggregate amount constant. Specifically, we multiply our estimated coefficient of interest from column (2) of Table II and Table III by the hypothetical additional amount of foreign Chinese real estate capital to compute the counterfactual house prices or employment size.³⁸ This counterfactual exercise is by no means a structural estimate, only a rough quantification.

The left plot of Figure IV illustrates the predicted house prices and employment size across ZIP codes under scenario (I). Zip codes are sorted into deciles based on their historical ethnic Chinese population. If ZIP codes in all deciles received the same amount of real estate capital from China as the top decile during 2007–13, house prices in the first decile ZIP codes would be 44.166% higher, and those in the ninth decile would be 8.497% higher. In terms of employment, the counterfactual scenario predicts an increase of 55.223% for ZIP codes in the first decile and 10.299% for ZIP codes in the ninth decile. As expected, house prices and employment in ZIP codes in the bottom decile would increase the most because they have received the least real estate capital inflows from China in the data. Given the log difference in housing prices and total employment between the first decile and the ninth decile ZIP codes are 1.439 and 2.309, respectively, our counterfactual calculations predict that the gap in house prices and employment size between the two ZIP code deciles would be 25.4% and 19.0% smaller than the actual variation during 2007–13.

The right plot of Figure IV illustrates the predicted house prices and employment size across ZIP codes under scenario (II). As with the left plot, ZIP codes are sorted into deciles based on their historical ethnic Chinese population. If ZIP codes across all deciles received the same amount of real estate capital from China as the mean ZIP code over the sample period, ZIP codes across the bottom eight deciles would have experienced an increase in housing prices, ranging from 1.359% in the eighth decile to 25.692% in the first decile. Similarly, total employment would increase across the bottom eight deciles, ranging from 1.635% in the eighth decile to 31.635% in the first decile. In contrast, house prices and employment in the top two deciles would decrease, as real estate capital inflows from China would decline under scenario (II). As with scenario (I), scenario (II) predicts a reduction in the cross-sectional variation in house prices and employment across ZIP codes if real estate capital from China were more evenly distributed across ZIP codes. In fact, the counterfactual reduction in the gap in house prices and employment between the first decile and the ninth decile ZIP code is the same as in the first scenario.

³⁸ See the notes in Figure IV for details of the calculation.

Figure IV. Distributional Effects across Zip Codes in Counterfactual Experiments



Note: This figure illustrates the predicted house prices and total employment across ZIP codes sorted by their historical ethnic Chinese population from 2007–13 under two counterfactual scenarios: (I) ZIP codes in each decile receive the same amount of real estate capital from China as ZIP codes in the top (10th) decile of the historical ethnic Chinese population; and (II) ZIP codes in all deciles receive the same amount of real estate capital inflow as the average ZIP code. The left panel shows the counterfactual house prices and total employment under scenario (I). The exact formula for the counterfactual calculation for decile i is as follows: $Exp[(\ln(CHTV_{decile\ 10}^{2013}) - \ln(CHTV_{decile\ i}^{2013})) * \hat{\beta}_{2007-13}]$, where $CHTV$ denotes foreign Chinese housing transaction value, $\hat{\beta}_{2007-13}$ denotes the corresponding coefficient on $\ln(CHTV) * Post$ from column (2) in Table II for house prices and column (2) in Table III for total employment. The right panel shows the counterfactual house prices and total employment under scenario (II). The exact formula for the counterfactual calculation for decile i is as follow: $Exp[(\ln(CHTV^{2013}) - \ln(CHTV_{decile\ i}^{2013})) * \hat{\beta}_{2007-13}]$, where $CHTV^{2013}$ denotes the mean level of $CHTV$ across ZIP codes in 2013, $\hat{\beta}_{2007-13}$ denotes the corresponding coefficient on $\ln(CHTV) * Post$ from column (2) in Table II for house prices and column (2) in Table III for total employment.

V A Simple Model

In this section, we develop a simple partial equilibrium framework to help interpret the main empirical results. Our goal is to highlight the channels through which higher house prices driven by the increase in foreign Chinese housing demand are transmitted to local employment. We then discuss the mapping between the model predictions and our empirical findings.

V.A Baseline

Consider an economy with two regions, indexed by $z = \{0, 1\}$, that differ in one key respect: Region 1 experiences an exogenous increase in foreign Chinese housing demand, while Region 0 does not. We consider Region 1 to contain ZIP codes historically populated with more ethnic Chinese and thereby attracting more real estate capital inflows from China.

Each region produces two types of goods, tradable (indexed by T) and nontradable (indexed by N). The tradable good is traded nationally and serves as a numeraire good with price $P^T = 1$. The housing stock, denoted by H_z , is fixed in each region. Regions freely trade the tradable good but consume the locally-produced nontradable good. In light of our empirical findings on migration effects, we allow workers to commute: They can work in a region other than the region of their residence. Workers can also move freely between the tradable and nontradable sectors within a region.

Let D_z denote the nominal income in each region, which consists of wage and rental income (rebated to local workers). To highlight the model's key insight, we make some simplifying assumption regarding preferences and production technology.

Preferences. Workers residing in region z have Cobb-Douglas preferences over consumption of the tradable good (C_z^N), nontradable good (C_z^T), and housing (C_z^H), with prices P_z^N , $P^T = 1$, and P_z^H , respectively. They spend income shares α , β , and $1 - \alpha - \beta$, respectively, on the three goods.

Budget Constraint. The budget constraint of workers is $P_z^N C_z^N + C_z^T + P_z^H C_z^H = D_z$. Based on the preference specification, consumption of the tradable good, nontradable good, and housing satisfies the following expressions: $C_z^T = \beta D_z$, $P_z^N C_z^N = \alpha D_z$, and $P_z^H C_z^H = (1 - \alpha - \beta) D_z$, respectively.

Output. Because the tradable good is traded nationally without friction, all regions face the same price for this good. The price for the nontradable good, on the other hand, is region-

specific because it is produced locally. Suppose that production is governed by a constant returns technology with employed labor, e , as the sole input: $y_z^T = be_z^T$ and $y_z^N = ae_z^N$, respectively, where b and a are (constant) productivity parameters. Housing supply is fixed at H_z .

Employment. Total employment in each region is normalized such that $e_z^T + e_z^N = 1$. Wages in the two sectors are given by $w_z^N = aP_z^N$ and $w_z^T = bP^T = b$. Free mobility of labor across sectors means that wage is equal across sectors, $w_z = w = b$, and the price of the nontradable good is independent of its region, $P_z^N = \frac{b}{a}$.

Initial Equilibrium. We solve for the initial equilibrium under the following simplifying assumptions: All regions have the same housing stock $H_z = H_0$, the economy achieves full employment, and no worker needs to commute (all workers work at the location of their residence).

In equilibrium, the goods markets clear. For the nontradable good, its output is equal to consumption in each region: $y_z^N = C_z^N$. Suppose that there is no trade imbalance in the aggregate initially, so total demand equates to total production for the tradable good: $\sum_{z=0}^1 y_z^T = \sum_{z=0}^1 C_z^T$. Housing demand is equal to supply: $C_z^H = H_0$. Nominal income is the comprised of wage and cost of housing: $D_z = w + P_z^H H_0$. The solutions to the key variables in this simple framework in equilibrium are as follows:

$$\text{Prices :} \quad P_z^{*N} = \frac{b}{a}; \quad P^{*T} = 1; \quad P_z^{*H} = \frac{1 - \alpha - \beta}{\alpha + \beta} \frac{b}{H_0} \equiv P_0;$$

$$\text{Employment :} \quad e_z^{*N} = \frac{\alpha}{\alpha + \beta} \equiv e_0^N; \quad e_z^{*T} = \frac{\beta}{\alpha + \beta} \equiv e_0^T;$$

$$\text{Wages :} \quad w_z^{*N} = w_z^{*T} = b \equiv w;$$

$$\text{Nominal income :} \quad D_z^* = w + P_0 H_0 = b + \frac{1 - \alpha - \beta}{\alpha + \beta} b \equiv D_0.$$

V.B The Impact of a China Shock in Housing Demand

Housing Demand. Suppose now that there is a housing demand shock from foreign Chinese in Region 1:

$$H_0 = C_1^H + C_{\text{chn}}^H,$$

where C_1^H is the housing demand by local workers, and C_{chn}^H is the (exogenous) housing demand by foreign Chinese.

Commuters. Suppose some labor amount \bar{e} who live in Region 0 choose to commute to Region 1 for work because of higher living costs in Region 1, and commuters consume at the location of residence. For simplification, assume that these commuters work only in the nontradable sector.³⁹ Therefore, the amount of workers that consume locally is $1 - \bar{e}$ in Region 1 and $1 + \bar{e}$ in Region 0.

New Equilibrium. We proceed to solve for local house prices (P_1^H and P_0^H), (nontradable and tradable sector) employment ($e_1^N, e_0^N, e_1^T, e_0^T$), and amount of commuters (\bar{e}) in the new equilibrium.

In the new equilibrium, nominal income for Region 1 is $D_1 = b(1 - \bar{e}) + P_1^H H_0$, so local housing demand can be expressed as follows:

$$C_1^H = (1 - \alpha - \beta) \frac{b(1 - \bar{e}) + P_1^H H_0}{P_1^H}.$$

Equating housing supply with housing demand from local residents and foreigners yields $H_0 = (1 - \alpha - \beta) \frac{b(1 - \bar{e}) + P_1^H H_0}{P_1^H} + C_{\text{chn}}^H$, which can be written as

$$P_1^H = \frac{(1 - \alpha - \beta)b(1 - \bar{e})}{(\alpha + \beta)H_0 - C_{\text{chn}}^H}. \quad (8)$$

Equation 8 shows a positive relationship between housing demand shock by foreign Chinese and local house price.

Similarly, nominal income for Region 0 is $D_0 = b(1 + \bar{e}) + P_0^H H_0$. Given Region 0 has no foreign demand for housing, local housing demand can be expressed as $H_0 = C_0^H = (1 - \alpha - \beta) \frac{b(1 + \bar{e}) + P_0^H H_0}{P_0^H}$ or rewritten as

$$P_0^H = \frac{(1 - \alpha - \beta)b(1 + \bar{e})}{(\alpha + \beta)H_0}. \quad (9)$$

Let ϕ be the commuting cost that is proportional to wage. In equilibrium, commuters are indifferent between commuting and living in Region 1, or $\frac{w}{(P_1^N)^\alpha (P_1^H)^{1-\alpha-\beta}} = \frac{w(1-\phi)}{(P_0^N)^\alpha (P_0^H)^{1-\alpha-\beta}}$, which yields

$$P_1^H = P_0^H \left(\frac{1}{1 - \phi} \right)^{\frac{1}{1-\alpha-\beta}}. \quad (10)$$

Equations (8)–(10) jointly determine the equilibrium house prices P_0^H and P_1^H and the amount of commuters \bar{e} . Given the three equations, we can derive an expression for the

³⁹ This assumption does not affect the model predictions, but it helps to highlight the key model insights by allowing explicit expressions of employment.

amount of commuters (\bar{e}):

$$\bar{e} = \frac{(\alpha + \beta)H_0 - \left(\frac{1}{1-\phi}\right)^{\frac{1}{1-\alpha-\beta}} [(\alpha + \beta)H_0 - C_{\text{chn}}^H]}{(\alpha + \beta)H_0 + \left(\frac{1}{1-\phi}\right)^{\frac{1}{1-\alpha-\beta}} [(\alpha + \beta)H_0 - C_{\text{chn}}^H]}. \quad (11)$$

Equation 11 shows that an increase in foreign Chinese housing demand (C_{chn}^H) leads to higher number of commuters.

Equations (8)–(11) show that a positive foreign Chinese housing demand shock could both raise local house prices and drive out local residents, with the latter force potentially moderating the former. With reasonable parameter values, the first force dominates, which implies that Region 1, which experiences more housing purchases by foreign Chinese, will have higher house prices than Region 0 and attract more workers to commute from Region 0. House prices also will increase in Region 0 because of demand from commuters driven out of Region 1, although the increase will be smaller than in Region 1, as shown in Equations (9) and (10). The size of the house price effects in both regions depends on the magnitude of the commuting cost ϕ . Consider an extreme case where $\phi = 1$, which implies no occurrence of commuting. Then all the house price effects are absorbed by Region 1.

Local employment by sector is pinned down by the local demand for nontradable goods:

$$e_1^N = \frac{\alpha D_1}{a P_1^N} = \frac{\alpha b(1 - \bar{e}) + \alpha P_1^H H_0}{b} = \underbrace{\frac{\alpha}{b} P_1^H H_0}_{\text{housing net worth channel}} + \underbrace{\alpha(1 - \bar{e})}_{\text{crowding-out channel}} \quad (12)$$

$$e_0^N = \frac{\alpha D_0}{a P_0^N} = \frac{\alpha b(1 + \bar{e}) + \alpha P_0^H H_0}{b} = \underbrace{\frac{\alpha}{b} P_0^H H_0}_{\text{housing wealth spillover}} + \underbrace{\alpha(1 + \bar{e})}_{\text{crowding-out spillover}} \quad (13)$$

As shown in Equation (12), foreign Chinese housing demand shock affects local nontradable-sector employment in Region 1 through two opposing forces. On the one hand, more foreign Chinese housing demand increases local house prices, which raises local housing net worth and hence demand for the local nontradable good, driving up local nontradable-sector employment. This *housing net worth channel* is shown in the first term on the right-hand side of Equation (12). On the other hand, the resulting higher living costs in the region increases the number of commuters, which lowers the demand for local nontradable goods. This *crowding-out channel* is shown in the second term on the right-hand side of Equation (12). If effect from the former channel dominates, which is the case under reasonable parameter values, then the model predicts that positive foreign Chinese housing demand shock increases local nontradable-sector employment in Region 1.

Equation (13) shows that a foreign Chinese housing demand shock also affects local nontradable-sector employment in Region 0 because of two spillover channels. First, because foreign Chinese housing demand in Region 1 crowds out commuters to Region 0, house prices in the latter region also increase, which raises local housing net worth, demand for the local nontradable good, and thereby nontradable-sector employment. This *housing wealth spillover channel* is shown in the first term on the right-hand side of Equation (13). The nontradable-sector employment increase in Region 0 is expected to be smaller than that in Region 1, because Region 0's house price increase is less pronounced, as shown in Equation (10). Second, commuters driven out from Region 1 now live and consume in Region 0, driving up demand for the Region 0's nontradable good and thereby employment. This *crowding out spillover channel* is shown in the second term on the right-hand side of Equation (13).

Tradable-sector employment in Region 1 and 0 in the new equilibrium is $e_1^T = 1 - \bar{e} - e_1^N$ and $e_0^T = 1 - \bar{e} - e_0^N$, respectively. Higher foreign Chinese housing demand lowers employment in the tradable sector in both regions even though demand for the tradable good increases because of higher housing net worth. This effect is because the increasing demand is met by imports from other regions outside of the model economy given the model setup in which the tradable good is nationally traded with a fixed price $P^T = 1$. In other words, the inflow of Chinese real estate capital acts as financial transfers to the (directly and indirectly) affected regions, allowing them to run trade deficits.⁴⁰

In sum, our simple model predicts that housing purchases by foreign Chinese raise the destination region's (Region 1's) local house prices, increases its nontradable-sector employment via a housing net worth channel, and lower local employment in the tradable sector. The first two predictions are consistent with our baseline empirical results. However, we do not find a significant relationship between foreign Chinese real estate capital and local tradable-sector employment. It is not obvious how to generate a null effect on the tradable-sector employment in the model without introducing friction such as employment slack or migration. We provide a discussion of related considerations in the subsequent subsection.

V.C Discussion

Our model resort to a simple structure to highlight the key mechanisms driving the effects of a foreign Chinese housing demand shock on the local economy. Similar intuitions hold in a more general setting that relaxes some of the simplifying assumptions.

For example, consider a local economy in which there are homeowners and renters, workers can move and commute across regions, and prices and wages are flexible. As in our

⁴⁰ The negative impact on the tradable-sector production and employment can be viewed as a form of the "Dutch disease."

simple model, the local economy comprises two regions: Region 0 and Region 1, with Region 1 historically populated with ethnic Chinese and thereby more likely to attract real estate capital flows from China. A positive housing demand shock from foreign Chinese would increase the wealth of homeowners in Region 1, inducing higher spending on its nontradable goods and raising employment in the nontradable sector. This mechanism is akin to the housing net worth channel described in the simple model. At the same time, rental prices also would increase in the region, which would push out renters from Region 1 to Region 0. The outflow of renters would lower demand for nontradable goods and employment in the nontradable sector in Region 1. This mechanism is similar to the crowding-out channel in the simple model, but in this case, it is specifically the renters that get pushed out. If the positive force from housing net worth channel exceeds the negative force from the outflow of renters (subject to migration and commuting costs), then nontradable-sector employment in Region 1 will increase, which is in line with the mechanisms highlighted in the simple model.

The effect of foreign Chinese housing demand on tradable-sector employment is less clear in this example as well. Homeowners' increased demand for tradable goods in Region 1 can be supplied by production outside the local economy, so the impact of foreign Chinese housing demand on employment in the tradable sector is more diffused than the nontradable sector. For a model to predict a null effect on tradable-sector employment—the result from our empirical analysis, tradable-sector employment in both Regions 1 and 0 would need to expand or shrink by the same magnitude, despite that the higher house prices and living cost in Region 1. Such a prediction is difficult to generate in a general equilibrium framework with flexible prices and full employment.⁴¹ Most standard models would predict a reduction in the tradable-sector employment in Region 1 just as in our simple model.

VI Conclusion

This paper documents an unprecedented surge in housing purchases by foreign Chinese in the United States since 2007 and analyzes the effects of these real estate capital inflows on U.S. house prices and employment. We apply an empirical strategy that exploits spatial variation in the concentration of ethnic Chinese population in the pre-sample period to identify differential exposure to real estate capital inflows from China. Using detailed transaction-level housing purchase data, we find that residential real estate capital inflows from China significantly induce higher house prices and employment in the local economy.

⁴¹ A model may be able to predict a null effect on tradable-sector employment if agglomeration spillovers are introduced in the Region 1. Developing such a model is beyond the scope of this paper and could be explored in future research.

The effects on employment are concentrated in the nontradable sectors, suggesting that the labor market response is transmitted through a housing net worth channel.

As China becomes more integrated into the global economy, a better understanding of its external impact is of utmost importance. While previous literature mostly focuses on the effects on the real side, our paper studies a “China shock” on the finance side, or, namely, in the U.S. real estate market. Our results reveal the potentially positive role of residential capital inflow on the domestic real economy during economic downturns. During the financial crisis period between 2007 and 2011, the improvement in household balance sheets in some neighborhoods resulting from foreign real estate capital inflows likely mitigated the brunt of the crisis on U.S. local economies.

What implications do our findings have for public policy on real estate capital inflows and foreign homebuying? Our results point to potential welfare gains that come with larger capital flows during economic downturns. However, because of data limitations, we have not examined distributional impacts of house purchases by foreigners on renters and homeowners. The potentially negative effects of foreign real estate purchases on domestic homeownership rate and gentrification have led to intensive policy debates on whether and how to control real estate capital flows from foreign countries. More research on the distributional gains or losses will help with designing optimal policies on the issue.

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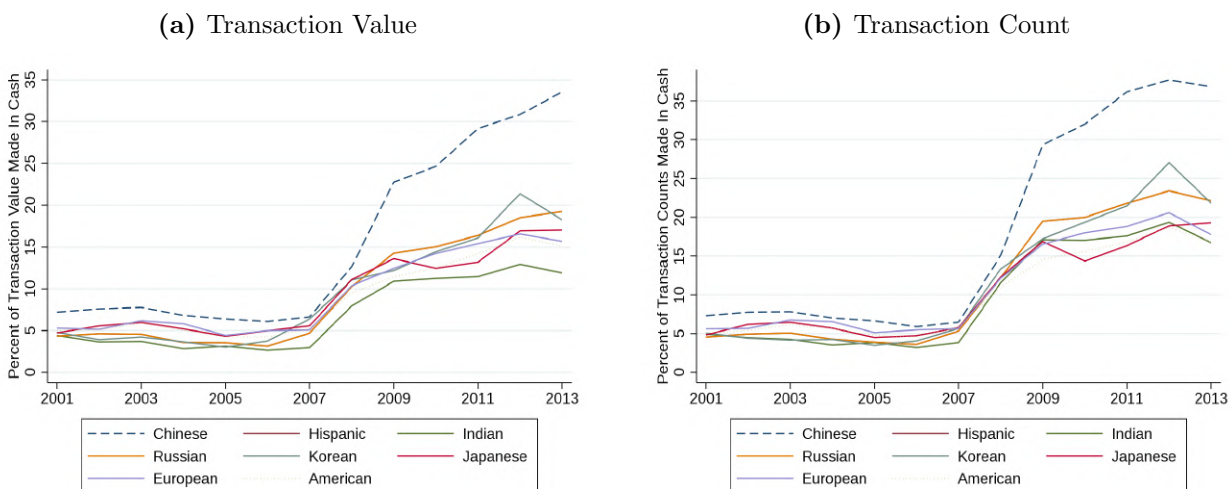
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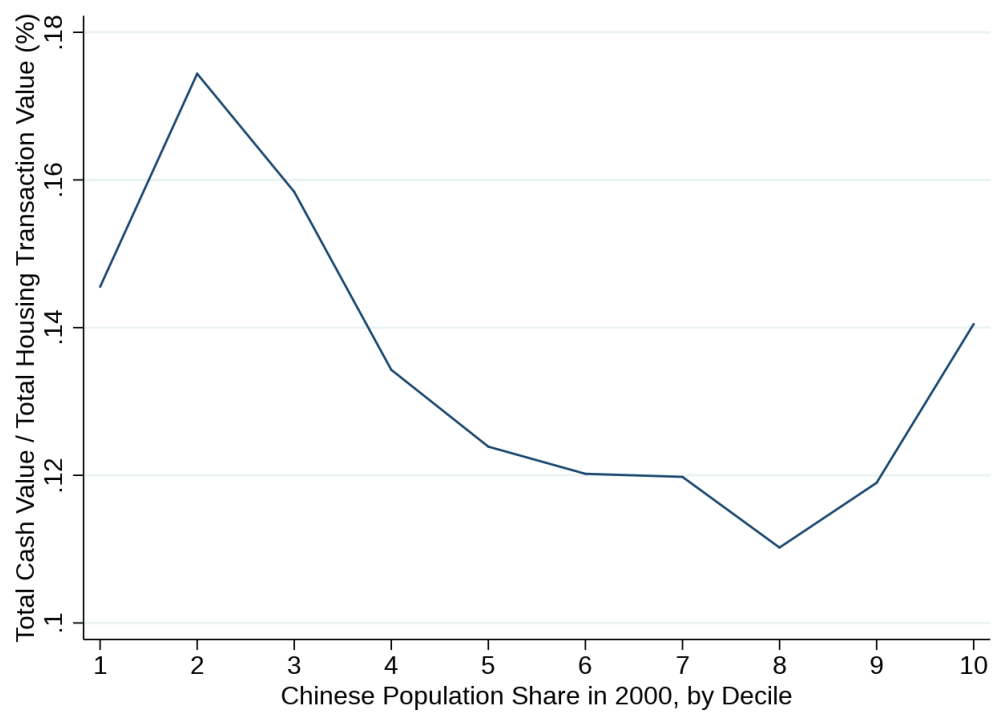
Online Appendix: Additional Figures and Tables

Figure A.1. Propensity for All-Cash House Purchases by Anglo-Americans and non-Anglo-American Ethnic Groups



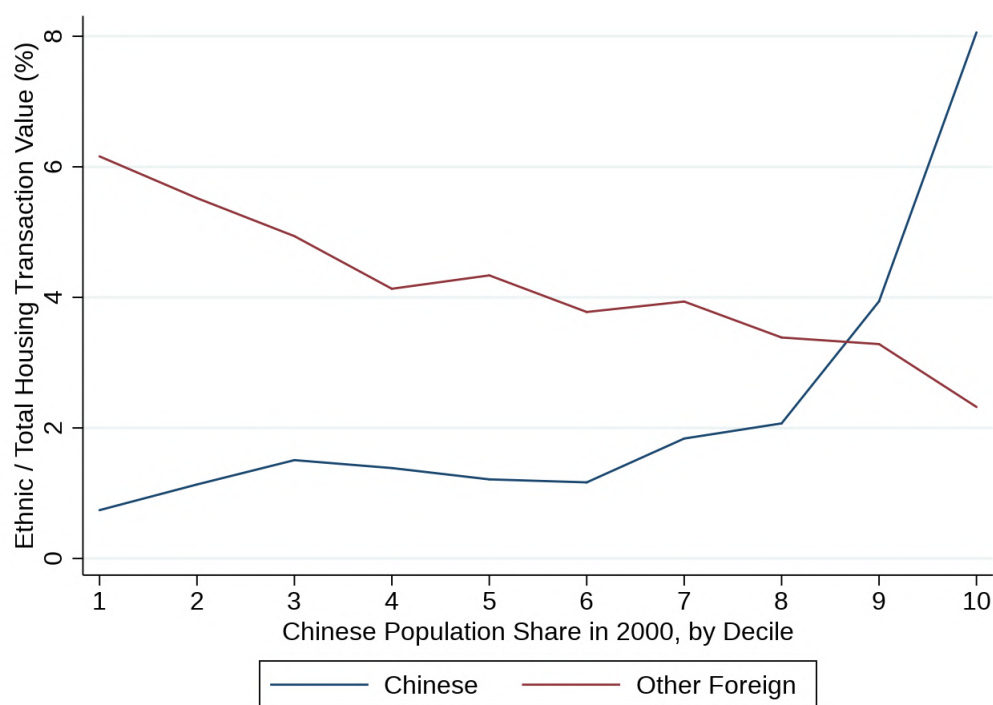
Note: Figure (a) plots the percentage of all-cash housing purchases as measured by transaction value by Anglo-Americans and non-Anglo-American ethnic groups between 2001 and 2013. Figure (b) plots the percentage of all-cash housing purchases as measured by transaction count by Anglo-Americans and non-Anglo-American ethnic groups between 2001 and 2013. The ethnicity assignments are made based on ethnic name-matching technique of Kerr (2008a). A buyer is considered to be a particular ethnicity if the technique assigns that ethnicity to the buyer with a probability of one. Source: DataQuick and authors' calculations.

Figure A.2. All-Cash Housing Transactions Share versus Historical Ethnic Chinese Population



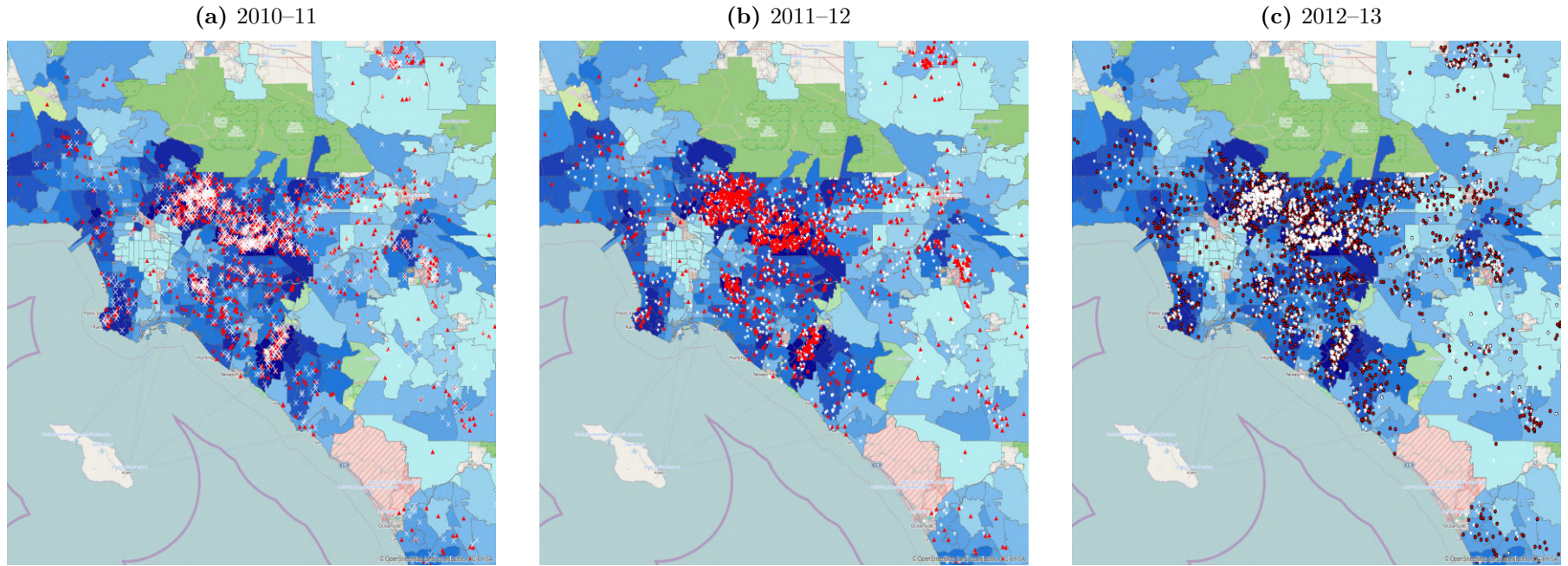
Note: This figure illustrates the share of all-cash house transaction made by ethnic Chinese (by dollar value) as a function of historical ethnic Chinese population based on the 2000 Census Survey.

Figure A.3. Housing Transactions Share by Foreign Chinese and Other Ethnicities versus Historical Ethnic Chinese Population



Note: This figure illustrates the share of house transaction made by foreign Chinese and other ethnic groups as a function of historical ethnic Chinese population based on the 2000 Census Survey.

Figure A.4. House Purchases by Ethnic Chinese in the Los Angeles Region



Note: This figure illustrates housing purchases by foreign Chinese in the Los Angeles region from 2010 to 2013. The blue shades in the background divides the region based on ZIP codes, where the darker shades represent ZIP codes with a higher share of ethnic Chinese population in 2000, based on the Census data. Figure (a) illustrates housing purchases by foreign Chinese in 2010 and 2011, where the white “X”s denote purchases in 2010 and the red triangles denote purchases in 2011. Figure (b) illustrates housing purchases by foreign Chinese in 2011 and 2012, where the red triangles denote purchases in 2011 and the white stars denote purchases in 2012. Figure (c) illustrates housing purchases by foreign Chinese in 2012 and 2013, where the white stars denote purchases in 2012 and the red circles denote purchases in 2013.

TABLE A.1. Foreign Chinese Housing Demand, House Prices, and Total Employment Using Alternative Specification

	House Price		Transaction Value		Employment	
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*\text{post}$	0.065*** (0.022)		0.119*** (0.021)		0.114*** (0.042)	
$\ln(\text{CHTV})$	0.062** (0.027)		0.014 (0.025)		0.061 (0.077)	
$\ln(\text{CHTC})^*\text{post}$		0.172*** (0.050)		0.282*** (0.053)		0.246*** (0.086)
$\ln(\text{CHTC})$		0.004 (0.043)		-0.091** (0.044)		-0.006 (0.090)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Post period	2007–13	2007–13	2007–13	2007–13	2007–13	2007–13
First-stage F-stat.	92.31	57.91	97.63	56.83	95.60	50.91
Observations	4013	4070	4270	4333	4290	4353

Note: The dependent variables are log Zillow Housing Price Index (column (1)), log housing transaction value (column 2), and log total employment (column (3)). *CHTV* denotes foreign Chinese housing transaction values instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), trend of income (1998–2001) and the outcome variable (1996–2000), and county fixed effects. Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1$, $p < 0.05$, $p < 0.01$.

TABLE A.2. Foreign Chinese Housing Demand and Foreclosure

<i>Panel A: Foreclosure Share</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*\text{post}$	-0.289*** (0.079)		-0.291*** (0.083)		-0.233*** (0.074)	
$\ln(\text{CHTV})$	0.089 (0.075)		0.080 (0.076)		-0.037 (0.075)	
$\ln(\text{CHTC})^*\text{post}$		-0.514*** (0.140)		-0.540*** (0.152)		-0.410*** (0.120)
$\ln(\text{CHTC})$		0.260** (0.121)		0.248** (0.122)		0.076 (0.101)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post period	2007–13	2007–13	2007–11	2007–11	2012–13	2012–13
First-stage F-stat.	43.03	23.63	38.99	27.68	33.02	22.91
Obs.	3974	4038	2949	3000	2044	2072

<i>Panel B: Foreclosure Count</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{CHTV})^*\text{post}$	-0.286*** (0.077)		-0.319*** (0.083)		-0.166** (0.075)	
$\ln(\text{CHTV})$	-0.012 (0.084)		-0.018 (0.086)		-0.180** (0.087)	
$\ln(\text{CHTC})^*\text{post}$		-0.537*** (0.135)		-0.627*** (0.159)		-0.330*** (0.111)
$\ln(\text{CHTC})$		0.149 (0.112)		0.153 (0.115)		-0.105 (0.098)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post Period	2007–13	2007–13	2007–11	2007–11	2012–13	2012–13
First-stage F-stat.	46.05	24.72	41.41	29.34	36.23	24.27
Obs.	3995	4053	3016	3061	2158	2180

Note: The dependent variable is log foreclosure count weighted by total residential home count in Panel A and log foreclosure count in Panel B. *CHTV* (*CHTC*) denotes foreign Chinese housing transaction value (count) instrumented by the aggregate housing transaction value (count) in California weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), and trend of income (1998–2001) and the outcome variable (1996–2000). Columns (1) and (2) show the results for the overall sample period. Columns (3) and (4) show the results for the HPR Phase 1 period of 2007–11, and columns (5) and (6) for the HPR Phase 2 period of 2012–13. Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1$, $p < 0.05$, $p < 0.01$.

TABLE A.3. Foreign Chinese Housing Demand, House Prices, and Total Employment using Alternative IV

	House Price (1)	Transaction Value (2)	Employment (3)
$\ln(\text{CHTV})^*\text{post}$	0.054** (0.021)	0.105*** (0.020)	0.098** (0.043)
$\ln(\text{CHTV})$	0.044* (0.026)	-0.015 (0.024)	0.047 (0.075)
Controls	Yes	Yes	Yes
County FE	Yes	Yes	Yes
Post period	2007-13	2007-13	2007-13
First-stage F-stat.	96.70	98.24	92.67
Observations	4013	4270	4290

Note: The dependent variables are log Zillow Housing Price Index (column (1)), log housing transaction value (column 2), and log total employment (column (3)). *CHTV* denotes foreign Chinese housing transaction values instrumented by China's gross domestic product weighted by the share of ethnic Chinese population across ZIP codes from the pre-sample period. *Post* is an indicator variable that takes the value 1 if the year is after 2007 and 0 otherwise. All regressions control for pre-sample period ZIP-code-level population, education (population share with bachelor degrees), trend of income (1998–2001) and the outcome variable (1996–2000), and county fixed effects. Standard errors are clustered at the ZIP-code level. *, **, *** denote $p < 0.1$, $p < 0.05$, $p < 0.01$.